FORESTRY IN KARNATAKA

A JOURNEY OF 150 YEARS

DIPAK SARMAH

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(2018)

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PREFACE

It was a cloudy morning of July, 1979 when I, along with my wife of a few months, had boarded a bus in Hubli bus-stand on our way to Yellapur, where I was to join the Forest department as a probationer. As we settled in the bus, a young man in khaki approached us, greeted me with a mild salute and gave a few colored slips of paper. I took him for the bus conductor dispensing tickets to the passengers and took out my wallet to pay for the tickets. He refused to take any money. He introduced himself as Mr. Sudhir Nayak, RFO, Hubli. He told that he had come to receive us and that he had already paid for the tickets. In spite of my repeated requests he refused to take the bus-fare. As the bus was about to depart, he quickly alighted from the bus after wishing us happy journey.

This is how I started my journey of forest service in Karnataka – in debt to the Forest department. As I joined the department and came across more and more people during the course of my service spanning thirty-five years and in various capacities in different parts of the state, my debt kept on mounting. This debt was not of money, but of love and affection. I was fortunate to be part of a department where human relations count a lot, where subordinate members stand by officers through thick and thin, and where superior officers are ready to extend all possible help to junior officers as they would do to younger brothers. It is very difficult to repay such a debt of love and affection received from so many people over the years. This book is dedicated to the entire fraternity of foresters as a token of gratitude.

A few words about the book: it is not a memoir. Nor is it about any personal milestones or achievements. It is a narration of events that unfolded in Karnataka's forestry sector during the last 150 years. Organized management of the forest areas of the present day Karnataka started during the mid 1860s. These areas were under different administrations and were integrated in 1956, after the reorganization of the states. An attempt has been made to bring out the salient developments regarding evolution of forest policy, law and management practices in these areas prior to integration as well as during the post-integration period. The events that have occurred during the last 50 years have been narrated in more detail for two reasons: first, documents highlighting the recent events are more in number and these are fairly elaborate with facts and figures. Secondly, having been a part of the Karnataka Forest department for close to forty years, I was witness to many of the events that have taken place during a major part of this period.

As regards motivation to write the book, rapid changes in the approach to forest management had taken place in Karnataka since the 1970s. This was triggered partly

by changes at the national forestry scenario. However, some of the events in Karnataka were innovative and were in fact precursors to developments that eventually unfolded at the national level. I had the privilege to serve the department during this phase, in the field for about sixteen years, in the headquarters for about fifteen years and on deputation to the Government of India for four years. While the field postings, mostly in Shimoga-Uttara Kannada regions and for a year in Dakshina Kannada district, brought me closer to the challenges and charms of forestry operations, postings in the headquarters in various capacities such as CF (Development), CCF (Vigilance), CCF (Working Plan), Secretary (Forest), APCCF (Personnel and Administration), APCCF (Headquarters and Co-ordination), APCCF (Working Plan and Training), APCCF (Vigilance), PCCF (Wildlife) and PCCF (HoFF) provided me with opportunities of having an overview of the Forest department and its working. My posting on deputation to the Government of India as Deputy Adviser in the Planning Commission and as DIG (Forest Policy) in the Ministry of Environment and Forests was also very fruitful and educative, as I had the privilege of having a national perspective on forest policy and planning.

The information provided in the document is primarily factual and has been as far as possible presented chronologically. I have attempted to provide some historical context to the information. In some cases I have given analytical comments based on field experiences and observations; some of the comments are also based on evaluation reports, annual reports, etc. The contents of the book are familiar to most of my colleagues and contemporaries in the Forest department. I must however confess that as I started collecting information from various sources and delved into a large volume of documents including old working plans, I gained much more information about the forests and their past history of working than I thought I had. My attempt is to piece these bits of information together and present them in the form of a book with the hope that these will be of advantage to the new and incoming generations of foresters who may like to know something about the past management of the forests with which they will be intimately involved during their service. Although the book has been prepared for general reading, a few technical (forestry) terms have crept in. For the convenience of readers without forestry background, explanation of these technical terms has been given in an Appendix.

Since the document is primarily narration of events that occurred over a fairly long period of time and as my desire was not to omit any important event by oversight, I had prepared a draft document and circulated it among my esteemed forestry colleagues for their inputs and suggestions. The draft has been revised on the basis of comments and feedback received from some of them. I am extremely

grateful to Mr. A. C. Lakshmana, Dr. S. N. Rai, Mr. Ganesh V. Sugur, Mr. Vinay Luthra, Dr. Ravi Ralph, Mr. Sanjai Mohan, Dr. K.N. Murthy, Dr. K. H. Vinaya Kumar and Mr. Vasantha Reddy for their valuable suggestions which have been incorporated in the final document. I am also thankful to Mr. R.M. Palanna, Dr. P.J. Dilip Kumar, Mr. A.K. Varma, Mr. I.B. Srivastava, Mr. B.K. Singh, Mr. R.M.N. Sahai, Mr. M.H.A. Shaikh, Dr. B. Raghotham Rao Desai, Mr. N.D. Tiwari, Mr. R.S. Suresh, Mr. B.J. Hosamath, Mr. K.S.Sugara, Mr. A.K. Garg, Mr. G. Vidya Sagar, Mr. Punathi Sridhar, Mr. T.V. Mohan Das, Mr. D.A. Venkatesh, Mr. C. Jayaram, Mr. Ajai Misra, Mr. Puneet Pathak, Mr. G.S. Yadav, Mr. Manjunath Veerannagowdar, Mr. Manjunath Chauhan and many others for their words of encouragement. I am also thankful to Smt. Usha Kumari, Senior Librarian and staff of Central Library, Aranya Bhavan for extending their help in providing data/information for the book.

Forestry, like the wilderness of a forest, is an immensely vast subject. This book is an attempt at sharing some information about the subject, with special reference to Karnataka. It is just a speck in this vast wilderness of knowledge - a fern in the wild. My sincere thanks are to Mr. Selvino Fernandes for the front cover photo and also to my forestry colleague Mr. Vijay Mohan Raj for providing the same.

- DIPAK SARMAH

INTRODUCTION

The present state of Karnataka came into being with effect from 1st November, 1956. The new state was formed as envisaged under Section 7 of the States Reorganization Act, 1956 by integrating the old Mysore state, the former state of Coorg, portions of the former Bombay and Madras Presidencies and some areas of the former Hyderabad state. As major portion of the re-organized state was from the old Mysore state, it was then named as Mysore state and was rechristened as Karnataka in 1973. As the integrating areas of the newly formed state were under different administrations, policies and laws for general administration of the areas evolved differently and in continuation of the policies or practices prevalent earlier. The same was also true of the policies and laws related to forest administration and management. However, as all these areas were directly or indirectly ruled by the British till India became independent, there were many commonalities in these policies and laws with local variations. Various aspects regarding evolution of forest policies, laws and management practices in the five integrating parts of Karnataka will be narrated in greater detail in the next chapter. However, as a prelude, it will not be out of place to have some background information about the political and administrative systems obtaining in these areas prior to their integration into Karnataka.

Mysore Kingdom

1.2. The Kingdom of Mysore was ruled by the Wodeyar dynasty and is believed to have been established in 1399 in the vicinity of the modern city of Mysore. The kingdom initially served as a vassal state of the Vijayanagara Empire. With the decline of the Empire in the middle of the 16th century, the kingdom became independent. The kingdom expanded its territory during the 17th century under the rule of Narasaraja Wodeyar I and Chikka Devaraja Wodeyar. Large expanses of what is now southern Karnataka and parts of Tamil Nadu were annexed, and the kingdom rose to become a powerful state in the southern Deccan.

1.3. Mysore kingdom had reached the pinnacle of its military power and dominion in the latter half of the 18th century under Hyder Ali and his son Tippu Sultan who were *de facto* rulers of the kingdom. During this time, it came into conflict with the Marathas, the Nizam of Hyderabad, the king of Travancore and the British culminating in the four Anglo-Mysore Wars (1767, 1779, 1792 and 1799). Success in the first two wars was followed by defeat in the third and fourth. Following Tippu's death in the fourth war of 1799, large parts of his kingdom were annexed by the

British, which signaled the end of a period of supremacy of the Mysore kingdom over southern Deccan. The British restored the Wodeyars to their throne by way of a subsidiary alliance and the diminished Mysore kingdom was transformed into a princely state. Under the benevolent and progressive administration by the Mysore kings, Mysore state registered all round development in all spheres including agriculture, education, health, science and technology, art and culture, etc. The Wodeyars continued to rule the state until Indian Independence in 1947, when Mysore acceded to the Union of India.

1.4. During 1900, Mysore state was made up of eight districts: Bangalore, Kolar, Tumkur, Mysore, Hassan, Chikmagalur (Kadur), Shimoga and Chitradurga. Mandya district was formed during 1939 by carving out a portion of Mysore district. Chikmagalur district was earlier known as Kadur district which was in existence as early as 1863.

1.5. In 1989, Bangalore district was bifurcated into Bangalore Urban and Bangalore Rural districts. During 1997, Davanagere district was formed by carving out Davangere, Harihar and Jagalur taluks from Chitradurga district, Channagiri and Honnali taluks from Shimoga district and Harpanahalli taluk from Bellary district. During the same year, Chamarajanagar district was carved out from Mysore district. During 2007, Ramanagar and Chikkaballapur districts were carved out from Bangalore Rural and Kolar districts respectively.

Kodagu State

1.6. Before 1956, the present Kodagu district with headquarters at Madikeri (Mercara) was an administratively separate state called Coorg State. Kodagu is the homeland of the Kodavas who were the earliest agriculturists in Kodagu, having lived there for centuries. The Haleri dynasty, an offshoot of the Keladi Nayakas, had ruled Kodagu between 1600 and 1834. The British, having fought with the Raja of Coorg (Chikka Virarajendra) in the Coorg War in 1834, annexed and ruled Kodagu. The British Resident in Mysore State served as *ex officio* Chief Commissioner of Coorg. This continued until India's independence in 1947. In 1956, the Coorg state was merged with the Mysore state and was incorporated as Kodagu or Coorg district.

Bombay Presidency

1.7. The Bombay Presidency was a province of British India. It began in the 17th century as trading posts of the British East India Company, but later grew to include much of western and central India. At its greatest extent, the Bombay Presidency comprised of the present-day Gujarat, western Maharashtra and northwestern

Karnataka. It also included the Sindh province of Pakistan and the British territory of Aden in Yemen. The presidency consisted partly of districts, which were directly under British rule, and partly of native or princely states, which were ruled by local rulers under the administration of a governor. The Bombay Presidency included the following areas which are in present day Karnataka:

(a) Belgaum district (excluding Chandgad taluk which now is in Maharashtra).

(b) Dharwar district which now has become three districts: Dharwar, Gadag and Haveri. Gadag and Haveri districts were carved out from the erstwhile Dharwar district in 1997.

(c) North Kanara district which is now called Uttara Kannada district.

(d) Bijapur district which has now become two districts: Vijayapura and Bagalkot. Bagalkot district was formed in 1997.

(e) The Savanur state, founded in 1672, became a princely state of British India in 1818. The state acceded to the Dominion of India in 1948. It was incorporated into the then Dharwar district and is now a part of Haveri district.

(f) The Ramdurg state, founded in 1742, became a princely state under the Bombay Presidency in 1799. The state acceded to the Dominion of India in 1948 and was incorporated into Belgaum district.

(g) The Jamkhandi state was a Maratha princely state of British India. It was founded in 1811. The state acceded to the Dominion of India in 1948. It was incorporated into the then Bijapur district and is now a part of Bagalkot district.

(h) The Mudhol state was a Maratha princely state and became a British protectorate in 1819. After its accession to the Indian Dominion in 1948, it was incorporated into the then Bijapur district and is now a part of Bagalkot district.

(i) The Kolhapur state or Kolhapur Maratha kingdom, founded in 1710, was a princely state of British India. It had entered into treaty relations with the British in 1812. It acceded to the Dominion of India in 1947. Most of the areas of the erstwhile Kolhapur state are now in Maharashtra except some areas of Raibag and Belgaum taluks in present Belgaum district.

(j) The state of Sangli, established in 1782, was one of the princely states of British India. It had become a British protectorate in 1819. It joined the Indian Dominion in 1948. Most of the areas of the erstwhile Sangli state are currently in Maharashtra except some areas which are in Belgaum taluk of Belgaum district.

Madras Presidency

1.8. The Madras Presidency was a province of British India comprising most of the present day Tamil Nadu with a few districts and taluks of Andhra Pradesh, Karnataka, Kerala and Orissa. The Madras Presidency included the following areas which are now in Karnataka:

(a) South Kanara district. This district then comprised of present Dakshina Kannada and Udupi districts of Karnataka along with the present Kasaragod district of Kerala. Udupi district came into being in 1997.

(b) Kollegal taluk in the Chamarajanagar district. It was a part of Coimbatore district of Madras Presidency. Until the recent formation of Hanur taluk, Kollegal was the largest taluk of Karnataka.

(c.) The present day district of Bellary and Harpanahalli taluk of Davanagere district (prior to 1997, Harpanahalli taluk was a part of Bellary district). These areas along with Anantapur, Kadapa and Kurnool districts of Andhra Pradesh were under the Deccan zone of Madras Presidency. The Deccan zone was also known as 'Ceded districts' since these areas were ceded to the British after the Anglo-Mysore War (1799).

(d) Sandur, a Maratha princely state founded around 1713, was surrounded by Bellary district. With the annexation of Bellary district to British India in 1800, the Sandur state came under the political authority of the Madras Presidency. Sandur formally became a British protectorate in 1818. The princely state enjoyed a considerable degree of internal autonomy. However, its foreign policy was completely controlled by a Resident who represented the Governor of Madras Presidency. The District Collector of Bellary was the Resident of Sandur state. After Indian independence, Sandur was integrated with the Madras State on 01-04-1949 and in the following year it was incorporated into Bellary district as a separate taluk.

1.9. The Madras Presidency lasted till 1950 when it became the Madras state after India became a republic. In 1953, Telugu-speaking regions of the state split to form

Andhra Pradesh and subsequently Kannada-speaking areas were merged with Mysore state. As a result, the districts of Bellary and South Canara (except Kasaragod area) and Kollegal taluk came to Mysore state. With the transfer of Bellary district, Sandur also got transferred to Mysore state. Kollegal taluk was included in the then Mysore district and is now a part of Chamarajanagar district.

Hyderabad State

1.10. The Hyderabad state was ruled from 1724 until 1948 by a hereditary Nizam who was initially a Mughal governor of the Deccan before becoming independent. It was the first princely state which came under British supremacy by signing a subsidiary alliance agreement in 1798. Under the agreement the Nizam was allowed to exercise local control. The agreement also provided for stationing of British troops in the state. After the Indian Independence, the state signed an agreement with the Dominion of India, continuing all the previous arrangements except for stationing of Indian troops in the state. However, with the rise of militancy, India found it necessary to station Indian troops and invaded the state in September, 1948 to compel the Nizam. Subsequently, the Nizam signed an instrument of accession, joining India.

1.11. During the Reorganization of States in 1956, the Hyderabad state was split up based along linguistic lines among Andhra Pradesh, Bombay state and Mysore state. As a result the districts of Gulbarga (except Kodangal and Tandur taluks), Raichur (except Alampur and Gadwal taluks) and Bidar (except Ahmadpur, Nilanga and Udgir taluks) came to the fold of Mysore state which later became Karnataka. Subsequently, Koppal district was created in 1997 by carving out areas from Raichur district. During 2009, Yadgir district was carved out from Kalaburagi (Gulbarga) district.

EVOLUTION OF FOREST POLICY, LAW AND MANAGEMENT PRACTICES UP TO 1956

Prior to Independence, the five areas which were integrated to form the present state of Karnataka were administered by the British Indian government either directly or through their representatives. For a major part of the British rule up to the enactment of the Government of India Act, 1919 by the Parliament of the United Kingdom, 'Agriculture' (including Forests) was a central subject and therefore the Union government had a pivotal role to play in shaping up forest policies and laws. During those days it was quite common for the Inspector General of Forests to conduct extensive tour of a province or a princely state and direct or advise the local administration in matters of forest management including formulation of policy and law. Quite often the services of an experienced Imperial / Indian Forest Service officer working in one province or state were placed at the disposal of another province or state for more effective management of forests. This resulted in evolution of similar forest management practices across the provinces/states with variations as were considered necessary to suit local or regional needs. In the following paragraphs we will discuss the salient features of forest management as they evolved in the five geographical areas before their integration into Karnataka in 1956. Needless to say, in this endeavor we have to keep abreast of the forestry scenario as it evolved at the national level.

BOMBAY AND MADRAS PRESIDENCIES

2.2. In the early years of their rule, the British Indian government had adopted a purely exploitative forest policy which was primarily motivated by trade and commerce. The British Indian administration was new to the idea of systematic forestry, as the forest organization in the United Kingdom then had not developed much. This resulted in their being generally indifferent towards the problems of forestry and forest development. However, unlike the invaders of the past, the British were far-sighted and had a long-term plan. They had nurtured an ambition of expanding their Empire and fulfilled this ambition by annexing more and more territories. The demand for timber therefore increased manifold because of its requirement in various construction activities such as railways, roads and bridges, dockyards, ship building, factories, buildings, etc. This resulted in heavy exploitation of timber, especially of teak. The teak bearing forests of both Bombay and Madras Presidencies became the prime targets. Another factor that contributed to loss of forest was the policy of the Government to expand agriculture at the expense

of forest land. While removal of valuable timber depleted the forest, extension of cultivation decimated the forest.

2.3. The beginning of the nineteenth century saw the British administration adopting a more systematic policy of forest exploitation. It dawned upon the rulers that the forest resources are not inexhaustible. Indiscriminate destruction of forests due to large-scale supplies of timber became a matter of concern and it drew the attention of the British Government. In the year 1800, a Commission was appointed to enquire into the availability of teak in the forests of Malabar. It was found that the more accessible forests had been worked heavily. Regulations followed; felling of teak trees below 21 inches in girth was prohibited. In 1805, a Forest Committee was constituted to enquire into the capacity of forests and the status of proprietary rights in them. As a result, a proclamation was made declaring 'royalty rights' over teak trees in the south and prohibiting their unauthorized felling. In 1806, a Conservator was appointed in Madras to organize timber supplies from the west coast. With the continued depletion of teak in Malabar, serious efforts were begun to regenerate these forests, and after several attempts, successful teak plantations were raised from 1842 in Nilambur in the present Kerala state. A small area of these earliest plantations has been retained as a preservation plot. In 1840, the British colonial administration promulgated an ordinance called Crown Land (Encroachment) Ordinance. This ordinance targeted forests in Britain's Asian colonies, and vested all forests, wastes, unoccupied and uncultivated lands to the Crown.

2.4. A report submitted in 1840 by Dr. Alexander Gibson, Superintendant of Botanical Gardens, Poona after a tour of North and South Kanara forests confirmed the fears about devastation and likely exhaustion of the forest resources. In 1854, Mr. McClelland, the then Superintendent of Forests in Burma submitted a report to the Government of India suggesting certain restrictions on the unchecked exploitation of forests. Based on this, Lord Dalhousie, Governor General in 1855 promulgated a 'Memorandum of the Government of India' outlining rules for the conservation of forests for the whole country. This is termed as the 'Charter of the Indian Forests'.

2.5. In the backdrop of forest degradation because of heavy felling necessitated by various demands, the British Government started contemplating about the need for development of a policy aimed at forest conservation and to put in place a frame-work for achieving the policy objectives. This finally resulted in the establishment of the Forest department in 1847 in the Bombay Presidency with Dr. Alexander Gibson as its Conservator. The establishment of the Forest department was a landmark decision in the history of forestry in Bombay Presidency as it gradually paved the

way for formulating and then implementing various rules and regulations to conserve the forests.

2.6. Developments similar to those of Bombay Presidency were also taking place in the forests of Madras Presidency. Earlier to the formation of the Forest department, the forests of Madras Presidency were exploited for timber, mainly teak, for about half a century. Appointment of one Mr. Watson as Conservator during the first decade of the nineteenth century (1806) brought in some semblance of systematic felling of trees in the region. However, the Forest department in the Madras Presidency was formally established in 1856 with the appointment of Dr. Hugh Cleghorn as its Conservator of Forests. Dr. Cleghorn was a Madras-born Scottish physician (civil surgeon) who is regarded as one of the pioneers of scientific forestry in India. After the formation of the Forest department, rules for the management of forests were promulgated in 1862.

2.7. The foundations of scientific forestry in India were firmly laid in 1864 when Dr. Dietrich Brandis, a fully qualified forester, was appointed as the first Inspector General of Forests. Dr. Dietrich Brandis (1824-1907) was a German-British botanist and forestry academic and administrator, who worked with British Imperial Service in colonial India for nearly 30 years. He joined the British Civil Service in Burma in 1856, shortly became head of the British forestry administration in all of Burma, and served as IGF in India from 1864 to 1883. He initiated the process of recruitment of trained personnel for organizing forest operations and for establishing the Forest departments in the states. He formulated new forest legislation and helped establish research and training institutions. He helped formulate the Indian Forest Act of 1865. He was among the earliest in India to formally link forest protection with local peoples.

2.8. By enacting the Indian Forest Act, 1865, the Government decided to treat forests as a State property. The Act provided for bringing land under trees, brushwood or jungle within its ambit without at the same time abridging or affecting any existing rights of individuals or communities. Under the Indian Forest Act of 1865, the local governments were empowered to draft rules for enforcement in their respective regions. Steps were taken accordingly to prevent acts which caused injury or destruction to the forests. By 1882, all the areas then under British rule had either extended the Indian Forest Act to their territory or brought out special Forest Acts. While drafting forest laws for different provinces, it was ensured that the long standing, customary rights of the people were protected by constituting them as prescriptive rights.

2.9. A revised Indian Forest Act (Act VII of 1878) was passed in the year 1878 and it was extended to all provinces of British India with the exception of Madras province and some other areas. This Act aimed at improving upon the inadequacies of the Indian Forest Act of 1865. This Act classified the forests into reserved forests, protected forests and village forests. In the reserved forests, most of the local rights were abolished while in the protected forests, some existing rights were accepted as a privilege offered to the local people that can be withdrawn if necessary. The village forests were reserved forests in respect of which any village community might be assigned the rights to govern prescribing the conditions of assignment including duties for the protection and improvement of such forest. The rights of the people over forest lands and produce in the reserved and protected forests were restricted and regulated by this Act. It empowered the government to exercise control over forests. It also made several provisions for imposition of duty on timber which later became a source of revenue to the government. In 1879-80, the new forest laws caused considerable dissatisfaction among the people at various places, particularly in Kumaon, parts of Andhra Pradesh, Madhya Pradesh and Orissa. The reservation of forest did create hardship to the people in some areas.

2.10. The Indian Forest Act was further revised in 1927 to consolidate the laws relating to forests and forest produce. The 1927 Act contained all the major provisions of the 1878 Act. This Act is in vogue till date. Some of the states have enacted their own full scale Forest Acts in line with the Central Act. In Karnataka, the Karnataka Forest Act was enacted in 1963 mainly in line with the Indian Forest Act, 1927 with modifications as were considered suitable and necessary.

2.11. The Forest Acts of 1865, 1878 and 1927 were adopted by the Bombay Presidency as and when these were enacted by the Union Government. The Bombay Presidency formulated the Bombay Forest Rules in the year 1942 by exercising the powers provided in the Forest Act of 1927.

2.12. The Forest Act of 1865 was not extended to the Madras Presidency. The provisions of the 1878 Act were also not fully acceptable to it. Evolution of a forest policy in Madras Presidency was shaped by an intense debate on the ownership of forests. The idea of forest conservation exclusively by foresters was not acceptable to the village communities who held a notion that the forests belonged to them and therefore they resisted any move for total state control. The policy makers also had recognized that the rights of village communities over forests cannot be ignored. In 1881, Dr. Brandis, Inspector General of Forests, visited Madras and spent considerable time making a report on the condition of forests. The report brought out

the need to have a Forest Act for the effective and scientific management of forests of the province. Eventually the Madras Forest Act was promulgated in 1882 to facilitate state control over forests. However, the claims of the village communities were taken care of in the Act. The Act became effective with effect from 1st January, 1883. The provisions of this Act were mostly taken, with some necessary modifications, from the Indian Forest Act of 1878 and Burma Forest Act of 1881. Salient provisions of the Act are: (a) Constitution of reserved forest and its protection; (b) Protection of Government land not included in reserved forests; (c) Control over land not at the disposal of the Government; (d) Control of timber transit; (e) Government's rights on royalties and other timber in transferred territories; (f) Penalties and Procedure; (g) Control of cattle trespass and (h) Rights of forest officers. The present State of Tamil Nadu continues to adopt the principal Act of 1882 although a number of amendments have been incorporated in the intervening period. Since the takeover of the forest areas by the Forest department and their subsequent reservation into various categories, there had been a simmering undercurrent of opposition, discontent and protest in the people of Madras Presidency. This culminated in handing over nearly one sixth of the Presidency's forests with Forest Panchayaths in the 1920s. However, this bold attempt proved disastrous and such forests had to be handed back to the Forest department around independence in a much depleted state.

2.13. The task of preparation of Working Plans was initiated in different parts of the country during the period 1871-1900 for prescribing treatment of the forests on scientific lines. With inadequate equipment and poor means of communication, the forest officers took up the pioneering task of exploring the forests and demarcating them. Technical education and training in forestry was further organized. In 1878 a Forest School was opened in Dehradun which trained Rangers from all the States. In 1885, training of forest officers for India commenced at Cooper's Hill in England. A Provincial Forest Service was inaugurated in 1891 with a view to training a suitable cadre of forest officers in India itself.

2.14. The first **Forest Policy** of the country was formulated in 1894. The policy was based on a report submitted to the Government on 'Improvement of Indian Agriculture' by Mr. J.A. Voelekar, Consulting Agricultural Chemist of the Royal Agricultural Society of England. In the report he had stressed upon the need for formulating a forest policy with a definite objective of serving agricultural interests. On the basis of these recommendations, the Government of India declared the forest policy on the 19th October, 1894. The policy subordinated forest conservation to the promotion of agriculture. The objectives of the policy were promotion of the general

well being of the country, preservation of climatic and physical conditions and fulfillment of the needs of the people. The forest policy broadly classified the forests of India into four categories: (a) Forests, the preservation of which was essential on climatic or physical grounds, (b) Forests which afforded a supply of valuable timbers for commercial purposes, (c) Minor forests which primarily provided fuel and fodder or grazing, and (d) Pastures and grazing grounds proper, which were usually forests only in name.

2.15. The 1894 policy accorded very high priority to community benefit. It repeatedly stressed upon the need to satisfy the genuine requirements of the local population from the forests. Even in the category (b) forests which were potentially productive for supply of valuable timbers, considerations of revenue were made secondary to the full satisfaction of local needs, and customary rights and privileges were fully recognized. As regards the forests in category (c), i.e. Minor forests, the policy resolution provided for very liberal and reasonable concessions to the local population. In the category (d) lands, i.e. pastures and grazing grounds proper, as also in the non-forest wastelands, the interests of the local community reached their maximum.

2.16. The 1894 policy provided for liberal diversion of forest land whenever it was required for agriculture. Forests were to be managed in the interests of and for the enhancement of agriculture. Forests were thus assigned a role subservient to agriculture. The fact that forests played a supporting and supplementing role to agricultural development was ignored. The policy did not consider conservation of forests as a higher priority over the demand of the land for agriculture. Absence of restraint against diverting forest land to agriculture and other uses led to large-scale deforestation.

2.17. With the gradual development of forestry and forest activities, the forestry establishment was expanded. The number of Conservators was increased to cope with the increased forest conservancy work, both administrative and technical. In 1905, the idea of having a Chief Conservator of Forests in each state crystallized. In 1906, the Imperial Forest Research Institute was established in Dehradun. To meet the timber requirements of the First World War (1914-1918) the Institute started conducting tests on the suitability of indigenous timbers for various uses. In 1910, a Board of Forestry, composed of the representative Conservators under the presidentship of the Inspector General of Forests was set up. Meetings were held once in three years to discuss the programme of research work as also the problems of general forest administration. In 1912, the Madras Forest College was started at Coimbatore for training Forest Rangers for the southern region of the country.

2.18. With the political changes in 1921, 'Forests' became a State subject and their administration came to vest in the Governments of the concerned provinces. As a result, forest organization and management also underwent a change. The Inspector General of Forests became the adviser to the Government of India. The Chief Conservators of Forests became independent heads of the respective State Forest Departments responsible to their respective provincial administrations.

2.19. During this period, notable advances in working plan work were achieved in most of the States. Natural regeneration of sal and deodar and artificial regeneration of teak received high attention in their respective zones. Interest was evinced in wildlife preservation and some sanctuaries were established for the preservation of wildlife. Soil conservation work was also organized.

2.20. The Second World War (1939-1945) resulted in the over-exploitation of the forests but many forest-based industries developed, particularly plywood industry. Saw mills of various capacities were also set up to cope with the demand for timber for construction. A few paper factories were also established.

2.21. With the merger of the princely states in 1948 all the forests owned by them came under the control of the respective state governments. Private forests were also acquired by the states and as a result the forest area under public ownership was almost doubled. For several years the state Forest departments were busy in the consolidation of the forests, unification of forest laws and extension of scientific management to the newly acquired forests on a unified basis.

2.22. In 1950, the Central Board of Forestry was set up to co-ordinate forest policy and other matters at the national level. At the time of its formation, the Union Minister for Food and Agriculture was the Chairman of the Board. The Ministers in charge of Forests in States and Union Territories, Secretary to the Department of Agriculture and the Inspector General of Forests were the members of the Board. The Central Board of Forestry used to meet annually.

2.23. During the beginning of the twentieth century including the pre-independence era, developments of far reaching importance had taken place in the country's economic and social scenes. The pressure of accelerated growth of population, unprecedented natural calamities like droughts and famines, food shortages caused by the above, and the World Wars resulted in large-scale deforestation in the country. The two World Wars necessitated uncontrolled and very heavy withdrawals from the forests in order to meet defense requirements. Following Independence, the national leadership, in order to make a determined bid for fast

economic development and national reconstruction, decided to have a fresh look at the Forest Policy.

2.24. The Government of India in Resolution No. 13/52/F, dated 12th May, 1952 enunciated a Forest Policy for the management of forests in the country to replace the forest policy of 1894. While the fundamental principles underlying the 1894 policy are ever true and were therefore reiterated, Government of India thought it fit to lay greater emphasis on a number of other points. It proposed the classification of forests on a functional basis into protection forests, national forests, village forests and tree-lands, depending upon the roles that they played. It emphasized the need for evolving a system of balanced and complementary land use, under which each type of land was to be allotted to that form of use under which it would produce the most and deteriorate the least. The policy considered it desirable to establish tree lands wherever possible for the amelioration of the physical and climatic conditions, and promoting the general well being of the people. It laid stress on retaining 60 per cent of geographical area in hilly regions and 20 per cent in plains under forest cover, so that one third of the total geographical area of the country should on the average be under forests. It made provision for ensuring progressive supplies of grazing, timber and agricultural implements and firewood to release cattle dung for use as manure. The national policy also discouraged indiscriminate extension of arable lands by sacrificing forest lands, as this not only deprives the local population of wood, grass etc., but also deprives the land of its natural defences against dust and storms, hot winds and erosion. It discarded the widely held notion that forestry has no intrinsic right to land. The role of forests - productive, protective and bio-aesthetic – entitles them to an adequate share of land to promote public well being and ensure balanced economy. The policy also stressed that it would be duty of the forester to awaken the interest of the people in the development, extension and establishment of tree lands wherever possible and to make them tree-minded. The national forests were to be managed on the principle of progressively increasing and eventually reaching the highest, sustainable yield to meet the requirements of defence, communications and industry. It also emphasized the need for affording protection to wildlife by its management for scientific study and for recreational purposes. The policy further laid stress on (i) weaning the local people by persuasion of the baneful practice of shifting cultivation; (ii) increasing the efficiency of forest administration by having adequate forest laws; (iii) giving requisite training to the staff of all ranks; (iv) providing adequate facilities for the management of forests and for conducting research in forestry and forest products utilization; (v) controlling grazing in the forests; and (vi) the need for promoting the welfare of the people.

2.25. As regards wildlife protection, the first codified law in India was enacted in the year 1887 by the British and was titled the Wild Birds Protection Act, 1887 (Act 10 of 1887). This Act enabled the then government to frame rules prohibiting the possession or sale of any kind of specified wild birds, which have been killed or taken during the breeding season. Again the British Government in the year 1912 passed the Wild Birds and Animals Protection Act, 1912 (Act 8 of 1912) as the Act of 1887 proved to be inadequate for the protection of wild birds and animals. Both the Acts of 1887 and 1912 were not found to be effective. However, wildlife received a fair degree of protection in the Reserved Forests under the provisions of the Indian Forest Act. The Act of 1912 was amended in the year 1935 by the Wild Birds and Animals Protection (Amendment) Act, 1935 (Act 27 of 1935) in order to make it more effective. In 1935, through the efforts of some wildlife enthusiasts, Government of India held a conference on wildlife which resulted in some concrete measures for the protection of wildlife. A number of sanctuaries for wildlife were established in some of the states. After Independence in 1947, concrete steps were taken to cry a halt to the indiscriminate killing of wildlife. The Constituent Assembly in the Draft Constitution placed 'Protection of Wild Birds and Wild Animals' at entry No. 20 in the State List and the State Legislature had been given power to legislate. In 1952, Government of India set up the Indian Board of Wild Life to advise it on all matters pertaining to wildlife.

2.26. As regards the forest areas of present Karnataka which were significantly impacted during the British administration, mention must be made about Belgaum and North Kanara districts of Bombay presidency and South Kanara district of Madras presidency. All these three districts lying in the lap of the Western Ghats were thickly forested with various hardwood timber species including high quality teak, especially in Belgaum and North Kanara districts.

2.27. Although Belgaum forest division was established as early as 1870, there was no organized working for a long time and the system of extraction was on selection basis which was very irregularly followed. The forest areas of the district were heavily exploited in the past to meet the requirement of fuel and timber and also to meet the requirement of industries and railways. Departmental cuttings were commenced in 1879-80. The practice was to fell trees within certain limits and to stack the wood in heaps of 5 feet x 4 feet x 10 feet, this quantity being equal to about one cart load, which were then sold by auction. The forests of Belgaum were initially worked more heavily than the Kanara forests because of proximity to the towns of Belgaum and Dharwad. The teak bearing forest blocks of Nagaragali range in Khanapur taluk were the first to be worked followed by the moist deciduous and

semi-evergreen forests of the taluk. In the beginning, follow-up planting operations were not prescribed in the teak bearing areas; but sporadic planting was carried out in certain patches which gave promising results in well-drained and well-tended areas. Due to adoption of the system of selection felling without follow-up improvement operations there was overall decrease in the proportion of teak in the teak-bearing forests. However, this was set right later by adopting selection-cum-improvement system in which artificial planting of teak was carried out in depleted areas. The first working plan for the teak-bearing forest areas of Nagaragali in Belgaum division was written by Mr. D. B. Sothers in the early 1900s. Mr. W.E. Copleston had written the working plan for Golihalli-Godoli areas (Blocks I and II) during 1903.

2.28. The miscellaneous forests of the division were heavily worked for supply of fuel wood for local consumption, and more importantly, for running of the locomotives of the Southern Maratha Railways, established in 1882. Continuous supplies of firewood to keep the locomotives running had caused severe depletion and degradation of the forests. The first working plan for the fuel forests of the division was written by Mr. N. D. Satarawala (1903). The plan was revised in succession by Mr. D. A. Thomson, Mr. E. M. Hodgson and Mr. D. B. Sothers. The silvicultural system adopted in these areas was either 'simple coppice' or 'coppice with standards'. Such systems in high rainfall zone caused irreversible damage to the forests, some of which gradually turned into open lateritic grassy blanks with stunted tree growth here and there. There was also an age-old practice of shifting cultivation called '*Kumri*' which was practiced extensively in certain forests with the result that vast tree-clad areas were laid bare. The practice was initially curtailed and then abolished in the latter half of the nineteenth century. However, scars reminiscent of this practice are prominently visible even today on several hill slopes of the region. Hirda (*Terminalia chebula*), an important revenue yielding species of the moist deciduous forests of Belgaum division, was reserved while working the forest areas. As a result of continuous retention of the species and heavy working of other species, we now have preponderance of Hirda in the forest with the other species mostly with stunted growth and quite a bit of thorny species.

2.29. Sandalwood was an important species of the division, but its extraction was haphazard. The prescribed sequence of coupes for exploiting sandal was not strictly adhered to. Easily accessible areas were repeatedly worked leaving difficult and inaccessible portions which were not worked. The term 'dead and dying' was loosely interpreted and even trees having superficial and minor defects were extracted under the pretext that they were dying. As a result, the species was left in a depleted state.

2.30. The forests of North Kanara (Kanara, for short) were well known for teak even before the advent of the British. Teak, rosewood and other hardwood timber from the Kanara forests were supplied in the eighteenth century to Haidar Ali and Tippu Sultan of Mysore kingdom. Prior to the advent of the British, these forests were subjected to exploitation of teak, sissum, matti, nana, karimuttal and other marketable timber and bamboos by private dealers on royalty basis. With the advent of the British rule, control over exploitation was exercised through the Revenue department. The exploitation was at first carried out by issue of licenses or permits to exploiters, who brought the timber to the checking depots where it was measured and released on recovery of royalties. Between 1859 and 1865, gradual changes took place in administration of forest in the district. First an Assistant Conservator of Forests was posted under the Collector and then in 1865, two Deputy Conservators of Forests were posted, one above the Ghats (Sahyadri) and the other below the Ghats. In 1865, Colonel Peyton established a Government sale depot at Haliyal, and commenced departmental working. (The sale depot was located on Dharwad-Haliyal Road; now it houses the forest offices, residential quarters for DCF and for some of the forest staff, and a few taluk offices.) A separate Forest department to take charge of forests was created in 1870. Colonel Peyton, one of the two Deputy Conservators of Forests was promoted to be Conservator of Forests. After 1880, the Kanara forests were divided into three divisions: Haliyal, Supa and Karwar comprised the northern division; Yellapur, Mundagod, Kumta and Ankola comprised the central division. Sirsi, Siddapur, Honnavar and Bhatkal comprised the southern division. Later, the divisions were further re-organized. Present Haliyal division and a part of Dandeli wildlife division comprised of Northern Division, Kanara (NDK). Areas coming under present Yellapur and Sirsi divisions comprised of Eastern Division, Kanara (EDK). Present Karwar and Honnavar divisions along with a part of Dandeli wildlife division comprised of Western Division, Kanara (WDK).

2.31. Among the forests of Kanara, the high forest blocks of Haliyal and Yellapur divisions were rich in teak trees with larger girth. The slope areas of Haliyal and Yellapur divisions such as Gund, Nagzari, Arbail and Nirsol were particularly famous for high quality teak. The pole forests of these two divisions, commonly referred to as teak pole areas, also had teak trees in larger numbers, albeit with relatively smaller girth. The Inland Coastal forest areas of Karwar and Honnavar divisions and Yekkambi-Sonda areas of Yellapur and Sirsi divisions had some proportion of Teak trees. Very moist deciduous forests of the divisions normally do not sustain teak; however, it is not uncommon to come across teak trees on the southern slopes of such forests too.

2.32. Prior to 1895, forest working in Kanara was extremely unorganized. Departmental working was started in 1895 in order to exploit the forests systematically, mainly for removal of teak. Working plan was prepared in 1895 for the high forest Blocks I to IX of Haliyal division by Mr. T. R. D. Bell. This plan was in effect an exploitation scheme as silvicultural aspects of different species were not known at that time, and Blocks and Compartments were laid out for the first time on the ground. Block XX with Block VII-A of Haliyal range was dealt with in a separate plan by Mr. W.E. Copleston in 1905. Bell's plan was reviewed in order to reduce excessive fellings. Blocks VIII and IX of Bell's plan along with Block XX of Coplestone's plan were included in a revised plan by Mr. W.A. Miller which was sanctioned in 1916. However, the modified plan could not be properly implemented due to the First World War which triggered large-scale demand of timber not only during the war but also for post-war reconstruction works. Later, the high forest blocks of the division were brought under four different plans: for blocks (I to VII) by Mr. Davis (1927), blocks (VIII, IX and XX) by Mr. S.N.J. Ratnagar (1929), Nagzari valley (XIA) by Mr. Kesarkodi (1935) and Gund (X and XI) by Mr. Hemmadi (1921). By and large, the revised plans prescribed clear felling and artificial planting with teak. In some localities selection and improvement fellings were also prescribed. With the commencement of the Second World War, working plans were relegated to the background and areas which were easily accessible and which contained valuable tree growth were heavily worked. The working plan for Gund (X and XI) was revised in 1943 by Mr. Kaikini. The working plan for high forests I to IX and XX was revised in 1956 by Mr. F. A. B. Coelho and that for Nagzari valley (XIA) by Mr. Britto in the same year. These plans were improvements over the earlier plans, being based on past experiences and continued learning, particularly in the artificial regeneration of teak. Clear felling was resorted to in relatively plain areas; selection felling was prescribed on the slopes.

2.33. The teak pole forest areas of Haliyal were not exploited until the beginning of the twentieth century because of lack of demand of trees of relatively smaller girth. Working plans for the Haliyal teak pole forests (Blocks I to X and VII-A) were written for the first time by Mr. Copleston and Mr. Miller during the early 1900s with 'coppice with standards' system. Later the plans were combined and revised by Mr. Miller. The combined plan was revised by Mr. Kesarkodi in 1933-34. Silvicultural system prescribed was simple coppice or coppice with standards. Next revision of the plan was done by Mr. Korlahalli in 1958-59 and by Mr. M. V. Mulimani in 1984.

2.34. Because of the absence of teak, the forests around Jagalbet, Tinaighat, Castle-rock and Anmod areas remained neglected and unorganized for quite a long

time. These forests were also affected by *Kumri* cultivation like the adjoining forests of Khanapur in Belgaum division. *Kumri* cultivation was banned in 1890. Extraction of fuel wood to meet the requirements of the Southern Maratha Railways was started in the beginning of the twentieth century. First working plan for Castle-rock area was written by Mr. D. A. Thomson in the year 1903. The plan had prescribed simple coppice system. Minor forest produce species including Hirda (*Terminalia chebula*) were reserved. With the Railways switching over to coal in 1927, felling of forest in these areas was reduced. Thomson's plan was revised by Mr. Mufti in 1946 and then by Mr. D. G. Wesley in 1960.

2.35. The forest sub-blocks of Supa-Jagalbet and Anmod areas, which contained non-teak hardwood timber species of bigger girth, were worked during the Second World War without a plan for supplying railway sleepers. The Supa-Jagalbet sub-blocks were brought under the working plan of Mr. G. R. Mavinkurve in 1957 and were worked mainly to meet the requirement of railway sleepers.

2.36. The first working plan for the Yellapur Ghat forests (Blocks XIII, XIV, XV, XVI, XVIII and XXI) was written by Mr. Copleston in 1901 prescribing selection felling. In 1908, Mr Aitchison wrote the plan for Mundgod high forests (XXII and XXIII) prescribing selection and improvement felling. In 1916-17, Blocks XIV and XV were taken away and included in the working plan by Mr. Miller under Kirwatti teak pole plan wherein he had prescribed a system of coppice with standards. In 1921, Mr. Edie re-organized the areas covered under all the above three plans and brought under one working plan, namely, 'Yellapur and Mundgod Teak high forest plan'. He had divided the area of the plan into four working circles comprising of the best forests (Circle I), medium forests (Circle II), poor forests (Circle III) and scattered grazing lands (Circle IV). The rotation periods fixed for circles I, II and III were 120, 90 and 60 years respectively. This plan envisaged elaborate work for artificial regeneration of teak. Mr. Garland revised Edie's plan in 1935 and prescribed rotation of 120, 105 and 90 years for the working circles I, II and III of Edie's plan. During the period of implementation of Garland's plan, heavy felling was undertaken throughout the plan area during the Second World War, in addition to regular regeneration felling.

2.37. The working plan for the high forests of Arbail slope (Block XII) and Nirsol slope (Block XVII) was first written by Mr. W. E. Copleston in 1901. Later Mr. Miller revised the plan for Arbail slope in 1916 and Mr. Ratnagar revised the plan for Nirsol slope, which was subsequently revised by Mr. Garland in 1942. The timber from these blocks was floated down the rivers to the coast. Felling of trees was by selection

system and a felling cycle of thirty years was fixed by Mr. W. E. Copleston, 13 years for Block XII and 17 years for Block XVII. Exploitable girth was fixed at 7 feet with a provision to reduce it to 6 feet 6 inches in case of non-availability of trees with 7 feet girth. Mr. Miller had fixed the exploitable girth at 5 feet 6 inches. The proportion of species aimed at after regeneration was teak 25%, matti 20% and sissum 15% and the remaining growing stock was to be contributed by nana (nandi), heddi, dhaman, honne and shivani.

2.38. The working plan for the forest areas coming under Yekkambi-Sonda high forest blocks (Block XXVIII and part of Block XIII) was first written by Mr. Aitchinson (1914). A portion of these forests now falls in Sirsi division. The system of extraction prescribed was by selection. Though selection system was prescribed to induce regeneration, there was not much evidence of improved regeneration of teak and other species like kindal, matti, nandi, etc.

2.39. Working plan for the Manchikeri-Yellapur high forest blocks XXIX to XXXIV was first written by Mr. G. R. Mavinkurve in 1954. He had prescribed for improving the growing stock by carrying out selection-cum-improvement felling and supplemented by introduction of teak. This plan was further revised by Mr. B.U. Chengappa (1985-2005).

2.40. The first regular working plan for the Mundgod teak pole forests was written by Mr. P. E. Aitchison who had prescribed 'coppice with standards' system. Regeneration of the felled coupes was depending upon coppice growth and no artificial regeneration was prescribed. This plan was revised by Mr. Korlahalli in 1956 and by Mr. H. P. Krishnappa in 1984.

2.41. Mr. Pearson wrote the first working plan for Kalinadi slope forests in 1908. This plan included slope forest areas of present Karwar, Yellapur and Dandeli (wildlife) divisions and provided for improvement felling. However, it was implemented in an irregular fashion in which the largest teak and sissum trees were removed with heavier exploitation in accessible areas. This plan was in operation till 1939 and was followed by in interim scheme of Mr. R.F. Sanderman in 1939 that was in force till 1950. The plan was revised in 1950 by Mr. G. R. Mavinkurve and selection cum improvement system was prescribed. The period of the plan was from 1950 to 1980.

2.42. As Sirsi division was earlier a part of Yellapur division, working of some of the high forests of the division having hardwood timber was included in the working plan for Yekkambi-Sonda high forest blocks by Mr. Aitchison (1914). Large extents

of high forests of the division were not brought under any working plan presumably because these are evergreen and semi-evergreen forests and there was no demand for timber from such forests at that time. However, considering the demand for fuel wood to Sirsi town and surrounding villages, a working plan, namely, Sirsi Town Fuel working plan was written by Mr. Aitchison in 1911 with a plan area of 3,300 hectares of forest. The silvicultural system prescribed was coppice with standards. This plan was revised in 1924 by Mr. H.J.C. Millet. No revision took place after the lapse of Millet's plan. The first plan for sandal areas of Sirsi and Siddapur was written by Mr. Kaikini (1944) which was in force up to 1953 and was further extended for another 10 years. This plan was primarily for extraction of sandalwood followed by artificial regeneration by sowing sandal seeds along with seeds of host species. The prescription of artificial regeneration of sandal as suggested in Kaikini's plan was not implemented properly and sandal stocking had reduced considerably.

2.43. The Inland Coastal Forests (ICF) of the erstwhile Western Division, Kanara (present Honnavar and Karwar divisions) were earlier worked under a system of annual coupe sale, in which annual coupes of about 30 acres were sold standing. Teak, rosewood, honne and other valuable species were reserved. The first working plan for these forests was written by Mr. Aitchison (1911-1928) and it was known as the Working Plan for the Inland Coastal forests of Ankola and Kumta. The plan had prescribed coppice with standards system. However, due to non-availability of adequate number of standards of sound quality, this system was given up in favor of clear felling with artificial regeneration, mainly with teak. As large extents of area (27,000 acre) covered by Aitchison's plan were eventually transferred to minor forest from forest proper due to persistent public demand (Collin's revised settlement), the next working plan for the Inland Coastal Forests was written covering more forest areas (Ankola, Kumta, Honnavar and Bhatkal) by Mr. S. N. J. Ratnagar (1928-1948). The plan prescribed clear felling and artificial regeneration. Fifty percent of the clear felled area was proposed to be regenerated by teak and rest of the area was to be covered with non teak hardwood species established naturally in the area. The prescriptions of the plan were partially modified by Mr. Y.R. Divekar, DFO, Western Division Kanara in 1933 by reducing clear felling to one third of the annual coupe area. The clear felled portion was prescribed to be planted entirely with teak. The working plan for the Inland Coastal Forests of Western Division Kanara was written by Mr. G.R. Mavinkurve (1953-1973) in which coppice with reserves system was prescribed for deciduous forests and selection-cum-improvement system was prescribed for semi-evergreen forests. Separate working circles were made for khair (*Acacia catechu*) and teak plantations.

2.44. The forest areas which had been taken out from Aitchison's plan due to revised settlement were brought under North Kanara Coastal Fuel working plan by Mr. Tuggerse (1924-38) providing for supplying firewood to the depots. But the plan could not be implemented and was suspended later as it prejudiced the exercise of privileges by the people.

2.45. Working plans for the Soppinahosalli high forests of Honnavar division were written successively by Mr. Aitchison, Mr. Kesarkodi and Mr. Britto. The silvicultural system prescribed by Mr. Aitchison was selection felling of hardwood timber such as teak, matti, nandi, kindal, etc. The subsequent plans prescribed selection-cum-improvement felling followed by artificial regeneration. Britto's plan also prescribed clear felling of 40 acres annually followed by planting of teak and special tending of coppice shoots and existing regeneration.

2.46. The high forests of Gangavali valley of present Honnavar and Karwar divisions were put to systematic management from 1908. Mr. Pearson wrote the first working plan for Ankola High Forest Blocks XXIV and XXV (1908-1927) prescribing selection system. Mr. Millet revised the plan (1927-1951) prescribing artificial regeneration of selected forest areas with teak and the rest of the forest was to be worked under improvement felling system. Mr. S. A. Mundukur revised the working plan (1955-1985) with selection-cum-improvement felling with intensive artificial regeneration. He also prescribed a selection-cum-improvement working circle with diffused regeneration and a plantation working circle. This plan also included the Arabail high forest (Block XII) of Yellapur division.

2.47. Extensive casuarina plantations had been raised in the coastal areas of Western Division, Kanara, mainly at Kasarkod and Haldipur areas of present Honnavar division. It was introduced at Harwad in 1888-89. A number of working plans were written to harvest these plantations. These were Copleston's working plan (1910), Vas's working plan (1935-55) and Korlahalli's working plan (1956-1972). These plans had prescribed clear felling and planting with rotation periods of 30, 20 and 15 years respectively.

2.48. The interior high forests of Honnavar, Karwar and Yellapur divisions remained unorganized for a long time for the reason that these were non-teak bearing areas and extraction of other hardwood species from such interior places was not economically viable at that time. These areas were brought under systematic working much later under Mr. Shanmukappa's working plan (1976-96).

2.49. The first working plan for the Karwar fuel reserves was written in 1899-1900 by Mr. D.A. Thomson. The main objective of the plan was to supply fuel wood to Karwar town. Thomson's plan had prescribed the system of coppice with standards (26 trees per acre) of important species like teak, matti, kindal, honne, etc. Subsequently, Mr. J.L. Bell in 1927 proposed to do away with standards, as ideal trees were not available in sufficient numbers. He had prescribed clear felling, burning of debris in heaps and planting of teak in well burnt patches. However, Mr. H.L. Newman, CCF in 1929 proposed to reserve 10 trees per acre in order to ensure that the entire area is not converted to wholesale teak bearing area. Mr. H.J.C. Millet suggested to reduce the size of the annual coupe to half and thereby to double the rotation period from 45 years to 90 years so that teak trees with saleable girth are obtained. In 1933, on the basis of suggestions from Mr. Y.R. Divekar, DFO, Western Division, the system of retention of standards was done away with and the annual coupe area was halved. The system was further changed in 1943 when clear felling was restricted to one third of the coupe area selected by the DFO as best suited for planting of teak. In the remaining two thirds of the coupe area the contractor was given the option to clear fell as much of the area he desired provided it was done in an orderly manner. The plan was further revised by Mr. Britto (1960-1980).

2.50. The forests of Supa and Joida areas which now fall in Karwar, Haliyal and Dandeli wildlife division remained unorganized until 1957 owing to the absence of teak in the crop which comprised mostly of miscellaneous hardwood and some softwood species. During the Second World War, portions of these forests were tapped for timber mostly on roadsides. Most of these forests were brought under the working plan written by Mr. G.R. Mavinkurve (1957-1967). The areas not covered under Mavinkurve's plan were brought under the working plan written by Mr. Shanmukappa (1966), but it remained in draft stage.

2.51. Mr. R.S. Pearson wrote the working plan (1909) for the teak plantations of Kadra, Mardi and Sulgeri of Karwar division prescribing thinning regime of the plantations which had been raised during 1865 to 1870 (288.39 ha). Most of these plantations (207 ha) have gone under submersion of Kadra reservoir.

2.52. The teak bearing forests of Dharwar district were brought under regular working during the early 1900s. Pole forests of Dharwar taluk and part of Kalghatgi taluk were worked under coppice with standards system as per the working plan of Mr. R.W. Wood Row (1900). Mr. W.A. Miller wrote the plans for Kalghatgi forests in 1917 and for Bankapur and Hangal forests in 1918 prescribing the same silvicultural system. The scrub forests of Dharwar and Kod (Hirekerur) were worked under

simple coppice system as per the working plan by Mr. Kanitkar written in 1924. Sandal forests of Dharwar and Bijapur districts along with those of Haliyal and Mundagod ranges of North Kanara district were worked under a plan written by Mr. Kesarkodi in 1932. The silvicultural system was improvement felling. Dead, dying and unhealthy sandal trees with 42 inches girth and above were extracted. Dibbling of sandal seeds was prescribed in certain areas. Natural regeneration of sandal was reported to be good.

2.53. As regards South Kanara district, during the British administration in the early nineteenth century, large areas of forests were cleared for the purpose of extension of cultivation. The forest also suffered to a great extent due to shifting cultivation (*kumri*). Timber extraction was not carried out extensively, perhaps due to non availability of teak in the region. Departmental working was introduced on a small scale in the year 1865. A system called 'voucher and license system' was in vogue and continued up to 1874-75 for extraction of timber. From 1875 to 1890, timber operations were almost entirely suspended because of settlement and demarcation works. From 1882 onwards, all the Government forests of the district were constituted into reserved forests under the Madras Forest Act.

2.54. The first working plan of the region, written by Mr. Foulkes for the period 1902-03 to 1912-13, was mainly for annual extraction of timber and fuel to ensure sustained supply to the important centers of consumption and to provide adequate rest and protection to those tracts which had suffered severely from excessive *Kumri* and other fellings in earlier years. This plan covered the forest reserves of Porkala, Shibaje and Kadambila. The forests were worked on a selection system with retention of suitable seed bearers. The principal species extracted were beete (*Dalbergia latifolia*), honne/benga (*Pterocarpus marsupium*), matti (*Terminalia tomentosa*), jamba (*Xylia xylocarpa*), etc. Reproduction was from coppice shoots from felled stumps and natural regeneration. Provision was also made for dibbling of seeds of kiralbogi (*Hopea parviflora*). After the expiry of the working plan by Mr. Foulkes, the next working plan written by Mr. Longrigg (1916-1926) prescribed improvement felling which provided for systematic removal of trees of saleable species above three feet girth which were badly shaped, unsound, dead or dying or were interfering with the growth of sound trees.

2.55. The first working plan for the forests of Mangalore South division was written by Mr. P. N. Davis for the period 1931-32 to 1942-43. This plan had eight working circles. This was followed by the working plan of Mr. B. S. Keshav Vittal for the period 1943-44 to 1957-58 and covered the forest areas of the present Mangalore

and Coondapur forest divisions with fourteen working circles. For timber extraction, concentrated regeneration felling or selection felling system was prescribed. Gaps created by selection felling and the patches where natural regeneration was deficit were to be artificially regenerated by sowing and planting of desirable species. For fuel wood extraction, simple coppice system was adopted.

2.56. One significant feature regarding silvicultural improvement that had taken place in the South Kanara district was with regard to the attention that was focused on the regeneration and tending of kiralbogi (*Hopea parviflora*), as this tract was considered to be the 'Home' of this species. Forest patches having good regeneration were tended by clearing of under-growth, climber cutting followed by judicious opening of the canopy thereby enabling the kiralbogi seedlings to establish as saplings. Very encouraging results had been obtained through this silvicultural intervention. On account of the value of teak as constructional timber, and in an effort to replace the degraded deciduous forests with teak, plantations were raised in selected areas. However, the results were not encouraging, except in certain patches. Growth was not satisfactory. Therefore, teak plantations had been discontinued. Cashew had been planted in some of the degraded fuel areas of the district with fairly encouraging results. Among softwood species, halmaddi (*Ailanthus malabarica*) plantations have done well in many areas in the district.

2.57. As regards Bellary district which was also a part of Madras presidency, forest management prior to 1861 was very simple. Graziers were allowed freely and they used to cut the tree growth for agricultural implements and for dwelling. Dr. Dietrich Brandis, Inspector General of Forests, inspected the forests of Bellary in 1881 and suggested lines of future management. He gave importance to the protection of forests and suggested for reservation of forests under the Madras Forest Act. He also suggested that kamara, teak and sandalwood should be reserved. Most of the major reserves of the district were constituted between the last quarter of the nineteenth century and the first quarter of the twentieth century. From 1905 till 1928 the forests were worked for fuel under simple coppice system as per the annual plan of operations and provisional working schemes. In 1906, Mr. A.W. Luishigton, the then Conservator of Forests prepared a scheme for planting *Casuarina* along the right bank of Hagari river to arrest the spread of sand. *Casuarina* plantations were raised during the period between 1907 and 1914. But only remnants are seen now. The Palmyra forests at Chilakanahatti which were previously managed by the Panchayath were handed over to the Forest department during 1911. During 1911 the Board of Revenue (Land Revenue) of the then Madras presidency ordered that the Daroji tank be under the control of the Forest department. The then Collector of

Bellary had thus described: *"*The tank contains excellent growth of babul [*Acacia nilotica*] over an area of 916 acres. If it is not reserved, it will disappear.*"*

2.58. From 1928 onwards welcome changes were brought about in the mode of management of the forests of Bellary. Ad-hoc forest working under annual plan of operations and provisional working schemes gave way to systematic working under working plans that clearly stated the objectives of working. During 1929, Mr. J. Sadashiva Iyer wrote the working plan for Ananthapur forest division of which the present Bellary division was a part. Forests in Hospet range were worked on simple coppice system spread over seven fuel series with a rotation of 30 years. Moka reserve was worked adopting a system of coppice with reserves, the number of trees to be reserved being 40 trees per acre. The plan was in force till 1938-39. During 1936, Mr. V.S. Krishnaswamy revised the working plan for Ananthapur forest division. The silvicultural system prescribed was simple coppice system. The only deviations he prescribed from the earlier plan were (a) a rotation of 40 years instead of 30 years and (b) fellings were restricted to such trees that the contractor wanted to remove. Ten working circles were constituted. These were: fuel wood, selection, small timber, sandal, bamboo, kamara, manure leaf, minor forest produce, grazing and protection working circles. The plan was operative till 1956. After the expiry of Mr. V.S. Krishnaswamy's working plan it was revised by Mr. K.A. Bhoja Shetty. However, the prescriptions were not implemented because of re-organization of states and consequently of the forests. After the expiry of Mr.V.S. Krishnaswamy's plan in 1956, no working plan was in force for the period from 1957 until 1977 when Dr. K. N. Baidya's working plan for Bellary forest division was approved. In the intervening period, felling in mining coupes was continued. In addition, some fuel coupes were laid and worked for fuel under simple coppice system to continue with supply of fuel wood for various purposes including defence supplies.

2.59. Before 1956, Kollegal taluk, which is presently in Chamarajanagar district, was a part of Coimbatore district of the Madras presidency. The taluk now comprises of the Male Mahadeshwara Hills (M.M. Hills) wildlife division and parts of Cauvery wildlife division and Biliranganagiri temple (BRT) tiger reserve. Kollegal forests were well-known for sandalwood even during the days of Tippu Sultan. When the Madras Forest department was established in 1856 under the control of its first Conservator Dr. Hugh Cleghorn, Kollegal forest area was one among the first to be brought under effective control along with other areas of Coimbatore and was placed under the charge of Major Morgon. Kollegal forest division came into being in 1909 prior to which it was a part of Coimbatore forest division. Kollegal division was known for abundance of sandalwood, firewood, bamboo, minor forest produce and

various kinds of small timber. The first working plan for the management of only sandal bearing areas around M.M. Hills and Bylur was prepared by Mr. P.M. Lushington in 1901. Uprooting of sandal was prescribed for mature sandal trees (above 32 inches girth at breast height) besides removal of dead and dying trees on a ten-year felling cycle. In 1923, Mr. Sadasiva Ayyar prepared working schemes for a period of three years for working sandal, fuel wood, small timber and bamboo. In 1928, Mr. N.D. Sahani prepared a consolidated working scheme for the entire division for a period of three years and the same was extended with necessary modifications by another two years, up to 1933. The first working plan for Kollegal forest division was prepared in 1933 by Mr. C.R. Ranganathan and Mr. M.H. Krishnaswamy under the direction of Mr. C.C. Wilson. This plan was in currency up to 1956-57. Mr. K. Shanmuganathan wrote the second working plan for the period from 1957-58 to 1971-73. Mr. K.R.V. Shetty wrote the working plan for the period 1973-74 to 1993-94. Management and extraction of sandal, fuel wood, minor forest produce and bamboo were the main working circles of these plans. Control of grazing was an important challenge of forest management in the forests of Kollegal division.

MYSORE STATE

2.60. The Mysore state became a princely state under the British in 1800. Information regarding forest management during the early British period is very sketchy. The four Mysore wars preceding British ascendancy must have caused heavy drain on the timber resources of the region. Formation of roads and construction of railway lines cutting through the forests of the peninsula and opening of large extents of forest land for plantation crops had caused large-scale exploitation of teak and severe damage to the forests. Significant development in the forestry sector does not appear to have taken place in the early part of British rule. However, sandalwood had gained importance and considerable interest was evinced in respect of sandalwood. There was a separate department called Sandalwood department directly under the control of the Commissioner. There was an elaborate arrangement of collection and disposal of sandalwood through the Revenue department. Sandalwood was collected through the '*Amildars*' of the taluks, who had employed on their own responsibility men called '*Managers*' who felled, prepared and collected the wood in small local stores called '*Pattadis*' distributed all over the taluks. When sufficient wood was collected in these local stores, it was sent to the central stores where the wood was classified and sold in due course.

2.61. Earlier to 1869, no rules were in existence for management of the forests although some arrangements were made for forest conservancy in the year 1857 in respect of some forest areas of Hunsur, Periyapatna and K. R. Nagar. The Mysore Forest Department was formed in the year 1864. The department was headed by one Major Hunter as Conservator and he was assisted by three Assistant Conservators and one Sub Assistant Conservator. Even though the Forest department was created it was a daunting task to exercise control over the management of the over-exploited and long-neglected forests in the absence of trained personnel at the field level. As a result, indiscriminate exploitation of the forest continued. The general practice after the advent of the department was to permit the public to cut timber for their requirements except sandal and teak by paying a fee of one Rupee per cartload. The department used to permit the traders to fell teak by paying a stamp fee of 8 annas per tree. This had caused irreparable damage to the forest.

2.62. The five-year tenure of Major Hunter as Conservator was a significant period of forest administration of Mysore state. He drew up a code of Rules, approved by the Commissioner for Mysore and confirmed by the Government of India, setting forth the 'Claims of Government on various kinds of woods and defining the privileges of ryots'. He set aside certain areas as 'Government Reserved Forests', introduced a system of inspection of lands applied for coffee plantation and imposed some checks on the felling of immature timbers. He introduced the system of Forest accounts. He was a true conservationist who realized even then about the need for strict conservation of forest and held the view that realization of revenue should not be the ultimate aim of forest management. Major Hunter took interest in the propagation of sandalwood and was one among the first to have recognized the need of host plants for the growth of sandal. He also introduced the system of departmental collection, preparation and dressing of sandalwood before its auction. The 'Managers' who were working under revenue officers were placed under the Forest department. Collection of sandalwood was done partly through contract and partly departmentally. At that time, only dead and diseased sandalwood trees were extracted. Earlier, the system of extracting oil in portable sills was also in vogue. This system was later discontinued as it was found that a lot of valuable material was wasted in the process.

2.63. Dr. Dietrich Brandis, Inspector General of Forests, Government of India after visiting Mysore state during 1867-68 suggested revision of the Forest Rules and proposed the appointment of trained forest officers from Europe. In the year 1869, Forest rules were framed for the management of the state forests and all such forests that were vested with the Forest department. Through these rules the department

made the first attempt to prevent the earlier practice of granting permit to cut and carry any tree other than sandalwood on payment by reserving 15 species as absolute property of the Government. Cutting of other species was permitted for the bonafide purpose of the farmers by issue of prepaid licenses.

2.64. Major Hunter was succeeded by Lt. Van Somersen as Conservator in 1869. Lt. Van Somersen, who had earlier served as Assistant Conservator under Major Hunter, was also a very committed forest officer. He was the first to classify the forests as 'Evergreen and Deciduous'. He re-organized the collection of sandalwood and introduced the system of its exploitation by uprooting (instead of felling) the marked mature trees. He had noticed the large-scale casualties of sandal in certain areas which he had attributed to drought and which perhaps might have been the first manifestation of the 'Spike disease'. Lt. Van Somersen took very keen interest in survey of forests, enumeration of trees and planting of trees in village groves and avenues.

2.65. During 1879, Mysore Forest Department was down-sized and the post of Conservator was abolished. Three trained forest officers were retained, one for the Western Ghats, one for Bangalore district and one for Railway supplies; the remaining charges were taken over by the Revenue officers. This was continued till 1885. Fortunately, the Forest department was restructured during 1886 when Mr. L. Rickets was appointed Inspector General of Forests in Mysore state. The Inspector General of Forests restructured the Forest department: the Deputy Commissioner was made in charge of forest administration of the district and there was a small establishment comprising of Rangers, Foresters and Watchers to assist him. Three students were sent for training as Rangers to Imperial Forest School, Dehradun. Systematic attempts to raise plantations of species such as sandal, teak, cardamom, etc. were made. A number of exotic species such as casuarina, eucalyptus, raintree, sissoo, mahagony, etc. were introduced. The '*Kheddah* method' of Elephant capture was introduced to replace the 'Pit method' which was found to be cruel. In the '*Khedda*' or Stockade method, hordes of wild elephants were scared away by drum beaters to move towards a designated enclosure well-fortified with wooden barricades where the animals would be captured by tying with ropes with the help of trained elephants and *Mahouts*. A *Kheddah* section was formed within the department. The Forest department was again reorganized in 1894 with a cadre of 16 officers. Uniforms for forest staff were introduced.

2.66. Mr. Rickets was succeeded in 1895 by Mr. Campbell-Walker who had a brief tenure of three years as Inspector General of Forests. During his tenure, the

Kheddah section of the department was closed. For the first time, a Gradation List of the Mysore Forest Department was printed in 1896. Mr. Pigot became the next Inspector General of Forests in 1899. A number of significant developments took place during his brief tenure of two years. A beginning was made in preparing of working plans for forest management. The Mysore Forest Regulation (No. XI of 1900) was enacted and Mysore Forest Rules, 1900 were also framed during the same year under the provisions of the Regulation. Mr. M. Muthanna, an Indian Forest Service officer, was appointed Conservator of Forests and ex-officio Secretary to the Government. In 1901, after the retirement of Mr. Pigot, Mr. Muthanna became the Head of the Department and steered the department for long twelve years (1901-1913). Mr. Muthanna took up his job in right earnest and started with proper survey of the forests. He got working plans prepared and implemented for the more important forests. With the implementation of working plans, forestry working became more and more organized. From 1902 onwards, felling was confined to annual coupes only. Earlier, during the period 1885 to 1902, felling was permitted in selection method in all accessible forest areas. The Mysore Forest Manual was compiled in 1907. Mr. Muthanna paid particular attention to exploitation of sandalwood and also fixed for the first time the share of private landholders to sandal trees growing in their lands. He encouraged research works to control the dreaded 'Spike disease' which had seriously affected the sandalwood trees. He had instituted an award of Rs 10,000/- for this purpose. The first Game Preserves in Mysore state were formed in 1904. He also encouraged export of Mysore forest products to various countries such as Egypt, China and Japan. He selected a site on the bank of Bhadra River for the location of forest industries beginning with a Saw Mill. He had built up an excellent cadre of trained forest officers and reorganized the Forest department in 1912.

2.67. The success of Mr. Muthanna is also attributed to the excellent relations he had maintained with the Government. His tenure also coincided with that of a civil servant of great foresight and diverse interest Mr. Vishwanath Patankar Madhava Rao (1850-1934) who served as Diwan of Mysore kingdom from 1906 to 1909 and Baroda from 1910 to 1913. He entered the service of the Mysore kingdom in 1869 as a headmaster of the royal school. He was later appointed public prosecutor of Mysore and served in the Judicial and Revenue departments. He also served as Inspector General of Police, Plague Commissioner in the Mysore kingdom from 1898 to 1901 and Revenue Commissioner from 1902 to 1904 before being appointed Diwan of Mysore in 1906. He was credited with a number of works such as revision of the Land Revenue Code, creation of the Department of Public Health, revival of Mysore Civil Service, introduction of kindergarten schools and free primary education, initiation

of a number of irrigation and power projects, sanctioning free grant of land to the Indian Institute of Science, etc. He also focused on conservation of forests and encouraged the Forest department in all possible ways.

2.68. Mr. M. G. Rama Rao succeeded Mr. Muthanna in 1914. This coincided with the outbreak of the First World War which had adversely impacted on Mysore Forest economy. During this period extraction of timber for war supplies increased and the department's effort consisted mostly in supply of Railway sleepers and Tent pegs. Traditional export of sandalwood had come to a halt. This prompted the Government to set up sandalwood distillation plants in Bangalore and Mysore (1916-17). The Government appointed two officers on special duty to survey the forest resources of the State. They were Mr. H.S.Narayana Rao and Mr. G. Krishna Murthy Naidu. Later, Mr. Naidu published his 'Economic Products of Mysore Forests', which is considered a classic on the subject. In view of the potential of bamboo as an important raw material for paper making, action was taken to draw up a working plan for the major bamboo forests. The First Conference of Mysore Forest Officers was held on 1st September, 1917. The Mysore Forest Rangers School was established in 1918-19 with a first batch of 26 students. The acute economic depression in the aftermath of the First World War affected the activities of the Forest department also: prices of timber fell sharply, there were heavy defaults by forest lessees, there was substantial retrenchment of the forest establishment and the Mysore Forest School was closed.

2.69. Mr. B. V. Rama Iyengar succeeded Mr. M. G. Rama Rao as Conservator in 1921. He had a very long tenure of 14 years as Head of the Forest Department (1921-1935). He was confronted with a major challenge of organizing supply of fuel and charcoal to Mysore Iron Works at Bhadravathi. The annual requirement of fuel was about 1,34,000 tons and the labour force engaged in ensuring its uninterrupted supply consisted of 5,000 men and 2,000 bullock carts. In order to supervise regular supply of fuel and charcoal, two special forest divisions, namely, Benkipura and Tarikere fuel supply divisions were formed during 1921 comprising of forest areas of Shimoga and Chickmagalur districts. The forests which were located within reasonable distance from the factory had to bear the brunt of this development process. Before the introduction of motorized transport, felling of trees took place on both sides of the tram-way passing through the forest. Later felling was more organized and well spread-out, but larger extents of forests had to be sacrificed. The department also contributed in a very big way in supplying poles of balagi (*Poeciloneuron indicum*) for electricity transmission from the evergreen forests of Shimoga and Chickmagalur districts. (The fuel supply divisions were later

reorganized and formed into regular forest divisions, namely, Bhadravathi and Koppa divisions.)

2.70. Mr. M. Machaya succeeded Mr. B. V. Rama Iyengar as Chief Conservator in 1935. He was the son of Mr. M. Muthanna and remained the Head of the Forest department till 1939. This period saw rapid development of the state and the Forest department contributed to this development process by ensuring extensive supplies of balagi poles and railway sleepers for which large extents of timber bearing forests, including evergreen forests of Chickmagalur and Shimoga districts were exploited. With the establishment of Mysore Paper Mill at Bhadravathi in 1937, the department had the added responsibility of ensuring supply of bamboo from the bamboo-bearing forests. Establishment of a plywood factory at Yeshwanthpur, Bangalore and revival of the Mysore Match factory at Shimoga necessitated opening up the evergreen forests of Shimoga and Hassan districts. This period also saw large-scale planting of trees in the *maidan* areas. One very important development of this period was the establishment of the Forest Research Laboratory at Bangalore in 1938. This was the second forest research institute in the country after the Forest Research Institute at Dehradun (1906).

2.71. Mr. C. Abdul Jabbar succeeded Mr. M. Machaya as Chief Conservator in 1939 and he remained in the post till his retirement in 1945. His tenure was almost coterminous with the Second World War and the department had to face the challenge of catering to the continuous demand of war supplies. The magnitude of the operations was so gigantic that during the peak period of 1943-44, the department had harvested and supplied 800,000 cubic feet of timber (including 270,000 cubic feet of sawn timber) besides huge quantities of poles, *ballies* and fuel wood from the forests. The Mysore Forest School was restarted in 1940 in the Forest Research Laboratory, Bangalore for training Forest Rangers. About 15 batches of trainees had passed out through the school.

2.72. The period immediately before and after independence also saw the gradual introduction of eucalyptus (a special hybrid – the 'Chikkaballapur' variety) in fuel wood plantations along with casuarina. An international forestry conference of independent India, namely the Far Eastern Forestry Conference was held in Mysore in 1948.

2.73. As regards writing of working plans, the forests of Mysore state were brought under regular working plans rather belatedly as compared to the forests of Bombay and Madras presidencies and Coorg state. Earlier to 1869, no rules were in existence for management of the state forests. In the year 1869, rules were framed for

management of the state forests and all such forests were vested with the Forest department. However, working of the Forest department got streamlined after its restructuring in 1886. From 1886 to 1902, felling was permitted in selection method in all accessible forest areas. Mr. G. Krishnamurthy Naidu drew up a provisional scheme for the forests of old Mysore forest division (comprising of present Mysore and Chamarajanagar forest divisions and excluding Hunsur, Periyapatna and K. R. Nagar taluks) in 1902. This scheme was replaced by a regular working plan written by Mr. H. Srinivasa Rao (1910-1930). This plan provided for felling in annual coupes and as a compensation for the wood exploited, plantations were prescribed in such coupes to ensure sustained yield. Yield was based on girth increment data obtained from analysis of teak stumps. This plan was replaced by the plan of Mr. M.M. Muthanna (1931-1941) who after detailed valuation survey of the growing stock and girth increment data on teak had prescribed three working circles based on the condition of the crop. Teak regeneration was prescribed in suitable localities. Dr. Krishnaswami Kadambi wrote the next working plan (1941-1961) which aimed at sustained yield from the forests by the attainment of normal forest and considering the demand for timber and firewood also. Mr. K.R.V. Shetty wrote the working plan for the period 1973-2003.

2.74. As regards the forests of Hunsur, Periyapatna and K. R. Nagar taluks of Mysore district, a provisional working scheme was drawn in 1902 for Veeranahosalli, Kachuvanahalli, Mavukal, Anechowkur and Doddaharave State forests dividing the area into several working circles and felling cycle was fixed at 20 years. Minimum girth was also fixed for timber trees. Mr. Abdul Jabbar had drawn a working plan for Anechowkur, Doddaharave along with Kachuvanahalli and Mavukal forests prescribing selection cum improvement felling with an object to introduce the regular system of exploitation. Later on, Mr. Venkata Vasudeva Iyengar had written working plan in the year 1921 for Kalbetta, Muthurayanahosalli, Gulledahalla and Arbitittu (Arbitittu is now with the wildlife division, Mysore). He had given the prescription of improvement felling for Gulledahalla and coppice with standards system for other areas. He had suggested sowing of seeds of bage, bilwara, hunse and sandal and to close these areas for grazing for five years. In the year 1943, Mr. K. Kadambi had written the working plan for all the forest areas of Hunsur, Periyapatna and K. R. Nagar. He had divided the above area into four working circles: (a) Superior Teak working circle - for best mixed Teak forests, (b) Inferior teak working circle or Regeneration working circle for mixed deciduous forest with inferior and poor quality teak, (c) Fuel working circle – for scrub forests with fire wood species like dindiga, kaggali, matti, bilijali, karijali, etc. and (d) Protection

working circle – for rest of the working plan area where no operation was prescribed except extraction of dead sandalwood and regeneration of fire wood species.

2.75. In Shimoga division, Shankar, Sacrebyle and Purdal state forests were brought under regular working plan during 1916. The plan prescribed 'selection felling' in higher quality forests and 'improvement felling' in the remaining forest areas. Masrur state forest and Hanagere state forest were brought under working plan during 1917 and 1918 respectively. The state forests of Ubbur, Bommanahalli, Kudi, Anesara, Chokkadebyle, Kumudvathi, Arasalu, Mugudthi and Kudrekonda were brought under working plans during 1917. Silvicultural system prescribed was 'selection-cum-improvement' or 'coppice with standards'. The forests of Agumbe and Balehalli were brought under systematic working in 1921 after the working plan by Mr. S. Venkatavaradayengar came into force. Selection felling was prescribed under this plan. Balagi poles for electric posts and dhuma (*Dipterocarpus indicus*) trees for railway sleepers were extracted quite extensively from these forests. A revised working plan for a large number of state forests of Shimoga division was written in 1930. A working plan for the Ghat forests of Shimoga and Sagar forest divisions including Agumbe, Balehalli, Varahi, Hulical, Kittandur and Manibyle state forests was written by Dr. Krishnaswamy Kadambi for the period 1941-1961. The plan was approved in 1945.

2.76. As regards Sagar division, a provisional working scheme was drawn up for Karadibetta state forest in 1903 for exploitation of hardwood timber trees including teak, matti, nandi, honne, beete, hunal and yethyaga under selection system. This scheme was replaced by a regular working plan written by Mr. H.S. Narayana Rao in 1918. The plan prescribed selection felling in type I forest (forest having better growth and stocking) and improvement felling in type II forest. Working plans for some of the state forests such as Koragi, Gilalgundi, Malandur, Chipli, Malali, Gangavanasara, Belandur, Ullur, Kalkoppa and Goverdhanagiri were prepared during the period between 1917 and 1930. The silvicultural system prescribed was mostly selection cum improvement felling. Gangavanasara forest was worked with 'coppice with standards' system. Special measures were taken for the protection of the *Kan* lands of Soraba taluk which are pockets of excellent evergreen and semi-evergreen vegetation in the midst of deciduous forests. Dr. Brandis, Inspector General of Forests had taken special interest in documentation and consolidation of the *Kan* lands.

2.77. The forests of present Bhadravathi division were brought under working plan during the early 1900s. Mr. Y. Seetharamaiah wrote the first provisional working

plan for Kukwada Ubrani state forest (KUSF) in 1900. Mr. G. Krishnamurthy Naidu wrote the regular plan for KUSF in 1907. This was followed by a number of working plans for other forests: Mr. B. V. Ramiyangar's plan for Lakkavalli and Thyagadabagi forests (1910), Mr. H.S. Narayan Rao's plans for Kakanhosudi, Aldhara, Umblebyle and Chornedehalli forests (1916) and Kukwada Ubrani, Rangaingiri, Hadikeri and Gurupura forests (1919). All these plans were primarily for extraction of timber from annual coupes besides assisting regeneration. Dr. Krishnaswamy Kadambi wrote another working plan for most of the forests around Bhadravathi wherein the best quality forests were reserved for timber supply while the second and third quality forests were allotted to firewood and charcoal production to meet the requirements of Mysore Iron and Steel Works (MISW) factory. This plan became operative from 1943. Large-scale felling of trees took place in the forests of present Bhadravathi and Koppa divisions (earlier Benkipura and Tarikeri fuel supply divisions) for supply of firewood and charcoal to the factory at Bhadravathi. Kadambi's plan was revised in 1962 by Mr. D.A. Rama Rao.

2.78. In Chickmagalur district, a provisional working scheme was approved in 1902 for Muthodi and Hebbe forests for exploitation of timber on selection basis. A regular working plan for Muthodi and Tegurgudda forests was written in 1916 by Mr. R. S. Narayana Rao prescribing selection felling followed by cultural operations. Basavanakote, Devadana, Halsur and Muduguni reserved forests (now in Koppa forest division) were worked under selection system as per the prescriptions of Mr. L. Srinivas Murthy's working plan which was implemented from 1927 to 1957. This plan provided for raising teak plantations at an annual rate of 20 acres. In Megarmakki and Kusgal reserved forests of present Koppa forest division, coupes were laid out and jambe (*Xylia xylocarpa*) was exploited under selection felling in the period between 1945 and 1966. Thereafter the area was clear felled for carbonization for supply of charcoal to Mysore Iron and Steel Ltd., Bhadravathi. The area was then planted with economic species like teak, eucalyptus or softwood / matchwood species. In Muduguni reserved forest, no regular felling was prescribed except for few stray fellings, particularly during wartime. During 1945, Dr. K. Kadambi wrote the working plan for Gangegiri, Tegurgudda, Waddehatti, Madla, Hebbegiri, Kagemanegiri, Muthodi and Muthodi Extension forests. He prescribed selection felling of teak. Mr. K. Keshava Gopala Naidu wrote a working scheme in 1949 for extraction of softwood timber from Balur state forest. The plan was revised in 1966 by Mr. Rama Rao. From 1966 the forest was leased out for extraction of softwood on selection basis to Mysore Commercial Union for a period of 20 years up to 1986.

2.79. The first working scheme for the Ghat forests of Hassan division was prepared by Dr. K. Kadambi in 1942 covering the forests of Kabbinale, Kemphole, Kagenari, Kenchanakumari and Bisle. The working scheme was mainly drawn up to provide timber for the plywood factory at Yeshwanthpur, Bangalore. The silvicultural system prescribed was 'selection on exploitable girth' principle. The exploitable girth fixed was 1.9 m for all species except dhuma (*Dipterocarpus indicus*) for which it was 2.44 m. The working scheme of Dr. K. Kadambi was revised by Mr. M. D. Mahadev in 1961. As regards the dry forests of Hassan division, a working scheme for the Hirekalgudda state forest was prepared in 1902 dividing the forest into five blocks and each block was further sub-divided into thirty annual coupes to be worked under coppice with standards system. However, this scheme was not followed systematically. A regular working plan was drawn in 1920 for Ramenahalli, Chakanakatte and Hirekalgudda group of reserved forests for a period of twenty years (1921-1940). Another working plan was drawn up in 1926 for a group of 26 forests. The forests were divided into annual coupes. The number of coupes for each forest varied from 5 to 30. The silvicultural system envisaged was 'coppice with standards' prescribing retention of 20-30 standards per acre. Sandal and MFP species were prescribed to be retained and the blanks were to be afforested with indigenous species. However, information regarding the implementation of these two working plans is not readily available.

2.80. The forests of Bangalore district were heavily extracted for supply of fuel, small timber, bamboo, etc. to meet the demands of Bangalore Civil and Military Station, the Railways and the growing population of Bangalore. Unregulated felling continued till 1902, when provisional schemes were drawn up for some of the forests in the early 1900s. This was followed by writing of regular working plans during the 1920s. The important forests covered under regular working plans were: (a) Basavanabetta, Chilandvadi and Muggur state forests - Mr. P. Krishnaswami (1922 to 1952), (b) Bilikal state forest – Mr. S. Venkatavardiengar (1928-1948), (c) Bananthimari state forest – Mr. B. Narasimha Iyengar (1927-1943), (d) Makli state forest (1919-1949), (e) Chickmannugudda and Doddamannugudda state forests – Mr. B. Narasimha Iyengar (1923-1932), (f) Ragihalli state forest - Mr. B. Narasimha Iyengar (1923-1943), (g) Ujjani, Hulkadi, Maklidurga, Saslu and Melnayakanahalli state forests - Mr. B. Narasimha Iyengar (1923-1943) and (h) Handigondi, Hulthar, Tenginakal and Savanadurga state forests – Mr. C. Abdul Jabbar (1918-1948). The provisional schemes had generally prescribed coppice with standards system of extraction with a felling cycle of 30 years. The working plans were more elaborate. The silvicultural system continued to be the same i.e. coppice with standards (except

in case of Chickmannugudda and Doddamannugudda state forests for which improvement felling was prescribed), but separate working circles were prescribed for fuel and small timber, sandalwood, bamboo and minor forest produce. Dibbling of seeds of various indigenous species such as bage, honge, bilwara, kaggali, banni, hunase, chujjalu, bevu, sissoo, kamara, honne, neralu, seegekai, bore, alale, karijali, etc. was prescribed in the plans. Dibbling of sandal was almost invariably prescribed in all the plans. However, only 18 forest blocks out of 146 blocks were covered under working plans. After the expiry of these working plans in the 1940s, revision of the plans did not take place for a long time. The other forest blocks of the district numbering about 128 were not brought under any systematic working. As most of the forest blocks of the district were located nearer habitations, these were subjected to uncontrolled felling, hacking, grazing, fires, encroachments, etc. Due to these biotic interferences, the unorganized forests, from the beginning, and the organized forests, since the expiry of the working plans, had started showing signs of deterioration. All the forests of the district were eventually brought under Mr. N.V. Ramchandra Chetty's working plan (1976-1986).

2.81. In Kolar district, about thirty-five forest blocks were reserved during the late 1900s and early 1900s. These include Kamasandra state forest (1898), Karbele Plantation (1896), Kamasandra Block-V (1905), Byapanahalli Plantation (1896), Vokkaleri Plantation (1896), Yeshwanthpura state forest (1896), Plantations of Ramachandrapura, Mallapanahalli, Lakshmisagara, Dinneri, New Kurundahalli, Old Kurundahalli, Kadamuthasandra, Marasandra, Bellav and Kashipura (1896), Agara state forest (1900), Srinivaspura state forest (1910), Addagal state forest (1910), Royalpad state forest (1896), Narasimha Devara Betta Blocks (1896-1908), Ittikalgudda SF Blocks (1911-1914), Konaguntulu (1915), Nandi SF (1911) and Kamashettihalli SF (1896). The remaining forest blocks of the district (about 100 in number) were reserved during the 1930s. The forest areas of Kolar district do not appear to have been brought under regular working plan. However, large-scale plantations were carried out in the forest areas since a very long time. Eucalyptus was planted extensively in these areas. This resulted in suppression of natural regeneration in extensive forest areas in the district. Some forests such as Kamasandra and Royalpad have retained excellent patches of natural vegetation. [Working plan for the forests of old Kolar division (including the present Chickkaballapur division) was written by Mr. C. Srinivasan (2002-03 to 2011-12)].

2.82. The forests of Tumkur district were reserved during the period 1863-1869 prior to which these were under the control of the Revenue department and people of the surrounding villages had free access to these forests and they could do anything

they wanted. After reservation, the Forest department took over the administration of these forests. However, being entrusted with the responsibility of supplying firewood to the Railways and other local users, large-scale extraction of the forests took place. Due to poor follow-up tending operations the forests were depleted. The first working plan for the Devarayanadurga group of forests was written by Mr. M. Venkanarayanappa and it came into force in 1899-1900. He had prescribed improvement felling with a felling cycle of 20 years. The plan had mixed result. Certain forest areas had very good and vigorous re-growth; certain areas where operations like climber cutting, thinning, clearing, etc. were not properly carried out were invaded by *Lantana* suppressing all regeneration. Mr. M. Venkanarayanappa's plan was revised in 1922 probably by the DFO, Tumkur who prescribed an improvement working circle and a coppice with standards working circle. He had introduced a method of temporary cultivation (*Hangami* or *Taungya*) to eradicate *Lantana*. However, as the *Lantana* eradicated areas were not immediately afforested they were again invaded by *Lantana.* Eucalyptus planting was started in Tumkur division in the early 1930s, perhaps in an attempt to suppress the menace of *Lantana*. Dr. Krishnaswami Kadambi wrote the regular working plan for these forests in 1942 which was in operation up to 1951. He had prescribed Regeneration working circle, *Taungya* working circle, Firewood working circle and Bamboo (overlapping) working circle. By this plan the management of the forests was systematized to some extent and attempts of raising plantations on a large scale were made. The working plan was revised by Mr. M.W. Palekhanda (1952-62) who discontinued the *Taungya* method of regeneration as it was a failure. He prescribed a Regeneration working circle and a Protection working circle. Attempts for raising plantations on large scale were made during the implementation of this plan.

2.83. The Bukkapatna and Manchaladore group of forests of Tumkur district were worked under a working scheme written in 1907 which mainly dealt with cultural operations, grazing and minor forest produce, as there was no demand for firewood from these forests at that time. The first working plan for these forests was written by Mr. K. Revanna who had prescribed improvement felling system. Because of poor demand for fuel, the annual coupes could not be worked properly till 1945 and many coupes remained un-worked. However, from 1945 onwards there was sudden rise in demand for firewood and charcoal from Bangalore. There was also demand for large quantities of poles of kamara and other hardwood species by the Bellara Gold mine, which had just started functioning. To meet this sudden increase in demand, the forests were worked under coppice with standards system. Revanna's working plan was revised by Mr. M.W. Palekhanda (1955-65) who had prescribed

three working circles, namely, Regeneration working circle, Firewood working circle and Protection working circle. Large-scale plantations were prescribed in the working plan.

2.84. The Devarayanadurga and Bukkapatna / Manchaladore groups of forests mentioned above comprised of only eleven forest blocks of Tumkur district which had totally about 150 forest blocks. The remaining forest blocks of the district were not covered by any regular working plan. Even the approved working plans had expired by the 1960s. The forests of the district were not brought under working plan for a very long time until the working plan by Mr. Range Gowda (2001-02 - 2010-11) came into operation.

2.85. The forests of Chitradurga district were brought under reservation during the first quarter of the twentieth century prior to which they were subjected to heavy biotic interferences including removal of forest produce, fire, grazing, extension of cultivation, etc. However, the forests were not brought under any regular working plan for a very long time. Some forest areas were worked under provisional working schemes which prescribed simple coppice or coppice with standards system. The then prevailing pre-paid permits system for removal of firewood had done a lot of damage to the forests till the system was discontinued in 1974. Regular working plan for the district (division) was written by Mr. Mohammad Ataulla (1980-89).

2.86. Although scientific forest conservancy was started in Mysore state since 1864 and progressive development took place in the forestry sector since then, for various reasons *ad hoc* management decisions had overridden rational and scientific treatment. Forest exploitation was planned and executed mainly for the benefit of the prevailing conditions at that time, as a result of which forests in general and the Ghat forests in particular were severely exploited. This trend continued up to the beginning of the 20th century. Forests suffered the most during the two World Wars when large numbers of trees were felled for war supply and the needs of the railways. The industrial development ushered during the first half of the twentieth century as reflected in the establishment of steel plant, paper mill, plywood factory, matchwood factory, extensive electrification network, etc. resulted in very heavy exploitation of the forests, including the evergreen forests, for supply of timber, bamboo, poles and fuel wood. The forests of Shimoga and Chikmagalur districts were particularly affected. The most telling damage to the forests was perhaps due to setting up of the Mysore Iron Works at Bhadravathi. The need for continuous supply of firewood and introduction of tramway for facilitating its exploitation and transportation resulted in rearrangement of the working of the forests leading to *ad hoc* working. As a matter of

fact, the introduction of tramlines became the primary guiding factor for arranging the felling series and annual coupes. Large-scale extraction of balagi poles for electrification programme from the evergreen forests of Bhagavathi valley of Chikmagalur district also caused wanton damage to the pristine forests. This practice continued for a long time even after the Independence up to the 1970s, by which time wooden posts were no longer in demand because of the advent of RCC posts.

2.87. As regards the dry deciduous forests of Bangalore, Tumkur and Kolar districts, these were worked mainly for catering to the demand of fuel wood and small timber from Bangalore and other urban centers. As the demand grew with rising population, intensity of exploitation also increased resulting in degradation and depletion of the forests. Attempts at regeneration were initially limited to sowing of seeds after felling under coppice with standards system. This was followed by the introduction of eucalyptus. Planting of eucalyptus became quite common from the early 1930s in these districts.

2.88. Capturing of wild elephants by *Khedda* method which was started during the 1890s continued to be very popular in Mysore kingdom. The *Khedda* operations were conducted by the Forest department under the patronage of the Maharaja of Mysore. The events were generally held to coincide with the visits of members of the British royal families and British Indian officials including Governors and Governor Generals of Mysore state. During the visit of the Prince of Wales in January 1906, 87 elephants were captured. During the *Khedda* operations conducted on the occasion of the visit of the Viceroy of British India, 92 elephants were captured. An important objective of the capture of wild elephants was to prevent elephants from straying into agricultural lands. The captured elephants after training were used for timber logging and also for performing ceremonial duties in royal and religious functions. Some of the elephants were gifted to temples, mutts, etc. Some were sold to private parties. *Khedda* operations were continued after Independence also. It was organized in December 1948 at Kakanakote forest in honour of the visiting Prime Minister Pandit Jawaharlal Nehru. Thirty-five (35) elephants were captured during this operation. This system of capture of elephants was brought to an end in 1971.

KODAGU (COORG) STATE

2.89. During the rule of the Raja of Coorg prior to the advent of the British in 1834, a system of issue of licenses/permits to exploit timber was in vogue. This system was also continued by the British administration for some time. The Coorg forest department appears to have been established during the year 1865 and it was designated as "Forest Conservancy Department". This department had taken up the

management of all the government forests and it was then headed by the Conservator of Forests, Mysore. The main functions of the Conservancy Department were extraction of all suitable trees of superior species in easily accessible localities and to earn as much revenue as possible. The principles of sustainable forestry were not observed. As a result all the valuable timber species in the accessible forests like Anekad were indiscriminately exploited.

2.90. During the end of the nineteenth century, priorities began to change with the introduction of plantation crops like coffee, cardamom, orange, etc. in addition to the extensive openings made for paddy fields. The detrimental effects of conversion of large extents of forest areas into plantation and agricultural crops were felt soon and the administration realized the need to have a holistic view of land management. Necessity to curb indiscriminate damage to forests and to protect these in the sensitive areas was felt. Such concerns came to be addressed by the enactment of the Forest Act in 1865 by the Union Government which was adopted as such in the Coorg state. Subsequently during implementation, when inadequacy of measures was felt, new rules for better management and preservation of forests were introduced. The Government of India in 1871 issued these rules, which were applicable only to Coorg. The amended Indian Forest Acts of 1878 and 1927 were also adopted as such in the State.

2.91. Later, Forest Rules were modified and the system of issue of licenses/permits to exploit timber that was prevalent during the time of Raja of Coorg was stopped. Timber was sold through depots which were opened at a number of places. Work of formation of forest roads was started in 1883. In the year 1876, for the first time, fire protection measures were taken up in the Anekad forests. All the timber depots were forced to close since the people started to meet their demand from their private *bane* lands. As a result the central depot at Hunsur was opened to attract the merchants from Mysore and other places.

2.92. Writing of working plans for some of the teak growing forests such as Dubare, Anekad, Arikeri, etc. was taken up during the 1890s. The system adopted was selection-cum-improvement felling regulated on area basis. As this system was not followed properly and only good timber was removed without giving any importance to improvement, it was found to be harmful to the forest. Mr. Tireman, dissatisfied with this system of exploitation and its injurious results, prepared a new working plan in 1912. Here the main prescription was selection felling combined with improvement felling to favour and induce reproduction of valuable species with certain supplementary regulations. This system was subsequently replaced by the

system of clear felling with concentrated artificial regeneration with teak. Subsequent working plans for the forests were revised by Mr. Brandis (1933-1943) and Mr. Rangaswamy (1940-1955).

2.93. As regards the Ghat forests, from 1867 to 1916 permits were granted to the merchants from the west coast to remove timber from any part of the forest without any control. The slopes within elephant haul and along river margins were mainly exploited. Mr. Tireman's plan, adopted in 1916, prescribed improvement felling followed by dibbling of seeds in the blanks created due to felling. This gave fairly good results. However, concentrated felling in accessible areas as well as shifting cultivation in some pockets adversely affected the evergreen forests of the region. This was brought to a halt in 1929 because of a resolution passed in the 3rd Silvicultural Conference held in Dehradun which advised against heavy felling in the evergreen forests. More regulated felling of trees in the forest was continued. Mr. Tireman's plan was revised by Mr. Vanhaeften which came into existence in 1938 for a period of ten years.

2.94. In the years 1954, 1957 and 1959, Mr. K. K. Somaiah had written three working plans covering most of the forests of Coorg. These were: (a) Working plan for Ghat forests of Coorg (1954-55 to 1973-74), (b) Working plan for a portion of the eastern deciduous forests of Coorg (1957-58 to 1971-72) and (c) Working Plan for the sandal forests of Coorg and other reserved forests (1959-60 to 1973-74).

2.95. By and large, the forests of Coorg state were worked systematically during the British administration. A lot of emphasis was given to writing of working plans and in implementing the prescriptions of the plans. A number of working plan officers such as Mr. Tireman, Mr. Brandis, Mr. Rangaswamy, Mr. Vanhaeften and Mr. K. K. Somaiah contributed to this noble work.

2.96. One significant aspect of Coorg is that of nature worshipping. Kodavas and other original inhabitants of Kodagu (Coorg) are nature worshippers. The rulers of Coorg used to grant forest lands in the name of village deities to be preserved as virgin forests called *Devarakaadu* (Sacred grove). The sacred groves are pockets of rich evergreen or semi-evergreen forests with enormous plant diversity. The British administration got the *Devarakaadus* surveyed and demarcated during 1863-1870. Dr. Brandis, Inspector General of Forests took special interest in the documentation and protection of the *Devarakaadus*. During 1905, the *Devarakaadus* were notified as protected forests under section 28 of the Indian Forest Act, 1878.

SANDUR STATE

2.97. The forests of the princely state of Sandur were governed under the Sandur Forest Act till the merger of the state with the Madras State in1949. The Sandur Forest Act was enacted in 1937 and it was amended in 1943. Under Section 3(1) of the said Act any land at the disposal of the *Sarkar* may be notified as "Village Forest". Under Section 2(11) of the said Act, all land at the disposal of *Sarkar* and which have neither been notified as "Village Forest" nor assigned under *Huzur* sanction for any public or communal purpose will be the State Forest. Under Section 2(8), the land "at the disposal of *Sarkar*" means land in respect of which no person has acquired (a) a permanent, heritable and transferable right of use and occupancy or (b) any right created by grant or lease made or continued by or on behalf of *Sarkar*. From the above it may be seen that all land falling in the erstwhile Sandur State fell in the category of "Forest" except the land (a) under grant/lease and (b) with a permanent heritable and transferable right of use and occupancy.

2.98. The princely state was spread across a total area of 433 square kilometers. According to the 1901 Census of India the total population of the region was 11,200. The Sandur Administration Report for the year 1943-44 states that the total forest area of the state was 75,619 acres comprising of 70,000 acres of State forest and 5,619 acres of Village forest. A letter dated 24th June, 1949 of the Chief Forest Officer of the erstwhile Sandur State addressed to the District Forest Officer, Bellary states that the total forest area in the State was 125 square miles (about 80,000 acres) out of which 117 square miles constituted State forest while the remaining 8 square miles constituted Village forest. The Mysore State Gazetteer also indicates that as in 1969-70, an area of 75,520 acres of land fall in the category of unclassed forest in the Sandur range. This clearly indicates that at the time of its merger with Mysore state, forest occupied more than 70% of its geographical area of Sandur.

2.99. The forests of Sandur state were divided into four blocks viz, NEB, RMB, SMB and DMB, which are abbreviated forms of Northeast Block, Ramanmalai Block, Swamimalai Block and Donimalai Block respectively. During the rule of the Maharajas of Sandur, free grazing, free removal of fuel for domestic use, free removal of thorns for fencing and removal of wood for repairing old houses were allowed.

2.100. With a relatively small population density, pressure on the forests of Sandur state during the earlier days must have been quite less. Besides, the forests do not appear to have been heavily worked for timber in the past mainly because of its limited availability. Trees in these forests generally attain smaller girths except in the

valleys which remain moist only for a few months during and after the monsoon. Hardwood species such as teak, rosewood, matti, honne, etc. are of relatively smaller girths, although kamara (*Hardwickia binata*) trees of larger girth appear occasionally. Fairly large-sized pollarded stems of kamara (heavily lopped for fodder) are frequently encountered in the forest near habitations. However, what strikes every visitor to Sandur is the magnificent diversity of her forests. Most of the species encountered in the moist deciduous forests of the Western Ghats occur in these forests along with the species generally found in dry deciduous forests. *Chukrasia tabularis* (kalgarike/kempudevadar), a tree species usually found in the semi-evergreen or very moist decidous forests of the Western Ghats, was reported (Gamble) from the forests of Sandur. There are a few excellent patches of bamboo (big and small) in Sandur. Good regeneration of sandal is also noticed in the tract.

2.101. The forests of Sandur are also very rich in medicinal plants. Many eternal springs locally known as "*Teerthas*" originate in Sandur hills. These *teerthas* are held in high esteem and are worshipped. The important ones are *Agastya teertha*, *Gaja teertha*, *Koti teertha*, *Brahma teertha* and *Hari-Shankara teertha*. Invaluable medicinal plants are found in the wild around these springs and the mineral springs are accredited with manifold healing properties. *Calotropis sandurensis* is endemic to Sandur. The Forest Department has established a Medicinal Plant Conservation Area (MPCA) at Sandur with the help of the Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore. The MPCA now extends over about 350 hectares in Swamimalai Block. The FRLHT has conducted floristic studies in Sandur MPCA commissioned under *in-situ* conservation of Medicinal plants programme. The studies revealed the occurrence of 279 species.

2.102. The unique and vibrant diversity of the Sandur forests in the midst of the otherwise degraded dry deciduous forests of Bellary district is an indication of the high quality of patronage and protection afforded by the erstwhile Ghorpade rulers, who were known for their admiration for wildlife and forest. Significantly, the royal insignia of the kingdom was a monitor lizard. Mahatma Gandhi, the Father of the Nation, who had visited Sandur before Independence was so enchanted by the beauty of the forests of Sandur that he had left an advice for the future nature lovers: "Come to Sandur in September".

HYDERABAD STATE

2.103. Prior to the establishment of a regular forest department, the forests in the Hyderabad State were administered by the Revenue department. At that time a 'darkhast' or application system was in vogue. Under this system permit holders were

allowed to cut trees wherever they liked in the forests. Since no special staff was employed to supervise the work, control was only nominal and vast tracts of forests covered with valuable tree growth were recklessly destroyed through this system of working. Besides, since forests were considered subservient to agriculture, clearance of forest land for extension of agriculture was the norm of the day. Even after the establishment of the Forest department in 1867, the department was manned by non-professionals for about 20 years and their work was mainly to protect and sell thirteen valuable tree species designated as '*Irsali*' or 'reserved' under a set of simple rules, while the rest of the tree species designated as '*Gairi*' continued to remain in the hands of the Revenue department. As a consequence, there was dual control over the management of forests and it adversely affected the forests. Vast expanses of forest lands were cleared for extension of agriculture without any regard for environmental concerns. However, in 1887 the government secured the services of a trained European Imperial Forest Service officer, Mr. Ballantine, from Berar. He served in the dominion of Nizam till 1893 during which period he was able to arrest forest abuses of unrestricted felling under 'darkhast' (application) system and selected several tracts of forests for reservation. Later in the year 1893 the government declared vast tracts of forest as protected forests and placed them under the charge of Forest department. The Government issued specific circular instructions for the administration of these protected areas. The Forest Act was enacted to obtain legal control over the forests in 1899 (1309-F) in conformity with the instructions contained in these circular instructions. The number of reserved timber species was increased in the non protected areas. The efforts of the department were directed mainly towards survey and reservation of forest areas, introduction of felling schemes and works of improvement, systematic exploitation of forest produce, development of sustained revenue and consolidation and conservation of vast and valuable forest areas. The Forest Act of 1899 (1309-F) was found inadequate for the growing requirements of the Forest department. It was, therefore superseded by a revised Forest Act of 1916 (1326-F), which laid the foundation for the establishment of a more effective forest administration. The Forest Act of 1916 provides for constitution, rules and conditions to demarcate and declare forests as reserved, protected, open and village forests. This Act was again superseded by the Hyderabad Forest Act of 1945 (1355-F), which was modeled on the lines of the Indian Forest Act, 1927.

2.104. The areas of Hyderabad state which were merged with Karnataka after reorganization in 1956 are the present districts of Bidar, Gulbarga, Raichur, Koppal and Yadgir. At that time, all these areas were included in one forest division, namely,

Gulbarga forest division whose jurisdiction extended over three Revenue districts, namely, Gulbarga, Raichur and Bidar. (Raichur, Bidar, Koppal and Yadgir forest divisions came into being with effect from 1961, 1974, 1997 and 2009 respectively.) There is very little information about organized working of the forests of Gulbarga in the distant past. As most of the forests were of inferior type and were in fairly degraded condition, there was no scope of large-scale extraction for timber or fuel wood. During 1915 there were simple working plans for small forest areas such as Chincholi where coupes were auctioned and the purchasers were supposed to coppice everything except the standards. Prior to 1955, fuel coupes were worked on simple coppice method. These coupes were marked on the map and after obtaining sanction of Inspector General of Forests, they were auctioned. The first working plan for the then Gulbarga forest division was written by Mr. Munavar Hussain. It came into force with effect from 1955 and its currency was for ten years (1955-1965). The working plan had prescribed three working circles: (a) Afforestation working circle, (b) Simple coppice working circle and (c) Protection working circle. The Afforestation working circle included areas where vegetation was sparse and scattered. In order to restore forest cover and to conserve soil and moisture, the technique of contour trenching and raising trench-mound plantation was prescribed. Seeds of locally available species were to be sown on the mounds and eucalyptus seedlings were to be planted in the trenches. The Simple coppice working circle included some of the better among the inferior forests of the district which were proposed to be worked to cater to the needs of the local people for fuel wood and small timber. Treatment suggested was a combination of exploitation of unsound crop and supplementing regeneration in gaps by artificial means. The areas which had not been included in the above two working circles were included in the Protection working circle. Patch sowing in lines after ploughing between the lines was prescribed.

2.105. Due to inadequate follow-up measures, hostile climatic conditions and severe biotic pressure, the prescriptions of Munavar Hussain's plan did not yield encouraging results. The changes in the administrative set up of the district as a result of the reorganization of the states may also have temporarily affected the quality of works.

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EVOLUTION OF FOREST POLICY, LAW AND MANAGEMENT PRACTICES AFTER 1956

In this chapter our focus will be on the policies and practices for forest management adopted in Karnataka after its formation in 1956. However, before doing so, it will be relevant to have an overview of the post-1956 forestry scenario at the national level for two reasons. First, 'economic and social planning' being a concurrent subject (No. 20) in the Indian Constitution, state sector planning including forestry sector planning is given a final shape in consultation with the central government. The thrust areas of national planning, including sector-level planning are reflected in the state planning. Secondly, with the 42nd amendment to the Indian Constitution in 1976, the Government of India has a much larger say in certain aspects of forest management by the states. Many of the developments that have taken place in Karnataka's forestry sector during this period have been impacted or influenced by policy directives or guidelines from the central government. In view of this, it is proposed to devote a few paragraphs mentioning in brief some of the important developments that have taken place at the national level. This will be followed by recounting the developments that have taken place in Karnataka's forestry sector.

NATIONAL SCENARIO

3.2. Over the years relentless pressure arising from increasing population, diversion of forest land for not forest uses and increased demand from forest based industries have caused serious depletion of forest resources. In the period following Independence, the conservation needs of forests were subordinated to food and developmental requirement of the nation. Forests were looked at as a source of direct revenue to the national exchequer. Investment in forestry development continued to be low and as a result large-scale forest conservation and development activities could not be pursued. Forest lands were released for a variety of purposes. The country lost large extents of forest land for expansion of agriculture and other uses. In order to arrest deforestation and to revamp the management of forests, the Government of India initiated a number of steps as narrated in the following paragraphs:

3.3. Forestry which was in the 'State List' of the Indian Constitution was brought under the 'Concurrent List' after the **Forty-Second Amendment of the Constitution in 1976**. Moreover, ten fundamental duties were included in the Constitution and the seventh one is: '(g). to protect and improve the natural environment including forests,

lakes, rivers and wildlife, and to have compassion for living creatures'. Again three new directive principles were added and one of them is: '48A. Protection and improvement of environment and safeguarding of forests and wildlife'. The constitutional amendments were considered a landmark because they enabled the central government to issue guidelines for the management of forests and wildlife.

3.4. In view of the subject of 'Forestry and Wildlife' having been placed in the Concurrent List by virtue of the 42nd Constitutional Amendment, the basic policy guidelines are formulated by the Union Government through the Ministry of Environment and Forests (since renamed as Ministry of Environment, Forests and Climate Change). The responsibility of administering the forests primarily vests with the State Governments, the primary executing agencies being the State Forest Departments.

3.5. The **National Commission on Agriculture (NCA)**, constituted in 1972, gave its final recommendations in 1976. It gave a new thrust and meaning to forest management in India. The Commission studied the forestry sector comprehensively and gave wide ranging recommendations touching all aspects of forestry. Recommendations were primarily on the following topics: (a) Forest Policy; (b) Production and Social Forestry; (c) Minor Forest Produce; (d) Forest Ecology and Wildlife Management; (e) Forest Protection and Law; and (f) Forest Planning, Research and Education.

3.6. One of the important recommendations in the report of the National Commission on Agriculture was on undertaking social forestry on a massive scale as a national program. The term 'Social Forestry' was first used in India in the Commission's final report (1976). Implementation of this recommendation resulted in India embarking upon social forestry projects by planting trees on all unused and fallow lands with the aim of taking the pressure off natural forests.

3.7. The National Commission on Agriculture had recommended that "Institutional changes should be brought about in the management for production forestry, and man-made forests be raised on an extensive scale with the aid of institutional financing." It was further recommended that "The existing system of harvesting of major and minor forest produce through the intermediary contractor must be replaced by taking it up either directly by the State forest departments or by a network of forest labour co-operatives, or by a combination of both." These recommendations led to establishment of a number of forest development corporations (FDC) in the states to ensure scientific harvest and sustainable management of forest and forest produce. This has helped in elimination of private

contractors and middlemen from forestry operations. These corporations have been able to take up extensive plantations by availing institutional finance. This has facilitated production of both industrial raw materials as also fuel wood and construction timber for public use. Many FDCs have also taken up organized collection and marketing of certain items of non timber forest products (NTFP).

3.8. The National Commission on Agriculture was of the view that for protection of forests and wildlife management, there should be sufficient buffer zone at the boundary of the national parks and the Wildlife Division in the Government of India be headed by an officer of the rank of Additional Inspector General of Forests. On forest protection and law, the Commission suggested soliciting support of voluntary associations, issuing letter of appreciation and cash reward to panchayats, undertaking large-scale social forestry programme and creating depots to supply timber and fuel wood to villagers and the enactment of an All India Forest Act by Parliament. On forest planning, research and education, the NCA recommended taking up of aerial photography for rapid forest survey. The Commission had recommended the creation of a national forest survey organization for a regular, periodic and comprehensive forest resources survey of the country.

3.9. The recommendations of the National Commission on Agriculture had far reaching influences on the evolution of forest policy and management in the country during the following years. In addition to the initiation of the programme of social forestry and establishment of forest development corporations as mentioned above, participatory approach to forest management was given increasing emphasis, which eventually led to formulation of a new national forest policy. In order to strengthen and give more focus on forest administration, a separate Ministry of Environment and Forests was created in 1984. The Forest Survey of India (FSI) was established in Dehradun in 1981 by upgrading the 'Pre-investment Survey of Forest Resources (PISFR)' – a GOI project sponsored by FAO and UNDP since 1965. The Indian Institute of Forest Management (IIFM), Bhopal was established in 1982 to fulfill the growing need for the managerial human resource in the area of management of forest, environment, natural resources and allied sectors.

3.10. The **Forest (Conservation) Act, 1980** was enacted to conserve forests and check further deforestation. The Act had the twin objectives of restricting the use of forest land for non-forest purposes and preventing de-reservation of reserved forests. Under this Act, prior approval of the central government is required before any forest land is diverted for non-forest purposes. In 1988, the Act was further amended to make the existing provisions more stringent. The amended Act sought to restrict

leasing of forest land to private individuals, authority, corporations not owned by the government, and to prevent clear felling of naturally grown trees. Some procedural difficulties were, however, experienced in the implementation of the Act. In order to streamline disposal of cases under this Act, the process of decision making has been decentralized and the procedures and requirements have been rationalized. Revised and comprehensive rules and guidelines under the Forest (Conservation) Act, 1980 have been formulated during 1992.

3.11. The nation took laudable strides towards tree planting and wasteland development since the beginning of the 1980s. During the decade 1980-1990 India embarked upon the **social forestry program** with the main objective of producing fuel wood, fodder, small timber and other products to meet the needs of rural communities by raising plantations on wastelands including community lands, degraded forests, other government waste lands, private marginal lands and agro-forestry. In view of limited availability of internal financial resources a number of externally aided social forestry projects were launched during this period as a result of which there was marked progress in afforeststion of degraded forest and community lands. During the five-year period of 1980-85, 4.65 million hectares of forest and waste lands were afforested as against 3.556 million hectares afforested during the entire thirty-year period of 1951-1980. This figure rose to 8.870 million hectares during the period 1985-90. While paucity of internal resources continued to affect the forestry sector, considerable external funding was made available for these and similar initiatives during the following decades. The advent of social forestry from the 1970s also contributed to the efforts at growing trees on non-traditional lands.

3.12. In view of the growing concern about the ecological effects of accelerated destruction of forest lands and serious depletion of the country's forest due to various factors such as increasing demand for fuel wood, fodder and timber triggered by rapid increase in population, inadequacy of protection measures, clearance of forest lands for other uses, increased demand for forest-based industries and the tendency to look upon forests as revenue earning resources, it became imperative to review the situation and to evolve a new strategy of forest conservation. The need for forest conservation as a pre-requisite to maintenance of environmental stability, protection of natural heritage and conservation of biological diversity has since come to be overwhelmingly accepted. In the newly emerging scenario, the term conservation has a wider connotation and includes a range of activities like preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment. It thus became necessary to review and revise the National Forest

Policy. The Government of India in Resolution No. 3-1/86-FP, dated 7th December, 1988 enunciated the **National Forest Policy, 1988**.

3.13. The new policy marks a major departure from the earlier policy which was primarily production oriented. It accords the highest priority to ensuring environmental stability and maintenance of ecological balance. Derivation of direct economic benefits is to be subordinated to this principal aim. The national goal is to have a minimum of one-third land area of the country under forest or tree cover. A massive need-based and time-bound programme of afforestation and tree-planting, with particular emphasis on fuel wood and fodder development, on all degraded and denuded lands in the country, whether forest or non forest, with people's involvement is stressed.

3.14. The new policy lays emphasis on meeting the local needs, in particular of the tribal population, and in safeguarding their traditional rights and concessions, subject to the carrying capacity of the forests. The domestic requirements of fuel wood, fodder, non-timber forest produce and construction timber required by the tribal and poor people living near the forests are to be regarded as the first charge on forest produce. The policy stipulates full protection of existing forests and forest lands and improvement of their productivity. It has laid stress on strengthening and extension of Protected Areas for the conservation of biological diversity. The policy has also laid down guidelines for preventing damage to forests from encroachment, fires and grazing, and issues related to tribal forest interface, shifting cultivation, forest extension, education, research, personnel management, etc.

3.15. In order to reduce pressure on natural forests, the new policy redefines the priorities in which the private sector is encouraged to grow and supply raw material for wood based industries. Above all, the 1988 policy has laid stress on creating a massive people's movement with the involvement of women, for achieving various objectives and to minimize pressure on existing forests.

3.16. In view of the growing demands on forests, the Indian sub-continent has been the laboratory for one of the most dramatic and dynamic experiments in the **participatory management of forests**. Since the late 1970s social and community forestry programs in India have attempted to radically transform the relationship between the Forest departments and the local people. These initiatives brought forestry out of the traditional forests and into the villages and farms of the people who are the primary forest users. The concept of participatory forest management on usufructs sharing basis started gaining ground as an effective means for regenerating India's degraded forests. Enlisting people's involvement in the development of fuel

wood, fodder, small timber and non-timber forest products (NTFP) for the rural and tribal population and creating a massive people's movement with the involvement of women is one of the basic objectives of India's National Forest Policy of 1988. It also stresses that rights and concessions from forests should primarily be for the bonafide use of the communities living in and around the forests, especially the tribal people.

3.17. It is in this context that the Government of India issued a **Circular on 1st June 1990** highlighting the need and the procedure to be adopted for the involvement of village communities and voluntary agencies in the protection and development of degraded forests. In order to ensure community participation the State Governments had been advised to enlist the communication and extension expertise of local non-government organizations to serve as interfaces between the Forest departments and the communities. These guidelines constituted a significant departure in forest management practice in that increasing emphasis had been laid in the active participation of the people in the programs of forest conservation and development by developing micro-plans right from decision making to carrying out the decisions. Another significant point to be noted in the guidelines was the benefit sharing arrangement which was intended to enable the village communities to develop a stake in the protection and development of the degraded forests.

3.18. In India planned development started in the year 1951 with the launching of the **Five Year Plans**. Within the forestry sector, the thrust in the sector in various Five Year Plans kept changing according to priorities felt at that point of time. The First and Second Plans (1951-56, 1956-61) were oriented towards rehabilitation of degraded forests, plantations of economic species and consolidation of forests. The Third and Fourth Five Year Plans (1961-66, 1969-74) aimed at increasing the productivity of forests quickly by plantations of fast growing species, scientific assessments and modern logging. The Fifth Plan (1974-79) laid stress on production forestry, large scale plantation, social forestry and forest conservation. The Sixth Plan (1980-85) realized the need for ecological and social security. The theme of this plan was development without destruction. Its main thrust was on saving natural forests from further depletion, creation of additional fuel and fodder reserves to meet the growing demand of local population, and establishment of more national parks and sanctuaries. The major objectives of the Seventh Plan (1985-90) were preservation of biological biodiversity, increasing the vegetal cover by massive afforestation and developing afforestation into a people's movement, enhancing the productivity of forests and meeting the basic needs of firewood, fodder and small timber. The thrust areas of the Eighth Plan (1992-97) were preservation of biological

further degradation, development of meaningful projects to utilize wastelands and make them productive, preservation and conservation of the fragile and critical eco-systems in the interest of sustainable development, adoption of a decentralized approach and involving people in the process of development. The thrust areas of the Seventh and Eight Plans were broadly in conformity with the policy objectives of the National Forest Policy of 1988. These have more or less defined the agenda for forestry development that are being pursued in the country in the subsequent years.

3.19. During the period of nearly five decades between the first and the eighth Five Year Plans, allocation to the forestry sector registered nearly three-fold increase. The percentage share of forestry sector outlay changed from 0.32 percent of the total outlay in First Five Year Plan to 0.94 percent in Eighth Five Year Plan. The highest allocation was in the Seventh Plan (1.09%).

3.20. In order to tackle the problem of degradation of lands, restoration of ecology and to meet the growing demands of fuel wood and fodder at the national level, the **National Wasteland Development Board (NWDB)** was established in 1985 under the Ministry of Environment and Forests (MOEF). The NWDB's main emphasis was on tree planting activities for development of wasteland. The Board sponsored a number of centrally sponsored schemes (CSS) such as Area Oriented Fuel and Fodder Projects scheme, Decentralized nurseries, Development of quality seeds, Aerial Seeding, etc. During 1992, the Board was reconstituted and placed under the Ministry of Rural Development. Its focus was mainly on development of wastelands in non-forest areas by involving local people. Its flagship programme was the 'Integrated Wasteland Development Programme (IWDP)' which aimed at improving the productivity of waste and degraded lands through people's participation keeping in view various issues such as poverty, backwardness, gender and equity.

3.21. With the shifting of the NWDB to the Ministry of Rural Development in a redefined role, a new Board, namely, the **National Afforestation and Eco-Development Board (NAEB)** was set up in August 1992 under the Ministry of Environment and Forests (MOEF) with the objective of promoting afforestation, tree planting, ecological restoration and eco-development activities in the country, with special attention to the degraded forest areas and lands adjoining the forest areas, national parks, sanctuaries and other protected areas as well as the ecologically fragile areas like the Western Himalayas, Aravallis, Western Ghats, etc. The NAEB, through its flagship programme 'National Afforestation Programme (NAP)', provided support to the Forest Development Agencies (FDA) to push forward

institutionalization of joint forest management (JFM). The FDA was conceived and established as a federation of joint forest management committees at the forest division level to undertake holistic development in the forestry sector with people's participation. The new centrally sponsored scheme (CSS) was in fact an amalgamation of four ongoing schemes of the Ministry of Environment and Forests, namely, (a) Area Oriented Fuel Wood and Fodder Projects scheme (AOFFPS), (b) Integrated Afforestation and Eco development Projects scheme (IAEPS), (c) Development of Non-Timber Forest Produce including Medicinal Plants scheme (NTFPMPS) and (d) Association of Scheduled Tribes and Rural Poor in Regeneration of Degraded Forests (ASTRP).

3.22. In 2003, the Government of India set up a **National Forest Commission (NFC)** with former Chief Justice of the Supreme Court of India, Justice B. N. Kirpal, as its Chairman and seven members to review and assess India's policy and law, its effect on India's forests, its impact on local forest communities, and to make recommendations to achieve sustainable forest and ecological security in India. The report of the Commission was submitted in 2006. The Report is very comprehensive and covers all aspects of forest management. The Commission made more than 300 recommendations covering various aspects such as forest policy, forest legislation, forest conservation, ecological security, sustainable forest management, meeting demand of forest products, arresting forest degradation, rehabilitation of degraded forests, increasing forest/tree cover, wildlife conservation, watershed management for sustainable supply of water, supporting sustainable agriculture, recognition of tenural rights, multi-stakeholder partnership, resolution of conflict among village institutions, forest certification, economic valuation of ecosystem services, ecotourism, areas not under the control of the Forest departments, constraints and threats, etc.

3.23. Besides many recommendations within the forestry sector, the Report has put a lot of emphasis on rural development and animal husbandry policies to address local communities' need to find affordable cattle fodder and grazing so that destruction of local forest cover can be avoided. With the objective of reducing pressure on natural forest from excessive removal of biomass for firewood and small timber, the Report has highlighted the need to encourage agro-forestry and farm forestry through financial and regulatory reforms, particularly on privately owned lands.

3.24. The National Forest Commission was of the opinion (with one dissent note) that the Forests Rights Bill is likely to be harmful to forest conservation and ecological security. (The Forest Rights Bill became a law since 2007.)

3.25. The Ministry of Environment and Forests in 2004, in pursuance of the order of the Hon'ble Supreme Court of India dated 30-10-2002, constituted the **Compensatory Afforestation Fund Management and Planning Authority (CAMPA)** for the purpose of management of money collected towards compensatory afforestation (CA), net present value (NPV) and any other money recoverable from the user agencies for utilizing forest land for non-forest purposes under the Forest (Conservation) Act, 1980. The MOEF, Government of India in 2009 issued guidelines for operating the funds under the CAMPA. Works implemented under the CAMPA include, (a) raising of compensatory plantations, (b) project specific activities in and around the project area for which forest land has been diverted (fencing of safety zone, raising of plantation in safety zone, canal plantation, medicinal plantation, soil and moisture conservation works, supply of energy saving devices to the people living in fringe villages, etc.) and (c) activities for the utilization of NPV (forest consolidation, forest protection, regeneration in natural forests, wildlife protection and management, infrastructure development, etc.). The Government of India has given detailed guidelines to the state governments regarding management of works under CAMPA. These include constitution of State Government Body, State Steering Committee and State Executive Committee. The Governing Body under the Chairmanship of the Hon'ble Chief Minister shall lay down the broad policy frame work for the functioning of the State level CAMPA and review its working from time to time. The State Steering Committee under the Chairmanship of the Chief Secretary to Government shall approve the Annual Plan of Operations (APO) and lay down the rules and procedures for the functioning of its Executive Committee and ensure interdepartmental co-ordination. The State Executive Committee under the Chairmanship of the Principal Chief Conservator of Forests shall prepare the Annual Plan of Operations and oversee its implementation after its due approval.

3.26. National Mission for a Green India or the commonly called **Green India Mission (GIM)** is one of the eight Missions outlined under India's action plan for addressing the challenge of climate change – the National Action Plan on Climate Change (NAPCC). The Green India Mission, launched in February 2014, is aimed at protecting, restoring and enhancing India's diminishing forest cover and responding to climate change by a combination of adaptation and mitigation measures. The mission has a broad objective of both increasing the forest and tree cover by 5 million hectares, as well as increasing the quality of the existing forest and tree cover in another 5 million hectares of forest / non forest lands in 10 years. The Mission proposes a holistic view of greening and focuses not on carbon sequestration targets

alone, but also, on multiple system services, especially, biodiversity, water, biomass, etc., along with provisioning services like fuel, fodder, timber and non-timber forest produces. It will also increase options of forest based livelihood of households living in the fringe of those landscapes where the mission is implemented.

3.27. In the newly emerging forest management approach, biodiversity conservation was made an integral part of overall forest management. The first comprehensive legislation relating to protection of wildlife was passed by the Parliament and it was assented by the President of India on 9th September, 1972 and came to be known as the **Wild Life (Protection) Act, 1972** (Act No. 53 of 1972). This Act provides the legal framework for conservation of the wildlife in the country. Far reaching changes took place in the wildlife front after the enactment of this legislation. The network of protected areas (PA) of the country was progressively expanded by declaring new wildlife sanctuaries and national parks besides increasing the extents of some of the already declared protected areas. Project Tiger, a tiger conservation programme was launched in 1973. The project was aimed at ensuring a viable population of Royal Bengal Tiger in their natural habitats in various parts of the country. The Government of India also launched a centrally sponsored scheme for assisting the state governments in developing the national parks and wildlife sanctuaries. The Indian Board of Wildlife, under the chairmanship of the Prime Minister, took a number of decisions which had far-reaching implications on the conservation of forest and wildlife in the country.

3.28. The first **National Wildlife Action Plan (NWAP-1)** was adopted in 1983, based upon the decision taken in the XVth meeting of the Indian Board of Wildlife held in 1982. The plan outlined the strategies and action points for wildlife conservation in the country. The plan identified the following key areas requiring action: Establishment of a representative network of protected areas (PA), Management of protected areas and habitat restoration, Wildlife protection in multiple use areas, Rehabilitation of endangered and threatened species, Captive breeding programme, Wildlife education and interpretation, Research and Monitoring, Domestic legislation and International Conventions, National Conservation Strategy and Collaboration with voluntary bodies.

3.29. The Wildlife (Protection) Act of 1972 was amended during 1991 (Act No. 44 of 1991) to make it more comprehensive and effective. Three new chapters were inserted in the Act: Chapter IIIA provided for protection of specified plants. Chapter IVA provided for constitution of a Central Zoo Authority to oversee the management of zoos in the country. Chapter VA was aimed at prohibiting trade or commerce in

trophies, animal articles, etc. derived from certain animals. A very significant amendment was the insertion of Section 26A in Chapter IV of the Act which enabled the State Governments to expedite the process of issuing final notifications in respect of the wildlife sanctuaries. This helped in the consolidation of the protected area network.

3.30. Besides legislative measures, efforts were made to reduce the dependence of the people residing within and around wildlife sanctuaries and national parks on forest products. With this aim in view a scheme for eco-development of villages in and around protected areas was initiated. The scheme aimed at increasing productivity of land in a manner that is consistent with the needs of wildlife conservation. In order to ensure long time survival of identified viable populations of elephants and to tackle the problematic elephant populations which were causing serious depredations, a new scheme called Project Elephant had been launched during 1991. This project was in line with similar other projects launched during the early 1970s for the conservation of Tiger and Rhino and which have been successful not only in the conservation of the species but also in the development of their habitats. The Government of India had also launched a centrally sponsored scheme, namely, 'Beneficiary oriented scheme for tribal development' with the object of rehabilitation of tribal people from inside protected areas, to improve their social and economic conditions and to eliminate human interference in conservation of wildlife.

3.31. The second **National Wildlife Action Plan (NWAP-2)** was adopted in 2002. The plan identified the following areas requiring formulation of strategy and implementation of action: Strengthening and enhancing protected area network, Effective management of protected areas, Conservation of wild and endangered species and their habitats, Restoration of degraded habitats outside protected areas, Control of poaching, taxidermy and illegal trade in wild animals and plant species, Monitoring and Research, Human resource development and personnel planning, Ensuring people's participation in wildlife conservation, Conservation awareness and education, Tourism in protected areas, Domestic legislation and International Conventions, Enhancing financial allocation for ensuring sustained fund-flow to the wildlife sector and Integration of National Wildlife Action Plan with other sectoral programs.

3.32. The Wildlife (Protection) Act, 1972 was further amended in 2006, and a separate chapter (Chapter IVB) has been provided, which *inter alia*, provides for constitution of the National Tiger Conservation Authority (NTCA). Constitution of

NTCA, an apex body for conservation of Tiger and its habitat, has brought about considerable improvement in the status of wildlife conservation in the country. Directives and guidelines issued from time to time by the NTCA on various aspects covering improvement of protection measures, strengthening of infrastructure, eco-tourism, voluntary relocation of inhabitants, etc. have been very helpful and effective in conservation of wildlife not only in the Project Tiger areas but also in other forest areas of the states.

3.33. The third **National Wildlife Action Plan (NWAP-3)** was adopted in October, 2017. The action plan which chalks out future road map for wildlife conservation in the country for the period 2017-2031 has laid stress on integration of climate change into wildlife planning, conservation of coastal and marine ecosystem, mitigation of human-wildlife conflict, wildlife health, people's support, private sector participation, etc. The plan has recognized the concerns relating to climate change impact on wildlife and impressed upon the need to take concerted actions for its mitigation and adaptation into the wildlife management planning process. In a deviation from the earlier two action plans which had adopted a 'protected area-centric approach' to wildlife conservation, the new plan adopts a 'landscape approach' in conservation of all wildlife - uncultivated flora and fauna - that have ecological value to the ecosystem and to the mankind irrespective of where they occur. It gives special emphasis to recovery of threatened species of wildlife while conserving their habitats which include inland aquatic, coastal and protected areas. The plan addresses rising human-animal conflict because of shrinkage, fragmentation and deterioration of habitats generating animosity against wild animals and protected areas. It underscores the increasing need for people's support for conservation of wildlife. It recommends eco-development, education, innovation, training, extension, and conservation awareness and outreach programmes. It underlines increased role of private sector in wildlife conservation. It lays down that sustained funding including Corporate Social Responsibility (CSR) funds are made available for implementation of the plan.

KARNATAKA SCENARIO

Beginning of an era of conservation forestry

3.34. Before re-organization of the states in 1956, the five integrating parts of the new Mysore or Karnataka state had different Forest Acts for the purpose of administration and management of forests. The Indian Forest Act, 1927 was applicable to the areas of Bombay province and the Coorg state, the Madras Forest Act, 1882 was prevalent in Madras province, the Mysore Forest Act, 1900 was

applicable in Old Mysore state and the Hyderabad Forest Act, 1945 was followed in the Hyderabad state. Each province or state also had Forest Rules which were framed on the basis of the corresponding Forest Act of the province or state. Naturally, there were differences among the Forest Rules of one province or state with those of another province or state. As it would be administratively difficult and inconvenient to enforce different laws in different parts of the same state, it became necessary to bring uniformity of forest laws throughout the entire state of Karnataka. As a result a new Forest Act, namely, the Karnataka Forest Act, 1963 (Karnataka Act No. 5 of 1964) was formulated.

3.35. The Karnataka Forest Act, 1963 was formulated mainly on the lines of the Indian Forest Act, 1927 with modifications and additions as were considered necessary. At the time of its enactment, the Karnataka Forest Act had twelve chapters (I to XII) and one hundred and eighteen (118) sections as against thirteen chapters (I to XIII) and eighty-six sections in the Central Act. Chapter IV of the Central Act, namely, 'Of Protected Forests' has been named as 'District Forests' in the Karnataka Act. Chapter V of the Central Act regarding 'Control over Forests and Lands not being the Property of Government' has been made more elaborate in the new Act with fourteen sections as against four sections in the original Act. This has been done in order to prevent private owners from recklessly exploiting the tree growth and forest produce with the sole idea of making immediate profits, without regard to ensuring sustained yield for the benefit of the community in future. There is power to assume management of forests in certain circumstances. Chapter VI of the Central Act, namely, 'Of the duty on timber and other forest-produce' has been omitted in the new Act. Chapters XI and XII of the Central Act, namely, 'Of Forest Officers' and 'Subsidiary Rules' have been omitted in the new Act but the relevant sections from these two chapters have been incorporated in Chapter XII of the new Act under the heading 'Miscellaneous'. Two new chapters (X and XI) have been included in the new Act: In Chapter X, provision has been made that all sandal trees which may grow in any land after the date of commencement of this Act will be the exclusive property of the Government and exploitation of all sandalwood trees should be done by the Forest department on behalf of the owner. These provisions were made to prevent smuggling of sandalwood. Special provisions relating to *catechu*, an important commercial produce, are made in Chapter XI. The Karnataka Forest Act, 1963 came into force with effect from 1st June 1969.

3.36. While formulating Karnataka Forest Act, 1963, Section 23 was incorporated in the Act to ensure that any forest which had been notified as a 'State Forest' under the Mysore Forest Act, 1900, or as 'reserved forest' under the Indian

Forest Act, 1927, the Madras Forest Act, 1882 or the Hyderabad Forest Act, 1355F (1945), prior to the date on which this Act comes into force, shall continue to be a reserved forest under this Act. Similarly, Section 35 was incorporated to ensure that any forest which had been notified as a 'minor forest' under the Mysore Forest Act, 1900, or as 'protected forest' under the Indian Forest Act, 1927, the Madras Forest Act, 1882 or the Hyderabad Forest Act, 1355F (1945), prior to the date on which this Act comes into force, shall continue to be a protected forest under this Act. It may be mentioned here that the princely state of Sandur also had a forest act, namely, the Sandur Forest Act, 1937. About 75% of the geographical area of the state was 'state forest' as per the provisions of Sandur Forest Act, 1937. However, this Act was not included in Section 23 of the Karnataka Forest Act, 1963. As a result, the 'state forest' status of the forests of Sandur was not protected in the Karnataka Forest Act, 1963 and the process of notifying the forest areas of the erstwhile Sandur state as reserved forest had to be initiated from the beginning i.e. Section 4 of the Karnataka Act. Unfortunately, for various reasons, the process of settlement of these forests has been highly delayed and these are yet to be notified as reserved forest as per the Karnataka Forest Act, 1963.

3.37. The Government of Karnataka, in exercise of the powers conferred by sections 30, 33, 38, 50, 59, 97, 101 and 102 of the Karnataka Forest Act, 1963 (Karnataka Act No. 5 of 1964), notified the Karnataka Forest Rules, 1969 for carrying out the provisions of the Act. The Karnataka Forest Rules, 1969 were published in Karnataka Gazette dated 27th March 1969.

3.38. With the coming into force of the Karnataka Forest Act, 1963 and the Karnataka Forest Rules, 1969, the need for a uniform Forest Manual was keenly felt in order to guide the officers of the Forest department about the important preliminary functions and procedure which should be followed by them in putting into effect the various provisions of the new Forest Act and Forest Rules. This resulted in publication of the Karnataka Forest Manual in 1975. The transactions pertaining to the Karnataka Forest Act and Karnataka Forest Rules form the contents of this Manual.

3.39. As there was no uniform Forest Code for Karnataka at the time of its formation, the Forest Codes of the erstwhile states had been followed in the respective integrating areas even after 01-11-1956. However, the need for a uniform Forest Code for the integrated state was keenly felt especially after the new Forest Act and Rules came into force in 1969. A new Code was also required to have uniform procedure in respect of working of forests vis-à-vis the duties and

responsibilities of various officers and officials. The Karnataka Forest Code was approved by the Government in 1976. The rules contained in this Code describe at length the organizational set up, the nature of working of the forest, working plans, duties and responsibilities of the various officers and officials, inspections of offices, administration reports, periodical returns, exploitation of sandalwood, control and management of departmental elephants and all matters concerned with silviculture, management and protection of forests.

3.40. Before their merger into Karnataka, the integrating areas had followed different forest accounting procedures as prevalent in the erstwhile states. With the formation of the new State of Karnataka, it became necessary to have a uniform procedure for financial transactions pertaining to receipts and disbursements. This was accomplished by the publication of the Karnataka Forest Account Code in 1976.

3.41. An important amendment was made in Section 28 of the Karnataka Forest Act, 1963 on 16-09-1974 (inserted by Act 23 of 1974) through which the power of the Government to de-reserve a forest by a notification was modified and it was stipulated that 'no such notification shall be issued unless a resolution to that effect has been passed by both Houses of the State Legislature.' This amendment was very significant in that it slowed down the process of de-reservation of forest areas and brought down the number of such cases. This amendment can be said to be precursor to the Forest (Conservation) Act which was enacted by the Government of India in 1980 in order to regulate diversion of forest land for non-forestry purposes.

3.42. The Karnataka Forest Manual provides for certain privileges to be enjoyed by the people residing in the vicinity of forests. These privileges were formulated on the basis of the privileges enjoyed by the people in the erstwhile provinces/states. These privileges were granted as a matter of favour and not as right. One privilege regarding removal of cart-loads of dry firewood (other than reserved species) on pre-payment was prevalent in all the *malnad* areas of Mysore and Coorg states and Bombay and Madras presidencies. This privilege was commonly known as pre-paid licence. This privilege was continued as a special privilege in the Karnataka Forest Manual [Para. 131(A)(6), 132B(1)(i) and 133 (1)] for the entire North Kanara, South Kanara and Coorg (Kodagu) districts and certain specified areas of Dharwad, Belgaum, Shimoga, Chickmagalur, Hassan and Mysore districts. Although this privilege was actually meant for removal of only dry firewood, it had degenerated into a pernicious system of cutting and removing green and immature trees from the forest. Because of continued abuse of this system, the forests, especially the areas nearer to habitations, had been severely degraded. It had become almost impossible

for the Forest department to implement the privilege in its true spirit as it was opposed by the general public who also had political backing. A very bold initiative was taken by the then Forest Minister of the state Shri K. H. Patil, who issued directives in 1974 to do away with the practice of issuing pre-paid licences for bringing firewood from forest. This was perhaps one of the most important decisions taken for forest conservation in Karnataka, as continuous degradation of large extents of forests of the state was halted and, within a span of six-seven years, these forests showed signs of recovery through natural regeneration.

3.43. Karnataka Forest Act was amended in 1974 (Act 23 of 1974) by inserting a new provision, namely, Section 64A which empowered a forest officer not below the rank of an Assistant Conservator of Forests to summarily evict encroachment in reserved forest. This act of summary eviction was without prejudice to any other action that may be taken against the encroacher under any provision of the Act or any law in force. The section was further amended in 1998 to include district forest, village forest, protected forest and any land under the control of the Forest department. This provision has immensely helped the Forest department in evicting encroachment of forest land and in preventing further encroachments.

3.44. During the year 1975, the Karnataka Forest Act, 1963 was amended (Act 15 of 1976 effective from 24-12-1975) by inserting a new chapter, namely, Chapter XI-A on 'Forest Development Tax' with a specific objective of augmenting resources for forest development. The amendment was enacted by inserting two new sections: Section 98A provided for levy of Forest Development Tax (FDT) at the rate of five per cent on the amount of consideration in respect of forest produce disposed of by the State Government by sale or otherwise. Section 98B provided for constitution of a fund called 'Karnataka Forest Development Fund'. It was stipulated that the tax levied and collected under section 98A shall first be credited to the Consolidated Fund of the State and then transferred to the Karnataka Forest Development Fund (KFDF). The amount at the credit of KFDF would be expended only for the raising of forest plantations and for such other purposes as are ancillary thereto. Subsequently, FDT was raised to eight per cent (Act 14 of 1980). By another amendment (Act 7 of 1983), FDT was raised to twelve per cent in respect of a few specified categories (when forest produce is sold to industries). The Act was amended in 1989 (Act No. 10 of 1989) enabling 'a corporation owned or controlled by or a body notified by the State Government' disposing of forest produce to levy and collect Forest Development Tax. During 2016, by an amendment to the Act (Act No. 23 of 2016), the word 'Tax' appearing in Sections 98A and 98B has been substituted by the word 'Fee' and a uniform Forest Development Fee of twelve per cent has been made

applicable in respect of sale of forest produce. During recent years, recovery of FDT/FDF by the Forest department in respect of sale of iron ore extracted from forest area has been contested by a number of mining lease holders and buyers of minerals in the Hon'ble High Court of Karnataka. In a judgement dated 04-10-2017, the Hon'ble High Court of Karnataka has held the recovery of FDT/FDF as illegal. The matter is now before the Hon'ble Supreme Court of India, as the state government has appealed against the order of the Hon'ble High Court of Karnataka.

3.45. An important amendment to the Karnataka Forest Act, 1963 was effected in 1976 (Act 50 of 1976) by inclusion of Section 71A which provided for confiscation of the property seized in a forest offence together with all tools, ropes, chains, boats, vehicles and cattle used in committing such offence. The confiscation proceedings are to be initiated by an authorized officer (not below the rank of an Assistant Conservator of Forests) and these proceedings are independent of whether or not a prosecution is instituted for the commission of such forest offence. Thus this amendment provided quasi-judicial power of confiscation of seized property to the forest officers which, in the long run, proved to be a very effective deterrent against commission of forest offences involving bullocks, carts and motor vehicles. In order to enable the Forest department in effectively handling forest offence cases, the Act was further amended in 1981 (Act No. 1 of 1981) by inserting sections 71B, 71C, 71D, 71F and 71G.

3.46. During the year 1976, an important legislation, namely, the Karnataka Preservation of Trees Act, 1976 (Karnataka Act No. 76) was enacted. The main purpose of the Act was preservation of trees by regulating the felling of trees in private lands, particularly in the *malnad* region. The Act also provided for planting of adequate number of trees whenever permission for felling of trees is accorded. This legislation helped in a very big way in restricting large-scale felling of trees in private lands, including plantation lands of the Western Ghat districts.

3.47. While the aim of the Karnataka Preservation of Trees Act, 1976 was to regulate felling of trees in private lands, it was also realized that such a regulation would discourage people from planting more and more trees in their own lands, as obtaining tree felling permission under the Act involves a process which at times may become lengthy and cumbersome. In order to encourage people to plant trees in their lands under social forestry and farm forestry programs, the Act was amended a number of times (1977, 1987 and 2015) by exempting certain tree species from the purview of the Act implying that prior felling permission is not required for such species. At present there are twenty seven tree species which do not require felling

permission under the Karnataka Preservation of Trees Act, 1976. The transport or movement of forest produce is governed by Rules 144, 145 and 146 of the Karnataka Forest Rules, 1969 and a transit pass issued by an authorized forest officer is required to accompany the forest produce in transit. In order to ensure that farmers growing trees in their own lands do not face difficulty in removing the timber/poles/firewood from their land, the Government, by invoking the provision of Rule 144 (f) of the Karnataka Forest Rules, 1969, has issued notifications exempting certain tree species from the operation of the transit Rules.

3.48. In 1981 an amendment was effected to the Karnataka Forest Act, 1963 (Act No. 1 of 1981) by inserting sub-sections (2) to (4) in Section 101A stipulating that the holder of a lease or agreement or any document granted or entered into prior to this amendment and providing for supply of fire-wood, timber or other forest produce by the State Government shall have to pay at rates specified from time to time, notwithstanding anything contained in the instrument of lease or agreement or other document. This enabled the State Government to recover realistic value for forest produce supplied to industries instead of recovering at low concessional rates fixed at earlier times. It was however stipulated that the rate or value in respect of any tree, wood, timber or forest produce shall not be enhanced more than once during any period of two years. By virtue of another amendment to the Karnataka Forest Act, 1963 in 1984 (Act No. 11 of 1984), a new section, namely, Section 101B was inserted stipulating that all forest leases, agreements or other documents entered into by the State Government and providing for supply of fire-wood, timber or other forest produce were abridged to five years and the supply under such lease, agreement or other document was made 'subject to availability' instead of the quantity committed earlier. This amendment was very significant as it enabled the state government to exercise control on release of forest produce to the industries. In 1989 the state government decided to stop all concessions to wood-based industries and they were required to obtain their requirements in open auction. This policy was also in keeping with the National Forest Policy of 1988 which had recommended that in order to reduce pressure on natural forests, the forest-based industry should meet its requirements of raw material by establishing a direct relationship with the individuals who can grow and supply such material.

3.49. In order to give thrust to the movement of joint forest planning and management (JFPM) and to institutionalize the working of the village forest committees (VFC), the Karnataka Forest Act, 1963 was amended in 1998 (Act No. 12 of 1998). A new section, namely, Section 31A was inserted with the heading 'Constitution of Village Forest Committee for Joint Forest Planning and

Management of Forest'. This amendment has empowered the Government to make rules regarding various aspects related to the constitution and functioning of VFCs, their duties and responsibilities, power and duties of forest officers, preparation of management plans, sharing mechanism, settlement of disputes, monitoring and evaluation, etc.

3.50. To enable Forest officers to conduct proper investigation of forest offence cases leading to higher rate of conviction, it was felt necessary to equip the forest officers with adequate powers. With this objective in mind, the Forest Act was amended by inserting Sections 62-A, 62-B and 62-C (Act No. 20 of 2000). As per Section 62-A, any Forest Officer not below the rank of a Range Forest Officer may, within specified jurisdiction and in respect of offences under the Forest Act, exercise powers conferred on an officer in-charge of a police station by the provision of the Code of Criminal Procedure, 1973. For the purpose of section 156 of the Code of Criminal Procedure, 1973, the area in regard to which the Forest Officer is empowered as above shall be deemed to be a Police Station and such officer shall be deemed to be the Officer in-charge of such Station. As per Section 62-B, a report submitted to the jurisdictional Magistrate by an investigation officer empowered by Section 62-A shall, for the purpose of Section 190 of the Code of Criminal Procedure, be deemed to be a police report. As per Section 62-C, a certificate regarding forest produce given by a trained Forest Officer not below the rank of Range Forest Officer may be used as an evidence of the facts stated in such certificate.

3.51. A very important amendment to the Forest Act was introduced in 2001 (Act No. 20 of 2001) by virtue of which the legal ownership of sandalwood trees growing on private land was vested in the land owner. This was done by amending Sections 83, 84 and 85 of the Act. Earlier, the Act had stipulated that sandal tree was the exclusive property of the Government. Sections 86 and 87 of the Act which provide for penalties in respect of sandalwood related offences were also made more stringent in a bid to curb sandalwood smuggling.

3.52. Withdrawing the status of sandalwood as state property was a positive step taken by the government. Earlier, persons having sandalwood trees had to go through a rigorous process of scrutiny and investigation in the eventuality of theft or damage of the trees. This had instilled a sense of fear in the public mind to own sandalwood trees. Besides, although there was a system of payment of bonus to the owners for the sandalwood extracted from their land, the amount was quite low compared to the market price of sandalwood. The procedure for departmental extraction of sandalwood as prescribed in the Karnataka Forest Rules, 1969 was also lengthy and

cumbersome. Thus owning or planting of sandalwood tree was not an attractive proposition to the farmer or land owner. The intention of the government for amending the provisions of the Forest Act in respect of sandalwood was to remove the fear from the public mind and to popularize planting of sandalwood in private lands.

3.53. Although the government withdrew the status of sandalwood as state property, in view of the precious nature of the wood it was decided to continue with the earlier policy of control of its extraction and disposal under the supervision of the Forest department. However, in order to streamline the procedure of extraction and disposal of sandalwood, changes were made in the rules governing sandalwood (Chapter XIII) in the Karnataka Forest Rules, 1969 by issuing a Government Notification No. FEE 16 FSW 2001 dated 05-09-2001. Rule Nos. 108 and 109 were drastically overhauled and almost re-written; a number of Rules (Nos. 104-107, 110-115 and 117) were omitted as these had become redundant due to amendment of the Act. Rule Nos. 103, 116 and 118-123 were also amended suitably. One important feature in the revised Rule No. 108 is that the owner of sandalwood is given an option to sell the sandalwood either to the state government or to any state government undertaking notified by the state government from time to time. The state government has already notified two undertakings, namely, the Karnataka State Handicrafts Development Corporation Limited (KSHDC) and the Karnataka Soaps and Detergents Limited (KSDL) for this purpose. The amendments with regard to sandalwood have been effective as farmers are found to be evincing interest in planting of the species in their farmland. Private sandalwood plantations have already come up in Kolar, Chikkaballapur, Bangalore, Tumkur and other districts.

3.54. The logging works of the Forest department were earlier undertaken by registered private contractors. The system of standing coupe sale was also in vogue in some of the high forest areas. This system of outright sale of standing crop was however given up during the early eighties and the system of pure logging was introduced. Under this system, all the logged produce was brought to government timber depots (GTD) and sold in public auction. The logging contractors were paid for felling, conversion and transportation of the forest produce to the government timber depots. The agencies for logging were fixed by calling for tenders. The Central Board of Forestry in 1980 had resolved that all forms of contract systems in forestry operations should be eliminated under a definite time bound programme for scientific working. The Board reiterated the same stand in 1984 recommending that Forest Corporations in the states should take over these works in the forest areas of the country. In consonance with the Central Board of Forestry's recommendations,

the Government of Karnataka initiated steps to do away with logging contract system. While spelling out policy guidelines (11-06-1986) regarding supply of raw materials to various forest-based industries, the policy to be adopted for exploitation of timber was also enunciated. It was specified that exploitation of timber should be taken up departmentally or preferably through the Karnataka State Forest Industries Corporation (KSFIC) in a phased manner such that private logging contractors are replaced within a period of five years. In Uttara Kannada district, registered Labour Co-operative Societies were allowed to undertake logging works. Prior to 1983, they were participating along with the private contractors in the tenders called for by the Forest department. The government used to give concession of 17.5% of working cost to the successful co-operative societies. Later on, this concession was stopped and logging works were allotted to them by a committee constituted by the CCF (General) and rates were fixed after negotiations. In 1991, the government accorded sanction to entrust up to 50% of the logging works in Kanara circle to the Labour Co-operative Societies and the remaining units to the KSFIC. The practice of allotting logging works to the Labour Co-operative Societies was continued up to 2006-07. Since 2007-08, logging operations of the department are being carried out by the KSFIC. Departmental extraction is also prevalent in case of smaller units. The present level of timber extraction, which is in fact salvaging of dead and fallen timber from some of the deciduous forests, is limited. Quantity of timber sold annually from the government timber depots varies considerably from year to year from about 30,000 cubic meters to 60,000 cubic meters comprising of hardwood species such as teak, rosewood, matthi, nandi, kindal, honne, heddi, jamba, etc. and medium-sized logs extracted from older plantations of *Acacia auriculiformis*. In the recent years, proportion of timber from *Acacia auriculiformis* has increased considerably. Bulk of the timber requirement of the state is met from imported timber. Some quantities of timber also come from private lands. These include miscellaneous timber species from coffee estates and species such as neem, karijali, ficus, hebbevu, bage, eucalyptus, etc. from private lands in the *maidan* region of the state.

3.55. An important step towards forest conservation was taken in 1983 when clear felling of natural forests for raising plantations had been stopped. Felling of natural green trees under the selection system was restricted - the number of trees which could be felled under this system was reduced from 6 trees per acre to 3 trees per acre. The state government issued comprehensive policy guidelines on 11-06-1986 imposing restrictions and regulations in respect of supply of raw materials to several types of forest based industries such as paper and rayon industry, plywood industry, packing case industry, match industry, chip board industry, saw mills, etc.

Felling in the evergreen forests in the state was stopped since 1987. The state government issued an order on 10-10-1990 imposing a ban on felling of green trees in all types of forest lands. This order was initially made effective for three years but was extended from time to time. The ban was continued until further orders in 1998.

3.56. As we have seen above, the period after 1980 marks a major departure in the forest management practices in Karnataka. Since the early 1980s, the Forest department shifted its focus of forest management from production forestry to conservation forestry. Some of these changes were initiated by the State Forest department well ahead of the policy changes that took place in the forestry sector at the national level. However, the initiatives taken by the Forest department gathered momentum in view of the national level changes as reflected in the thrust areas of the Five Year Plans as well as in the National Forest Policy, 1988 which advocated a 'conservation oriented forest management' approach.

3.57. In view of the newly emerging forest management approach, working of the forests for harvest of timber and firewood was limited to selection felling of mature trees carried out departmentally or under departmental supervision. This system was eventually changed over to salvaging of only dead and fallen trees. By the turn of the twentieth century, when the working plans of the territorial forest divisions were revised, it was ensured that removal of dead and fallen trees was carried out only in the deciduous forests. Most of the evergreen and semi-evergreen forests, as also deciduous forests in inaccessible areas and on steep or difficult slopes, were brought under 'Bio-diversity Conservation' or 'Protection' working circles where logging was prohibited and rigid protection measures were prescribed. Protection from fire was given utmost priority. These measures resulted in gradual reduction of human interference in the forests leading to their restoration and rejuvenation.

3.58. As regards management of the wildlife sanctuaries and national parks of Karnataka, till the late 1980s these were for all practical purposes under the direct control and supervision of the territorial forest divisions. The only exception was the Project Tiger, Bandipur which was administered directly by the Field Director. There was also a skeletal presence of the Wildlife wing under a few Assistant Conservators of Forests with headquarters at Bangalore (Bannerghatta), Mysore, Shimoga and Dharwar. They carried out certain conservation and development activities in the sanctuaries and national parks under the guidance of the Chief Conservator of Forests, Wildlife and the Chief Wildlife Warden. They however did not have overall control over the areas. As wildlife conservation was gaining importance and the

protected areas required special attention for their conservation and development, the need for personnel exclusively for wildlife management was felt. As the territorial officers were burdened with multifarious responsibilities, the government decided to constitute separate wildlife divisions with the specific objective of managing the wildlife sanctuaries and national parks strictly as per the principles of wildlife management. During early 1990s, a number of wildlife divisions were created by carving out the areas coming under sanctuaries and national parks along with some peripheral areas. The wildlife divisions were Hunsur, Shimoga, Bhadra, Kudremukh, Dandeli, Cauvery, Chamarajanagar and Bannerghatta. These divisions were brought under the exclusive control of wildlife officers who managed the areas as per the prescriptions of management plan specifically prepared for each protected area. The process of transfer of possession of the forest lands from the territorial wing to the wildlife wing was by and large smooth except in some pockets where it took some time for one reason or the other. Be that as it may, with the creation of these divisions, wildlife conservation of the protected areas got special attention both in terms of technical expertise and additional funding. Creation of the wildlife divisions also helped in consolidation of the protected areas. Around that time, with the amendment of the Wildlife (Protection) Act, 1972 (Act No. 44 of 1991) which *inter alia* provided for inclusion of Section 26A, the process of issuing final notifications for most of the wildlife sanctuaries was hastened as these were originally reserved forests with already settled rights and concessions. Subsequently, two wildlife sub-divisions, namely, Madikeri and Mysore were upgraded to full-fledged wildlife divisions. With the declaration of Male Mahadeshwara Hills (M.M. Hills) wildlife sanctuary in 2013, Kollegal territorial division was re-designated as a wildlife division.

3.59. The expansion of the protected area network of Karnataka is quite impressive. Starting from the hunting reserves at Bandipur and Nagarahole established in the early 1900s, a number of wildlife habitats were established prior to the enactment of the Wildlife (Protection) Act, 1972. These included Venugopala Wildlife Park (1931), Jagara valley game reserve (1951), Nagarahole game reserve (1955), Dandeli wildlife sanctuary (1956), etc. These wildlife habitats comprised of about 3.2% of the total forest area of the state. Enactment of the Wildlife (Protection) Act in 1972 ushered in an era of wildlife conservation and a number of national parks and wildlife sanctuaries were notified in rapid succession throughout the state. During 1995, the total extent of protected areas in the state rose to 17.5% of the total forest area comprising of five national parks and 20 wildlife sanctuaries covering an area of 6700 square kilometers. During the last decade (2005-2015), the department has increased the protected area network either by adding more reserved forests to the

existing sanctuaries / national parks or by notifying new sanctuaries and conservation reserves. A number of wildlife sanctuaries notified during the last decade are situated in the dry deciduous forests which were earlier under-represented in the protected area network of the state. These are Rangayyandurga, Chincholi, Yadahalli, Jogimatti and Thimlapura wildlife sanctuaries. The extent of protected area network of the state has now expanded to more than 10,200 square kilometers comprising of five national parks, thirty wildlife sanctuaries, fourteen conservation reserves and one community reserve. These protected areas constitute about 25% of the total forest area of the state. This phenomenal increase of the protected areas has been extremely beneficial for the growth and development of wildlife, as it has been possible to interlink the protected areas facilitating carefree movement of wildlife over a larger landscape. The Forest department's initiatives to expand the protected area network during the last decade received wholehearted support of the state government, notably from the then Principal Secretaries Mr. Kaushik Mukherjee and Mr. R. Sridharan. Acknowledgement is also due to Dr. Sanjay Gubbi from the Nature Conservation Foundation, Mysore, who provided a lot of technical input to the department. Further scope of expanding the existing protected area network should be explored, especially by providing connectivity between the forests of Sakleshpur taluk in Hassan district with the forests of Chickmagalur district, as it will provide an excellent corridor for movement of wildlife through the entire Western Ghat belt in Karnataka.

3.60. Setting up of wildlife divisions in Karnataka during the early 1990s was a very significant decision in terms of the policy of exploitation of forest produce. Earlier, when the wildlife areas were under the control of the territorial wing of the Forest department, operations such as salvaging of dead and fallen trees, extraction of bamboo, etc. were going on in the wildlife areas such as Nagarahole, Dandeli, Shettihalli, Sharavathi, etc. Some of these areas, notably in Hunsur and Haliyal forest divisions, have excellent trees of teak and other hardwood species yielding high quality timber. The scale of these operations came down after transfer of the wildlife areas to the newly created wildlife divisions. With an order of the Hon'ble Supreme Court dated 14-02-2000, complete moratorium was imposed on removal of any forest produce, including grass, from the protected areas.

3.61. It must however be mentioned that a few forest patches in Karnataka were kept free from logging operations by the Forest department even before the enactment of the Wildlife (Protection) Act, 1972. These areas were located in the old Mysore state and were used as game reserves by the Maharaja of Mysore. Among these, Bandipur areas including the erstwhile Venugopal Wildlife Park came under

the fold of Project Tiger in 1973 and were provided utmost protection under the project. Areas coming under Nagarahole game reserve were however worked because of the presence of high quality teak trees. Parts of Muthodi and Lakkavalli forests of the present Bhadra wildlife sanctuary including the erstwhile Jagara valley game reserve were not subjected to logging, although extraction of dead and flowered bamboo was permitted. Thus, portions of Bandipur and Muthodi-Lakkavalli forests are perhaps the only deciduous forests in the state which had not been logged for more than 100 years. The Bandipur forests, being primarily of dry deciduous nature, have been harboring trees of moderate size. Parts of Muthodi-Lakkavalli forests, which are in the moist deciduous zone of the Western Ghats region, are now home to some of the biggest trees of the state belonging to various species such as teak, beete, matthi, nandi, honne, etc. One also comes across very large trees of nandi, honne, beete, etc. in some of the coffee estates in the periphery of Muthodi forests where felling permission under mafi pass was denied by the department for some reason. As regards evergreen trees, one can still come across trees of gigantic size in some remote and inaccessible pockets of the Western Ghats, especially along the common boundaries of Coondapur, Shimoga, Sagar and Honnavar divisions and in parts of Kodagu district.

3.62. Another significant outcome of the Mysore kingdom's initiative in wildlife preservation through setting up of a number of game reserves is the relative abundance of wildlife in the forests of old Mysore state as compared to the forests of Bombay and Madras presidencies. The British rulers do not appear to have given much consideration to preservation of wildlife. As a matter of fact, going by the many references about hunting and killing of tiger and panther during that period, substantial decline in wildlife population had taken place under their rule. Besides, their exploitative policy of working most of the deciduous forests had put a heavy toll on the wildlife population in the forests. An indirect but positive result of declaraing game reserves in Nagarahole and Jagara valley by the Mysore kings was that large tracts of pristine moist deciduous forest were prevented from being converted into coffee plantations.

3.63. Most of the protected areas in the state are generally flanked or surrounded by reserved forests (RF) which are under the control and management of the territorial wing of the Forest department. The reserved forests constitute buffer or cushion around the protected areas and provide for free and unhindered movement of wildlife. In view of the present conservation oriented approach of the department in managing forests, the management principles adopted in the reserved forests now are

almost similar to the management principles adopted in the protected areas. This has resulted in restoration and improvement of the reserved forests as ideal wildlife habitat.

3.64. While the protected areas have been expanded and interlinked by including some reserved forests as indicated above, the focus of management of the remaining reserved forests (not included in the protected area network) has also been reoriented so as to complement wildlife conservation. Fire protection, soil and moisture conservation, assisted natural regeneration, prevention of smuggling and poaching, etc. have been given utmost priority in these areas. As wild animals freely roam about in the forests unaware of the artificial boundary between protected areas and territorial forests, need was felt for convergence and co-ordination in management by the wildlife and territorial wings of the Forest department. Instances of man-animal conflict have also become quite common nowadays requiring effective handling by the staff of both the territorial and wildlife wings of the department. With the department increasingly adopting an approach of conservation oriented forest management, the working methods of both the wings have become somewhat similar, the focus being more on protection and development. To achieve better co-ordination among the officers of the two wings in carrying out protection related activities, the wildlife and territorial divisions have been brought under the same controlling officer, namely, Chief Conservator of Forests (CCF), at the circle level.

3.65. Karnataka has set up a very extensive network of anti-poaching camps / forest protection camps in the Project Tiger areas, sanctuaries, national parks and vulnerable reserved forests. These camps, located at convenient and vantage points, mostly employ tribal and other youths from the neighboring villages or hamlets and they patrol designated forest areas on daily basis. These camps have been very effective in controlling poaching and smuggling besides preventing forest fires during the fire season. Karnataka is the first state in the country to have recruited a Special Tiger Protection Force (STPF) as per the guidelines of the National Tiger Conservation Authority (NTCA). The services of this force are being utilized with very good results in the protection activities in Bandipur, Nagarahole and BRT Project Tiger areas.

3.66. With regard to rehabilitation of people residing inside the protected areas, the state government's policy has been to encourage only voluntary relocation. Facilities for rehabilitation are provided to those who wish to come out on their free will. There are two types of habitations within the protected areas: the habitations

inside Nagarahole and Biligiri Rangana Temple (BRT) tiger reserves are by forest dwelling tribal people. However, the habitations within Bhadra tiger reserve, Kudremukh national park and Anshi-Dandeli tiger reserve are primarily small revenue pockets (private holdings) within the protected areas inhabited mostly by non-tribal and some tribal families. Out of about two thousand tribal families residing inside Nagarahole tiger reserve, about one third families (635) have been rehabilitated outside the reserve by providing facilities as per the rehabilitation package of the National Tiger Conservation Authority (NTCA). Facilities for rehabilitation of another 200 families are being developed. In respect of Bhadra tiger reserve, most of the families residing deep inside the reserve have been rehabilitated. More than one hundred families have also relocated from Anshi-Dandeli tiger reserve and the process of relocation of another two hundred families is in progress. In Kudremukh national park, out of about one thousand four hundred families, more than two hundred families have already relocated to areas outside the park and about six hundred more families have given their willingness to move out. Prior to the Forest department's program of voluntary relocation from Kudremukh national park, an NGO led by Dr. K. Ullas Karanth, with the approval of the state government, had motivated and provided financial support to a number of families residing in enclosures deep inside the park and facilitated their relocation.

3.67. The beneficial effects of relocation of people from inside a protected area have been amply demonstrated in the Bhadra tiger reserve where the forest ecosystem has shown signs of tremendous recovery. The private holdings, mostly paddy fields, which have been abandoned, have gradually turned into grasslands and it is a common sight now to find large herds of herbivores grazing in these open lands. The number of tiger has also increased in the reserve. The relocated people have also been greatly benefited because of easy access to facilities such as education, health care, improved agriculture, civic amenities, etc. Similar positive developments have taken place in respect of the relocated people from Kudremukh national park and Anshi-Dandeli tiger reserve. While the vacated areas have shown signs of ecological recovery, the quality of life of the people who have opted to come out from deep inside the forests has improved considerably.

3.68. Even though the Forest department is fully convinced that relocation of people from the protected areas is beneficial to both people and forests, it has adopted a cautious approach towards rehabilitation and moved forward only in cases where people have shown willingness to relocate. In respect of forest dwelling tribal people, rights have been conferred on them as per the provisions of the Forest Rights Act. It must however be admitted that the process of relocation of people from inside the

protected areas has been somewhat unsettled by the process of settlement of rights as per the Forest Rights Act. This is more palpable in tiger reserves with higher concentration of tribal population such as Nagarahole tiger reserve. The tribal population in BRT tiger reserve is relatively small with about four hundred families comprising of about two thousand persons. Besides, this population is thinly distributed in a number of pockets in the reserve. Considering that this small and scattered population is almost in sync with the forest ecosystem of the reserve, the Forest department, with concurrence of the NTCA, has not proposed any plan for relocation of the people out of the reserve. However, the situation in Nagarahole is somewhat different with a tribal population of more than 2000 families. This number is also increasing because of division of families and other reasons. As already mentioned, more than six hundred families have already been rehabilitated by the department after obtaining their willingness to move out from deep inside the forest areas. Arrangement for rehabilitation of another two hundred families is under progress. At this juncture, some families who had earlier given willingness to move out are now in two minds. Some families who have already been rehabilitated appear inclined to go back to the forests because of the perceived benefits accruing out of the Forest Rights Act. Under these circumstances, the relocation programme of Nagarahole tiger reserve has faced some operational hurdles.

3.69. Another problem faced by the department in respect of tiger reserves with sizeable tribal population is about providing civic amenities to the people who have been settled deep inside the forests as per the Forest Rights Act. These activities, when carried out for the benefit of a large number of families, result in serious disturbances to the wildlife ecosystem. With the winds of development blowing all around, life of a tribal family now is no way different from the life of any other family in a town or a village. Large settlements of the new generations of tribal people deep inside the tiger reserves adversely affect the tranquility of the reserves and are detrimental to conservation of the pristine habitats. The commonly held concept that tribal and tiger live together cannot be stretched beyond a limit. In the interest of conservation of these unique tiger habitats, it is necessary to evolve feasible and practical models which enable the tribal people to improve their economic and social conditions without at the same time bringing the precious abodes of the magnificent animal to the brink of extinction. It is hoped that the National Tiger Conservation Authority (NTCA) with the approval of the policy makers of the country can provide workable and practical guidelines in this direction so that the field officers are left in no doubt or confusion about how to go about in cases where there are direct conflicts between implementation of the Forest Rights Act and safeguarding the inviolate nature of a tiger reserve.

3.70. One area of concern regarding wildlife management is the increase in the number of incidents relating to man-animal conflict. Instances of man-animal conflict involving elephant, tiger, leopard and sloth bear are on the rise resulting in death or grievous injuries to human beings. Elephants cause considerable damage to property. Instances of cattle kill by tiger and leopards are also common. Crop damages by elephants, bisons, black bucks, sambar and other herbivores are frequent in agricultural lands abutting forest areas. People affected by animal damages often resort to retaliatory killing of animals by various means such as electrocution, shooting, snaring, trapping, poisoning, etc. A number of reasons are attributed to the increasing trend of wild animals straying out of their natural home and entering into villages, towns and agricultural lands. Shortage of fodder or prey animals sometimes forces the animals to come out from forest. Injured or aged carnivores come out looking for easy prey. However, shrinkage or fragmentation of wildlife habitat is the most important reason forcing the animals to come out of their natural habitat. In the past, there used to be extensive tree-covered buffer area between the forest proper and agricultural lands. Animals straying out of the forest proper normally remained within the limits of this buffer area. The buffer area consisted of both non-forest public land and private land. With the increasing demand on agriculture, most of the private lands in the buffer zone have been cleared of vegetation and brought under cultivation. Most of the non-forest public lands have been either encroached upon for extension of cultivation or granted for cultivation under land grant rules. As a result, agriculture has extended to the edge of the forest proper. This has made the wild animals very vulnerable and their entry into human habitations has become very common resulting in frequent conflicts with human beings.

3.71. Another important reason for increasing man-animal conflict due to elephant depredation is disruption or fragmentation of the traditional migratory routes of elephants. It is believed that the entire elephant population of Karnataka was earlier only one group. A large number of animals from this population had been using a very long migratory route starting from the forests of Mysore-Chamarajanagar and passing through the contiguous Ghat forests of Kodagu, Hassan, Dakshina Kannada, Chickmagalur, Shimoga and Uttar Kannada districts. The forests of Dandeli in Uttar Kannada and Nagargali of Belgaum were believed to be the northern most limits of this migratory route. However, over the years, especially during the last 150 years, considerable transformation has taken place in the surrounding landscape due to demographic changes. Development activities such as large-scale expansion of agriculture, proliferation of human settlements, establishment of coffee plantations, etc. have resulted in such a transformation. A

number of hydro-electric and irrigation projects have come up in the area necessitating construction of huge reservoirs. These developments have taken place right on the traditional migratory routes of the elephants and as a result, their migratory behavior has been affected or disrupted. It is believed that it is on account of such disruptions that we now have distinct sub-groups of elephant populations in Karnataka such as in Bhadra and Dandeli, where certain number of elephants, which were on the move along their traditional migratory route, got trapped. The recent phenomenon of a small group of elephants getting trapped in Doddabetta forest of Hassan district is a similar example. Having been denied unhindered movement along the traditional migratory routes, which they had been using for centuries and for generations after generations, these trapped elephant groups tend to exhibit aberrations in their movement within their present habitats. Instances of Dandeli elephants straying into Goa-Maharashtra areas, Dharwar-Haveri areas and Shikaripur-Soraba areas are indicative of such aberrations. Similarly, the elephants of Bhadra are often found to move towards Mudigeri, Sakleshpur, Hassan and even to Dakshina Kannada areas. The elephant population at Bannerghatta near Bangalore had access to Mysore-Chamarajanagar-Sathyamangalam forests through the forests of Karnataka and Tamilnadu along both sides of the Cauvery River. The same population also used to move up to the forests of Andhra Pradesh. Disruption of their traditional migratory routes has resulted in occasional straying of these animals towards Kolar, Malur, Kuppam, etc. The same group of elephants also moves towards Savandurga, Tumkur and beyond. A large group of elephants from Nagarahole forests has almost set up their residence within the coffee estates of Kodagu district.

3.72. Increased human activities in the natural animal habitats have also influenced the behavior of elephants resulting in their straying out into human territories. There has always been some presence of small elephant herds in the evergreen and semi-evergreen forests of Sakleshpur taluk of Hassan district. These elephants normally move along the water courses such as streams and rivulets in view of abundant availability of fodder such as *Ochlandra*, *Oxytenanthera*, etc. besides water throughout the year. However, human activities in these areas such as setting up of mini-hydel plants on the water courses, construction of roads and bridges and boring of huge underground tunnels through the hills have adversely affected the normal movement of the elephants in their habitat. This is reflected in the increasing number of incidents of man-elephant conflict in and around the coffee estates and settlements in the region. Similarly, there is considerable movement of elephants along the Cauvery River in the Shivanasamudra area adjoining Kollegal

and Malavalli taluks. The elephants mostly move along the riverbed and the adjoining forest, as there is assured availability of fodder and water during the whole year in this tract. In the recent years, a number of mini-hydel projects have come up in the area in order to harness the water from the river. This has resulted in heavy construction activities right across the river bed. As a result, the elephants, instead of restricting themselves within their habitat, are often forced to move out to nearby agricultural lands and human habitations in Malavalli and other taluks of Mandya district.

3.73. In view of fragmentation of forest landscapes and consequent disruption of free movement of elephants and other animals, it has now become necessary to consolidate these fractured landscapes by protecting and strengthening the existing corridors or by creating new corridors wherever feasible. In the publication 'Right of Passage: Elephant Corridors of India', eighty-eight (88) elephant corridors or critical pathways connecting major elephant habitats in the country have been identified. Out of these, six corridors pertain to Karnataka. These are: (1) Karadikkal-Madeswara (Ragihalli) (Length 1 km and Width 0.3-0.4 km), (2) Tali (Chattiramdoddi-Hunsanhalli) (L 2 km and W 1 km), (3) Edayarhalli-Doddasampige (Bekkatur-Arabikere) (L 0.5 km and W 2 km), (4) Chamarajnagar-Talamalai at Punjur (Punjur-Kolipalya) (L 1.5 km and W 1 km), (5) Chamarajnagar-Talamalai at Muddahalli (Talavadi-Muddahalli) (L 1.5 km and W 1 km) and (6) Kaniyanpura- Moyar (Kaniyanpura) (L 1 km and W 0.4 km). Out of these, the corridors at Tali and Chamarajnagar-Talamalai at Muddahalli are situated partly in Karnataka and partly in Tamil Nadu. The remaining four corridors are situated within Karnataka. The legal status of the land falling in the corridors is reserved forest except in Edayarhalli-Doddasampige corridor where it was both reserved forest and revenue land. The revenue land has since been acquired with funds provided by the Wildlife Trust of India and is now under the control of the Karnataka Forest Department. The corridor at Kaniyanpura- Moyar (Kaniyanpura) which connects Bandipur national park and Satyamangalam forests was initially very narrow of about 100 m width. The Karnataka Forest Department has acquired the adjacent revenue land and annexed it to the reserved forest to widen the corridor. As regards land use in the corridors, the Karadikkal-Madeswara, Tali, Edayarhalli-Doddasampige and Kaniyanpura-Moyar corridors are under forest cover. The corridor at Chamarajnagar-Talamalai at Punjur (Punjur-Kolipalya) is partly under forest and partly under tribal settlement made during 1990-91. The corridor at Chamarajnagar-Talamalai at Muddahalli (Talavadi-Muddahalli) is partly under forest and partly under settlements and agriculture granted during 1959. Relocation of these settlements and acquisition of the land will

go a long way in securing uninterrupted movement of elephants and other animals throughout the forests connected by the above corridors. In Kodagu district, two coffee plantations have disrupted the continuity of forests between Nagarahole tiger reserve and Brahmagiri wildlife sanctuary. Acquisition of portions of these coffee plantations (Huvinakadu and Faith Estates) near Kutta-Tollpatty road adjacent to Kerala border can restore an excellent long-lost pathway for elephants and other animals between these two important wildlife habitats.

3.74. The Forest department has taken up various measures to reduce the frequency of occurrence of man-animal conflicts. Habitat improvement works are carried out regularly within the forests so that the conditions are favorable even during the pinch season when the animals tend to move out looking for more conducive environment. Physical barriers are erected along the forest boundaries to prevent animals from straying out. These include barriers such as elephant proof trench, reinforced walls, reinforced fencing with rails, etc. In the recent years, the Forest department has been receiving fairly liberal funding under a number of plan and non-plan schemes for carrying out these works. In order to mitigate the sufferings of the people affected by wildlife damages, the department has been making timely payments of ex-gratia amounts for human death, cattle kill and crop/property damages. The compensation amounts are fairly liberal and these are revised regularly.

3.75. The Forest department has adopted a guarded and conservative approach towards eco-tourism in the wildlife areas including the tiger reserves to ensure least disturbance to the wildlife habitats and to preserve their tranquility and serenity. During 2004, the department announced its eco-tourism policy, namely, 'the Wilderness tourism policy in national parks, sanctuaries, reserved forests and other forests of Karnataka', which gave guidelines regarding conduct of tourism within the protected areas and other forests. The objectives of this policy were to further the cause of conservation of forest and wildlife. The Forest department wanted to permit wilderness tourism in specific areas of national parks, sanctuaries and forests, and use it as a tool of conservation. In 2012-13, the Government of Karnataka set up the Karnataka Eco-tourism Development Board to nurture and promote eco-tourism in an organized manner across the state. The principal focus of the Board is to monitor, facilitate and regulate eco-tourism and to ensure that eco-tourism does not degenerate into mass tourism in forest areas.

3.76. The extent of tourism zone within each tiger reserve has been kept below the NTCA prescribed limit of 20 per cent of the area of the reserve. Number of tourist

vehicles permitted to enter for safari is strictly monitored and kept within the carrying capacity of the reserve as prescribed by the NTCA. Private vehicles or vehicles owned by private resorts are not allowed to ply within the reserves. Tourists are ferried into the reserves for safari either in vehicles of the park authorities or in vehicles owned by M/s Jungle Lodges and Resorts Ltd, a state government undertaking.

3.77. In order to ensure free movement of wildlife within the protected areas, movement of vehicles along highways or public roads passing through protected areas is regulated by establishing checking gates at entry and exit points. Speed breakers or rumble strips have been provided at frequent intervals along these roads to slow down the speed of vehicles to avoid injury or death of animals while crossing the roads. Night traffic along the highways passing through Bandipur and Nagarahole tiger reserves has been stopped.

3.78. In view of various initiatives taken by the Forest department since the 1980s as recounted above, there has been perceptible improvement in the status of conservation of the forest areas in general and of the protected areas in particular. This has in turn led to development of the areas as ideal wildlife habitats. It is a matter of achievement for the Karnataka Forest department to have shown remarkable progress in wildlife conservation as reflected in the census reports on estimation of tiger and elephant. As per the report titled 'Status of Tigers in India, 2014' released during January 2015 by the Ministry of Environment, Forests and Climate Change, Government of India, Karnataka has the highest population of tigers estimated at 406. Karnataka also has the largest number of wild elephants, with an estimated population of about 6000 animals, as per the census carried out during 2012 and 2017. The efforts of the department have also been complemented by a number of voluntary organizations and wildlife experts who have provided technical input and assisted the department in monitoring the population dynamics of wildlife.

3.79. During the last two decades, the Forest department has accorded high priority to recruitment and training of field-level personnel in order to raise the level of efficiency in protection and management of forest and wildlife areas. During the late 1990s, there was severe shortage of field-level staff due to general economy ban on recruitment. The ban had seriously and adversely affected the department's functioning as there were more and more vacancies, especially at the level of forest guards and foresters. In addition, the general policy of the government at that time was to abolish posts which had remained vacant for a long time. This resulted in abolition of many vacant posts of the Forest department, although these were very

essential for the protection and management of forests. As the average age of the field functionaries kept on rising because of retirements without commensurate infusion of young blood, it became absolutely inevitable to recruit personnel to fill up the growing number of vacancies in the department. In order to strengthen the front line staff that forms the backbone of forest protection, the department was eventually able to obtain special permission from the government to recruit field staff such as forest watchers, forest guards, deputy range forest officers (earlier known as foresters) and range forest officers. In this regard, a number of interventions from the Hon'ble High Court of Karnataka had also expedited the pace of recruitment. Since 2002-03, the Department has recruited, trained and appointed more than 5200 field-level forestry personnel. The process of recruitment is now on rails and is taking place at regular intervals ensuring continuous entry of youngsters into the department. There is however need for streamlining the recruitment process so that it takes place more frequently and the facilities of the training institutions are utilized optimally. One significant feature of the recruitment of forestry personnel in the state is that the entire exercise is carried out by the Forest department through a very strict and transparent process. It has been observed that persons with much higher qualifications than those prescribed for the posts have joined the department. The new recruits have to undergo comprehensive and rigorous induction training in the forestry training institutes of the state before embarking upon their field responsibilities. The young and energetic recruits have also been able to absorb the information and communications technology (ICT) initiatives of the department more effectively. These have improved the efficiency of the department which has been able to gradually develop a robust human resource. It is necessary for every forest officer in the department to guide, motivate and provide able leadership to the young recruits so that the future of the forests is in safe hands for all the years to come.

3.80. The Government of Karnataka on 11-06-2013 notified the Karnataka Forest Policy formulating the guidelines for forest conservation and development in the state. The guidelines include sustainable forest management through adoption of appropriate silvicultural systems for raising forest productivity while ensuring bio-diversity conservation, maintenance of environmental balance through protection and rehabilitation of degraded forests, adoption of appropriate soil conservation measures to improve availability and quality of water, encouraging natural regeneration in all types of forests, conservation of wildlife and its habitat, reduction of man-animal conflict, management of forest with stakeholders' participation, planting trees in non-forest and private lands to increase availability of firewood, fodder, NTFP and small timber through appropriate technology and extension

methodologies, *in-situ* and *ex-situ* conservation of medicinal plants, etc. The State Forest Policy is completely in conformity with the National Forest Policy, 1988.

3.81. The policy has reiterated the state government's stand of continuing with the ban on felling of naturally growing trees. It has stipulated increase in tempo of planting activities so as to reach the national goal within ten years. The need for expanding the protected area network and creation of wildlife corridors to provide connectivity among various wildlife habitats has been highlighted. The policy has laid emphasis on supporting and encouraging joint forest planning and management (JFPM) in order to develop the degraded forests. The need for preparation of appropriate scientific working plans for sustainable forest development has been stressed. It has recommended adequate provision for resources and manpower to effectively implement the plans. The policy has suggested that forestry planning and management should aim at mitigation of the effects of climate change. It has also recommended that forest based industries should be encouraged to procure their raw material from plantations raised in institutional, private and other lands and the growers should be provided incentives for tree planting initiatives.

3.82. The thrust areas of the state forest policy are: increasing tree planting throughout the state including in open urban areas, improving water bodies inside forests by appropriate soil and moisture conservation works, conservation and development of swamps, habitat improvement works in protected areas, propagation of endangered plant species, forest consolidation, development and modernization through GIS/MIS, increasing staff strength, strengthening of survey units, providing basic amenities and equipments to field functionaries, strengthening of forest protection, planting trees in rural and community lands, increasing production of important species of the state such as sandal, rosewood and various medicinal plants, encouraging people to plant firewood, fodder and small timber yielding species of their choice in their lands, establishment of a dedicated publicity wing, encouraging forest research works, etc.

3.83. Initiated by a handful of army and civil service officers and then taken over by professional foresters, the Forest department of Karnataka has come a long way, having already crossed the milestone of 150 years. This long journey has not been smooth. Working in inhospitable climate and treacherous terrain with minimum basic facilities was definitely a very challenging task in the beginning of this long journey. While working conditions in forest areas have gradually improved over the years due to improvement of civic amenities in interior areas and expansion of road network providing easy accessibility, the forest officers have been confronting newer

challenges while discharging their duties. In addition to the challenges posed by smugglers and poachers, some of them highly organized and lethal, the forest personnel are also in constant confrontation with a section of the society which is always on the lookout for an opportunity to encroach upon forest land or to commit forest offences involving unauthorized removal. The forest guard or forest watcher has always to be vigilant against any such illegal activity taking place in the forest. By and large, the duty of a forester is to conserve, and this conservation oriented approach is for larger, long term public good and for all-round development of the environment. However, this approach quite often comes in the way of so-called development works and as a result, the forester is often depicted as a villain of the society. This approach of the Forest department also antagonizes the powerful sections of the society who do not mind compromising long term benefits for the sake of getting instant popularity by doling out short term largesse. There is also a historical context to this antagonistic attitude towards the Forest department: Prior to the advent of the Forest department in the 1860s, forests were managed by government officials without proper code and rules, resulting in arbitrariness and complacence. There was generally a cozy nexus between the rural elite and the officialdom. The Forest department, which immediately after its establishment went ahead professionally with the task of reserving forests for the long term survival of these invaluable national assets, was considered as an intruder spoiling that cozy relationship.

3.84. It is a matter of gratification that in spite of various constraints and problems, the Forest department has been able to face the challenges and carry out various tasks and activities directly or indirectly related to protection and management of forests and wildlife. The credit for this remarkable achievement must go to the front line field functionaries who have toiled hard day and night, at times against very heavy odds and risking their own lives. The department also remembers with profound gratitude the forest officers and officials who laid down their lives for the cause of forest and wildlife. During the last fifty years, forty-two officers/officials (Appendix-I) have become martyrs of the Forest department by making the supreme sacrifice while performing their duties.

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WORKING PLANS FOR FOREST MANAGEMENT

Although development of forestry and forest management must have been engaging the attention of the rulers and the people since ancient times, recorded evidence pointing towards planned forest management in the pre-colonial era is very sketchy and almost non-existent. Abundance of forest resources coupled with limited population with limited needs might have resulted in a situation of contentment. In such a scenario, the need for prudent management of forest resources might not have gained importance or urgency. However, clearing of forest land for cultivation and settlements had continued over the ages as a necessity in view of increasing population and growing needs. It had also been encouraged by the rulers of the time with a view to collecting more land revenue. Such clearing of forest naturally generated abundant resources which would have been partly utilized and partly wasted.

4.2. Increased exploitation of forest appears to have gained momentum during the colonial period. This was necessitated by the creation of a huge demand for timber and fuel wood for revenue generation, trade and commerce, war supplies, dockyard construction, ship building, railway construction, roadways and bridges, buildings, industries, townships, developmental works, etc. However, it goes to the credit of the colonial administration for having introduced the required forest policy interventions and implementation of planned and scientific forestry practices to achieve these policy objectives. The colonial era marked the beginning of planned working of forests by bringing in the concept of working plan which aimed at sustained production of forest produce.

4.3. The British forest administrators took keen interest in the preparation of working plans as a preliminary step to working of forests. A lot of time and attention was devoted to preparation of these documents by collecting and collating field data and analyzing these. As the primary motive behind writing these working plans was for extraction of timber and fuel wood, priority was given to the relatively wooded areas or 'high forest blocks'. The reserved forests were the first to be brought under working plans. Forests with precious timber yielding tree species such as teak, beete, honne, karimuttal, etc. were preferred for obvious reasons. The main focus of the working plans was on extraction of timber from a forest block in a planned and scientific manner to ensure sustained production during the plan period and beyond. Planting or regeneration per se was limited to areas from which trees were totally removed under the silvicultural system of 'clear-felling'. However, such planting was

limited to relatively smaller patches of forest which were generally planted with teak. The more prevalent systems adopted were 'selection-cum-improvement felling' or 'coppice felling with retention of standards'. These systems did not call for intensive planting as a follow-up measure although limited planting with teak stumps along with dibbling of seeds of native species in gaps was prescribed.

4.4. Although the working plans of the colonial era were primarily meant for facilitating exploitation of forest, these were written after considerable survey and study of the forest area. The aim of the working plan officers was not only to harvest timber and firewood from forest but also to ensure that the quality or stocking of forest is not compromised. As a matter of fact, they attempted to improve the quality and stocking by prescribing improvement or cultural operations. As we have seen earlier, most of the working plans of Bombay and Madras presidencies were written by senior Imperial Forest Service (IFS) officers who had extensively studied the forest areas. Some of the working plans of Mysore and Coorg states were also written by eminent and senior forest officers. Dr. Krishnaswami Kadambi, a very erudite forest officer had immensely contributed to writing of many working plans for the forests of Mysore state. Mr. G. R. Mavinkurve, a forest officer of Bombay presidency also had major contributions in writing of working plans for a number of forests of Kanara.

4.5. Except during the two World Wars, when exploitation was also carried out from forests not covered by working plans, working of forest was by and large restricted to forest areas covered by working plans. Even if a forest was to be worked for an emergent purpose, exploitation was carried out after preparing a working scheme and getting it approved from the competent authority. This resulted in discipline in forest management besides ensuring sustainable production of timber and firewood. Even for supplying firewood to towns such as Karwar and Sirsi, which were thinly populated during those days, a lot of efforts and serious discussions with concerned officers had gone into writing of working plans to ensure sustained supply. Similarly, even for management of inferior forests such as the scrub forests of Dharwar and Kod (Hirekerur), working plan was prepared with equal sincerity before taking up working.

4.6. The working plans were initially written for individual forests or a group of forests. The concept of writing a composite working plan for the entire forest division had not yet evolved during the colonial era. It was perhaps because the forest divisions of that era were much larger in size and it would have taken considerable time, energy and resources to cover all the forest tracts of the division in one

document. Besides, all forests were not considered worthy of exploitation at that time. For example, a teak bearing moist deciduous forest block was considered on priority over a moist deciduous forest without teak or an evergreen/semi-evergreen forest. The practice of writing forest-wise working plan was continued even during the post independence period up to the 1980s although a few working plans covering the entire forest division had been written and approved by then.

4.7. The working plans written in the colonial era were for varying plan periods such as 10 years, 15 years or 20 years, sometimes even more. Some of the working plans had provisionally prescribed works for the post-plan period also. The plans written during the post-independence era up to the 1990s were generally for a period of 10 years or 20 years. However, the present guidelines for writing working plans provide for writing of composite working plan for all the forests of a division with a uniform plan period of 10 years.

4.8. As regards writing of working plans in Karnataka during the post-independence era, the progress was moderate in the period immediately after independence. However, this important activity of forest management appears to have lost momentum after the mid-seventies till the late nineties; very few working plans were written and approved during this period. A number of documents which were prepared were not approved for one reason or the other. These included the draft working plans for Sirsi division (Mr. S.C. Thippeswamy), Anmod, Anshi and Ulvi forests (Mr. Shanmukappa), Shimoga division (Mr. Kittanna Rai), Haliyal division (Mr. K.N. Murthy), Bidar division (Mr. S. Nagaraj), Mangalore division (Mr. B. Shantaram Adappa), etc.

4.9. A number of reasons are attributed to the apparent lack of interest or motivation in writing of or giving approval to working plans:

- As already mentioned, the main focus of a working plan as it evolved over the years was on working of the forest in terms of exploitation or harvest of timber, fuel wood and other forest resources. During the period starting from the seventies to the mid nineties, large extents of forest areas in the Western Ghats region of the state had to be cleared for the purpose of a number of hydro-electric and irrigation projects and related activities. As these obligatory clearances resulted in extraction of large quantities of timber and fuel wood, the Forest department had consciously brought down the momentum of tree felling in the forest areas as per the prescriptions of the working plans. Working plan

prescriptions regarding felling of trees were virtually ignored in some of the forest areas during this period. This worked as a disincentive for writing of working plans.

- ❖ In the early 1980s, the Karnataka Forest Department shifted its focus of forest management from production forestry to conservation forestry. The system of selling of forest coupes was discontinued, clear-felling of natural forest for regeneration was stopped, felling of natural green trees was restricted and direct supply of raw material from forest to wood-based industries was done away with. Forest working was limited to selection felling of mature trees carried out departmentally or under departmental supervision. Even this system was eventually changed over to salvaging of dead and fallen trees. The department's shift in approach from felling of trees to overall forest conservation also resulted in reduced focus on writing of working plans which were generally visualized as documents meant for planned and organized felling of trees.

- ❖ Due to changing forest management objectives, the department gradually switched over to writing of working plans which are in fact management plans with primary focus on multifarious activities such as forest protection, bio-diversity conservation, afforestation, enrichment planting, soil and moisture conservation, joint forest planning and management, extraction of forest produce, etc. However, there is tremendous mismatch between the amount required for implementation of the works prescribed in the working plan of a forest division and the budgetary allocation provided for various forestry works to the division. In other words, funds received for implementation of activities prescribed in the plans have no bearing on the targets given in these documents, and as a result, the prescriptions of the document are implemented limited to the available funds only. Chronic inability to carry out all the prescriptions of the working plans due to non-availability of sufficient funds had perceptibly reduced the importance of the documents.

4.10. The working plans written and approved during / for the period from 1947 to 2000 for the forest areas or forest divisions of Karnataka are listed below:

TABLE-I

Sl. No.	Name of the Working Plan.	Name of the Author.	Period of the Plan.
1	Working Plan for composite Mangalore division (present Mangalore and Coondapur divisions)	Mr. B. S. Keshav Vittal	1943-1958
2	Working Plan for Kalinadi Slope Forests (of Haliyal, Karwar and Yellapur divisions).	Mr. G. R. Mavinkurve	1950-1980
3	Working Plan for Devarayanadurga group of forests.	Mr.M.W. Palekhanda	1952-1962
4	Working Plan for Inland Coastal Forests of Kanara Western Division.	Mr. G. R. Mavinkurve	1953-1973
5	Working Plan for Ghat forests of Coorg.	Mr. K.K.Somaiah	1954-1973
6	Working Plan for Yellapur Manchikeri forest of Yellapur division.	Mr. G. R. Mavinkurve	1954-1973
7	Working Plan for Bukkapatna and Manchaladore group of forests.	Mr.M.W. Palekhanda	1955-1965
8	Working Plan for Gulbarga forest division (old).	Mr. Munawar Hussain	1955-1965
9	Revised Working Plan for Gangavali valley high forests.	Mr. S. A. Mundukur	1955-1985
10	Revised Working Plan for the High Forest Blocks I to IX and XX of Kanara Northern Division.	Mr. F. A. B. Coelho	1956-1976
11	Working Plan for Nagzary valley (Block XIA)	Mr. Britto	1956-1976
12	Working Plan for Mundgod Teak Pole Area of Yellapur division.	Mr. Korlahalli	1956-1976
13	Working Plan for Casuarina plantations of Honnavar division (Western Division, Kanara)	Mr. Korlahalli	1956-1972
14	Working plan for a portion of the eastern deciduous forests of Coorg.	Mr. K.K.Somaiah	1957-1972
15	Working Plan for Joida-Supa forests of Haliyal and Karwar divisions.	Mr. G. R. Mavinkurve	1957-1967
16	Working Plan for Kollegal forest division.	Mr. K. Shanmuganathan	1957-1972
17	Working Plan for Teak Pole Areas of Haliyal division.	Mr. Koralahalli	1958-1978
18	Working plan for the sandal forests of Coorg and other reserved forests.	Mr. K.K.Somaiah	1959-1973
19	Working Plan for Castle Rock area for firewood of Haliyal division.	Mr. D. G. Wesley	1960-70
20	Working Plan for Karwar Fuel Reserves.	Mr. B.F. Britto	1960-1980
21	Revised Working Plan for the high forests of Yellapur division.	Mr. D. G. Wesley	1961-1980
22	Working plan for merged princely states of Ramdurga, Mudhol and Jamakhandi.	Mr. G. V. Sringeri	1965-1975

23	Working Plan for Belgaum district (present Ghataprabha division and part of Belgaum division)	Mr. C. J. Fernandez	1965-1980
24	Working Scheme for extraction of softwood from Balur State forest of Chickmagalur division.	Dr. Rama Rao	1966-1986
25	Working Plan for Sandal areas of Sirsi and Siddapur taluks.	Mr. D. G. Wesley	1970-1980
26	Working Plan for Ghat forests of Belgaum division.	Mr. S. C. Thippeswamy	1971-1980
27	Working Plan for High Forest Block XIX (Nagargali Block of Belgaum division).	Mr. H. P. Vishwanathanan	1972-1981
28	Working Plan for Koppa forest division	Mr. K. Belliappa	1972-1982
29	Working Plan the Ghat forests of Hassan division.	Mr. B. S. Parishwad	1972-1987
30	Working Plan for composite Mysore division (present Mysore and Chamarajanagar divisions).	Mr. K. R. V. Shetty	1973-2003
31	Working Plan for Kollegal forest division.	Mr. K. R. V. Shetty	1973-1993
32	Working Plan for the Eastern Dry Forests of Hassan division.	Mr. K. Belliappa	1974-1984
33	Working Plan for composite Bangalore division (present Bangalore Rural and Bangalore Urban divisions).	Mr. N. V. Ramachandra Chetty	1976-1986
34	Working Plan for Interior High Forest of Yellapur, Honnavar and Karwar divisions.	Mr. G. Shanmukhappa	1976-1996
35	Working Plan for composite Dharwad division (present Dharwad, Gadag and Haveri divisions).	Mr. B. K. Jagadish Chandra	1977-1996
36	Working Plan for Raichur forest division.	Mr. P. K. Devaiah	1977-1996
37	Working Plan for Bellary forest division.	Dr. K. N. Baidya	1977-1996
38	Working Plan for the composite Hunsur division.	Mr. U. T. Alva	1978-2003
39	Working Plan for Chitradurga forest division.	Mr. Mohammad Ataulla	1980-1989
40	Working Plan for Honnavar forest division.	Mr. M. V. Mulimani	1984-2003
41	Working Plan for Mundgod Teak Pole Area of Yellapur division.	Mr. H. P. Krishnappa	1984-2003
42	Working Plan for Teak Pole Area of Haliyal division.	Mr. M. V. Mulimani	1984-2003
43	Working Plan for Yellapur Manchikeri forest.	Mr. B. U. Chengappa	1985-2005
44	Working Plan for Madikeri forest division.	Mr. Akbar Sha	1986-1995
45	Working Plan for Yekkambi-Sonda area of Yellapur division.	Mr. G. L. Hullur	1989-2009
46	Working Plan for Yellapur High Forest Blocks.	Mr. G. L. Hullur	1989-2003

4.11. Perusal of the above list indicates that during the period 1947 to 1990, the number of working plans written and approved for working / management of forests was quite less. Most of the plans were written for one forest or a group of forests. Very few plans had been written covering all the forests of a division. Many divisions, notably the high forest divisions, did not have any working plan for a very long period. Considering an average plan period of 20 years, each division should have

had at least two or three working plans during the above period of fifty years. Kollegal division is the only forest division in the state which was continuously covered by a working plan since its forests were brought under systematic management.

4.12. The Hon'ble Supreme Court of India in Writ Petition (Civil) No. 171/96 (Mr. T. N. Godavarman Thirumulpad versus Union of India and others) had passed a historic judgment on 12-12-1996 on various matters relating to the protection and conservation of the forests throughout the country. A number of directions had been given by the Hon'ble Court which had far reaching implications. One of the directions was relating to the working plans. The Hon'ble Court had directed that:

"The felling of trees in forests is to remain suspended except in accordance with the Working Plans of the State Governments, as approved by the Central Government.-----"

4.13. The above direction of the Hon'ble Court stipulated that any felling of trees in forest must be carried out as per the prescriptions of working plans of the State Governments which are duly approved by the Central Government. This direction set in motion the pace of writing working plans for various forest divisions of the state. Inventory works for collection of field data were started in right earnest as a preliminary exercise to writing of the working plans. The above exercise was carried out on war footing and as a result, all the working plans of the forest divisions of the state were prepared in a time-bound manner. The working plans were written for all the 37 territorial forest divisions of the Forest department during 2001-02, 2002-03 and 2003-04 and were sanctioned by the State Government after obtaining due approval from the Central Government. The period of each of these working plans was 10 years. With the expiry of these plans, the Forest department had initiated the revision of the working plans. Approval of most of the working plans for another ten years has already been obtained from the Government of India. The remaining plans are also in the final stages of approval.

4.14. Although the main objective of a working plan is to prescribe how the forests of a division should be managed for a prescribed period, the document in itself is much more than that. The first part of the document with a long title - 'Summary of facts on which the proposals are based' – is an abundant storehouse of information relating to or having bearing on the forests. Various facets of the forests are brought out in a number of chapters in this part of the document. The information provided is historical, verifiable, factual and legally acceptable. It provides an insight into the past management of the forests and the results obtained thereupon. The data

presented in the document provides input regarding how the forests have responded to the earlier treatments and enables the working plan officer to take informed decisions as to the future course of management in sync with the potential of the forests and compatible with the policy objectives of the state regarding forest conservation and development.

4.15. Although the working plan is written by the working plan officer, the deputy conservator of forests (DCF) in charge of the division has a very responsible role to play in its preparation. He has to furnish all basic and preliminary information and data about the division and its forests which are required for preparing the plan. The DCF is also fully responsible for implementation of the prescriptions of the approved plan. For effective and meaningful implementation of the plan, it is therefore necessary for the DCF and his staff to provide full support to the working plan wing. They should also give feedback regarding difficulties and constraints faced in implementing the prescriptions of the previous plan so that these are adequately addressed in the new plan.

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IMPACT OF PLYWOOD AND MATCHWOOD INDUSTRIES ON FOREST

The plywood industry in India is about a century old. The initial growth of the industry was associated with the development of tea industry. As the tea industry grew, demand for tea chests for packing tea kept on rising. The first two plywood factories in the country were set up in Assam during the early 1920s. Over the years, due to continuous and progressive research and development in the plywood industry there has been tremendous expansion of the scope and utility of plywood products. The industry now produces different types of products such as flush doors, block board, shuttering plywood, etc. Presently plywood products are put to a variety of uses besides tea-packing such as wall paneling, flooring, roof ceiling, furniture making, flush door making, shutter making, railway wagon and coach building, body building of buses and trucks, marine engineering, aircraft making, making of toys, sports goods and musical instruments and for decoration of houses and offices.

5.2. In India, large scale working of forests started in order to extract trees yielding hardwood. While Teak was the prime target, demand for other hardwood species also grew because of the expansion of railways, roadways, shipyards, dockyards, factories, buildings, etc. These species were mostly available in the deciduous forests. The evergreen and semi-evergreen forests were generally left untouched as these forests predominantly harbored medium and soft wood trees. However, search and research for finding alternative ways and means for utilizing the vast timber resources of the evergreen and semi-evergreen forests continued. As the Second World War (1939-1945) resulted in over-exploitation of the deciduous forests, such efforts were intensified in the post war period. This resulted in development of the technology of making plywood under Indian conditions. The plywood industry was also encouraged to explore the possibility of utilizing various softwood timber species, as it would indirectly reduce the pressure on our deciduous forests which had been over-exploited for a long time. During the post war period as well as after the Independence, a number of plywood factories were set up in the eastern and southern regions of the country.

5.3. The first plywood factory in Karnataka was established in Yeshwanthpur, Bangalore during late 1930s. Subsequently a number of plywood factories were set up in South Kanara, North Kanara, Shimoga, Dharwar and Mysore districts. The Indian Plywood Manufacturing (IPM) Company Limited, in particular, established factories in Dandeli, Dharwar, Subramanya, Talaguppa, etc.

5.4. With the establishment of the plywood factories in the state and liberal commitment made by the State Government to supply them with the required softwood timber at concessional rates, it became incumbent upon the Forest department to open up the evergreen and semi-evergreen forests for timber extraction. In addition, a number of match factories including the Mysore Match Company (Shimoga) and the Western India Match Company (WIMCO) were allotted matchwood timber at concessional rates. The forests of Shimoga, Chikmagalur, North Kanara, South Kanara, Hassan and Kodagu were worked for extraction of softwood timber for the plywood and matchwood industries. Until then, these forests were hardly touched, except for extraction of balagi (*Poeciloneuron indicum*) poles for electric posts and some hardwood timber species such as dhuma (*Dipterocarpus indicus*), ebony (*Diospyros ebenum*), poon (*Calophyllum tomentosum* - for ship masts), etc.

5.5. Extraction of softwood timber for plywood industries was started in the 1940s after the setting up of a few factories in Bangalore, Mangalore and few other places. However, the number of factories increased after the Independence and it led to increased demand of the raw material. Softwood extraction reached its peak during the period between 1960 and 1980. Timber was supplied not only from the forests covered by working plans but also from forests which were not covered by working plans. During that period, working plans for many of the high forest divisions had expired and revised plans had not yet been in place. Some forest divisions such as Shimoga, Sagar, etc. did not have working plans for a long time. However, *ad hoc* arrangements were made for the extraction and supply of softwood timber to plywood and matchwood factories from the forest areas of these divisions. In respect of some of the forests such as the Ghat forests of Hassan division or the Balur state forest of Chickmagalur division, working scheme or working plan was drawn up mainly to provide timber to plywood factories. The average yield of softwood timber per coupe as estimated in Dr. K. Kadambi's working scheme (1942-1961) for the Ghat forests of Hassan division was 2,75,000 cubic feet. During the period 1975 to 1984, about 10,000 cubic meter of timber was extracted from the forests of Hassan to supply to plywood factories such as Mysore plywood, Mafatlal plywood, etc. The Balur state forest of Chickmagalur forest division was also exclusively worked for supply of softwood timber until 1984-85 as per the working scheme prepared by Mr. K. Keshava Gopala Naidu in 1949 and the working plan prepared by Dr. Rama Rao (1966-1986). The plywood and matchwood industries were also allowed to select logs of their choice from the regular timber depots where departmentally extracted timber logs were brought and stored for public auction. Large quantities of timber

were made available to them from the timber depots which had stored timber extracted from submersion areas such as Supa, Varahi, Chakra, etc.

5.6. The plywood and matchwood companies were permitted to select and extract a large number of tree species from the forests. The species included gulmavu/kularmavu (*Machilus macarantha*), mango (*Mangifera indica*), bural (*Bombax ceiba*), ambate (*Spondias acuminata*), godda (*Lannea grandis*), jarmal (*Tetrameles nudiflora*), hebbalsu (*Artocarpus hirsutus*), kaidhupa (*Canarium strictum*), gandhagarike/red cedar (*Toona ciliata*), kalgarike (*Chukrasia tabularis*), cadamba/apate (*Anthocephalus chinensis*), banate/belpaale *(Lophopetalum wightianum),* sampige *(Michelia champaca*), tumri/kat-kumbala (*Trewia nudiflora*), saldhupa (*Vateria indica*), ranjal/bakula (*Mimusops elengii*), poon/surohonne (*Calophyllum tomentosum*), gowri mara/maragowri (*Polyalthia fragrans*), rakta mara (*Myristica attenuata*), mashe/phadgus (*Alseodaphne semecarpifolia*), karagil (*Ammora canarana*), pali (*Palaquium ellipticum*), bhende (*Kydia calycina*), tare (*Terminalia bellerica*), etc. Earlier, there was also a provision empowering the Conservator to allot species, including certain hardwoods, not included in the lease agreement to the plywood factories on recovery of rates fixed by him. Species like teak (*Tectona grandis*), rosewood (*Dalbergia latifolia*), matthi (*Terminalia tomentosa*), thadasal (*Grewia tiliaefolia*), kindal (*Terminalia paniculata*), etc. could also be allotted on recovery of market rates.

5.7. The procedure for allotment of plywood and matchwood timber to the concessionary industries was through long-term lease agreements as approved by the Government. Although the preliminary work of enumeration and marking of trees in the specified forest area (coupe) was to be done jointly by the lessee company and the departmental staff, the system had undergone change over the years and, more often than not, the 'enumeration and marking' list was prepared by the lessee which was then verified by the departmental staff including forester, ranger and ACF before the list was finally approved for felling by the DCF. It must be conceded that the plywood and matchwood companies, in view of the special concessions accorded to them, had developed tremendous clout in the Government and at various levels of the Forest department; so much so, that there were instances when these companies had put undue pressure on the lower and middle level subordinate staff of the department at various stages - starting from enumeration, marking and checking of the trees to measuring and releasing of the logs - in order to expedite the release of timber.

5.8. Each plywood or matchwood company was allotted certain quantity of timber every year from a designated forest area (annual coupe) as per the lease

agreement. The number of trees to be felled per acre depended on the prevalent policy of the Government, condition of the growing stock and prescriptions of the working plan, if in place. Normally a limit of two or three trees per acre above a prescribed girth was stipulated. As the evergreen and semi-evergreen forests are located in hilly and difficult tracts of the Western Ghats, felling of the trees and carting / transportation of the logs were challenging tasks. Besides, the eligible trees (i.e. trees with bigger girth) in the forest coupe were not uniformly or evenly distributed. Such trees were more in number in the valleys and along the streams than on the slopes. Carting or transporting of logs along the valley was also comparatively easier than along the steep slopes. Because of these perceptible advantages, more trees were marked in the valley portions of the coupe although the total number of trees in the coupe was kept within the prescribed limit. This resulted in skewed distribution of the marked trees in the forest coupe. As felling of more number of trees in smaller areas would lead to creation of permanent openings in the forest, the departmental staff at the time of checking used to delete the excess trees marked in the valley areas. Any such attempt to correct anomalies of marking by the checking officials of the department was generally resented by the companies, as the number of trees to be felled in the coupe used to come down as a result of such correction.

5.9. In the initial years (1940s), there were only a few plywood factories in the areas of present Karnataka and their requirements were of the order of about 15,000 cubic meters. Exploitation at this stage was confined to only a few species in a few forest areas. However, as the industry expanded after the Independence, the number of plywood and matchwood factories increased manifold and the demand of softwood increased to more than 2 lakh cubic meters. The allotment ordered by the government totaled up to 1.5 lakh cubic meters. The extraction and supply from the forest reached its peak during the 1970s when about 1.1 lakh cubic meters of timber was supplied from almost all evergreen and semi-evergreen forests of the state. However, due to rigid conditions imposed by the Forest department, the annual supply was brought down since the 1980s and it was maintained at the level of about 50,000 cubic meters.

5.10. The rates paid by the plywood and matchwood industries for the timber they received from the Forest department were fixed at the time of entering into the long-term lease agreements. These were concessional rates offered to the industry as an incentive. Naturally, these rates were much lower than the market rates prevalent at that time. For example, during the period 1944-45 to 1950-51, the concessional rate for species allotted to M/s Indian Plywood Company Limited, Dandeli as per the lease agreement was Re. 1/- per ton. During that period, the Conservator had allotted

certain additional species for which the rates recovered were Rs 20/-per ton and Rs 25/- per ton. Even these rates were lower than the market rates. As the concessional rates were to remain static during the entire period of the lease agreements, and as the market rates of timber kept on mounting as the years rolled by, the concessional rates offered to the industry became unrealistically low. It was increasingly realized that the government was losing considerable revenue because of the abysmally low rates at which the softwood timber was offered to the industry. Considering that the logs selected by the plywood and matchwood industries were mostly of 'A' quality, the loss to the government was enormous. As a matter of fact, the government earned much higher returns by auctioning the softwood logs which the industry had rejected due to some defects and which were delivered to the government timber depots.

5.11. Releasing of very high quality timber at throw-away prices became a matter of concern to the state government. It was in this background that the government contemplated amending the Karnataka Forest Act, 1963. In 1981, the Act was amended (Act No. 1 of 1981) by inserting sub-sections (2) to (4) in Section 101A which provided for recovery of realistic value for forest produce supplied to industries irrespective of past commitments regarding rates. It was stipulated that industries have to pay for the raw material at rates specified from time to time with a provision that the rate shall not be enhanced more than once during any period of two years. In 1984 by another amendment to the Forest Act, 1963 (Act No. 11 of 1984), Section 101B was inserted by virtue of which all forest leases to industries were abridged to five years and the supply of raw material was made 'subject to availability' instead of the quantity committed earlier. These amendments enabled the State Government to exercise control over release of forest produce to the industries at realistic rates.

5.12. Felling of the gigantic trees in the evergreen and semi-evergreen forests was not only a difficult task but it also caused a lot of damage to the surrounding forest areas. A number of trees in the vicinity of the marked tree invariably used to get damaged during the felling of the tree. A lot of seedlings and saplings were also damaged. Carting of the logs to the loading points often caused serious damage to the forest floor. Besides, large numbers of small and medium trees, saplings and seedlings had to be sacrificed while forming roads throughout the coupe to enable trucks to ply in and out of the forest to evacuate the logs. After removal of the logs, no cultural operations or artificial regeneration activities were carried out and the forest was generally left to itself to recoup. Many of the forest areas were repeatedly worked because of their easy accessibility. As a result of heavy and repeated biotic interference and lack of adequate follow-up cultural interventions, natural

regeneration of the indigenous species was absent or unsatisfactory. This in the long run resulted in modification of the crop composition and adversely affected the pristine nature of the forests.

5.13. The period from 1980 to 1990 was very significant from the point of forest conservation in Karnataka. This period heralded a major change in the forest management practices with the Forest department shifting its focus from production forestry to conservation forestry. Although this change was triggered partly by the overall change in the national forestry scenario which had highlighted the need for ecological security, preservation of natural forest and biodiversity conservation, sincere attempts were made at the state level towards protection of forests in general and protection of evergreen and semi-evergreen forests in particular. The department had done away with the system of standing sale of forest coupes in the early 1980s. Clear-felling of natural forest for regeneration was stopped and felling of natural green trees was restricted in 1983. Felling in the evergreen forests was discontinued in 1987 and two years later, the state government stopped all concessions to wood-based industries and they were required to obtain their requirements in open auction. In 1990, felling of all naturally growing green trees was banned. These changes initiated by the Forest department were in conformity with the National Forest Policy, 1988 which advocated a 'conservation oriented forest management' approach. In order to reduce pressure on natural forests, the new forest policy redefined the priorities in which the private sector is encouraged to grow and supply raw material for wood based industries.

5.14. Withdrawal of permission to harvest timber directly from forest and the ban imposed on felling of green trees came as a big relief to the Forest department and to the forests, as it brought an end to an era of heavy exploitation of the evergreen and semi-evergreen forests of the state that lasted for more than half a century. These forests are by nature very sensitive to interventions and take a very long time to regain their lost glory. Unlike deciduous forests which show tremendous resilience to bounce back due to inherent coppicing power of most of the constituent species, the evergreen forests do not exhibit such tenacity or resilience to revive or rejuvenate. Most of the evergreen tree species regenerate from seeds. The seeds generally have limited viability. For effective germination and initial growth, the seeds prefer a forest floor rich in humus. The seedlings as well as the saplings prefer sheltered light. These conditions are generally met with in a normal evergreen forest thereby ensuring regeneration and growth of the existing forest in perpetuity. The moment such an evergreen forest is opened up and exposed to biotic disturbances, the local conditions of the opened-up area change due to over-exposure to light and heat; the

soil surface rich in humus soon gets drained and impoverished as a result of heavy rainfall. Removal of forest cover is quickly followed by permanent drop in fertility. The conditions obtaining in such exposed and disturbed areas are by and large not conducive to regeneration of the existing tree species. Such areas are quickly invaded by light demanding weeds and shrubs. Colonizing tree species such as uptige/chandoda (*Macaranga peltata*), bettadavare/holenekki (*Macaranga indica*), charcoal tree (*Trema orientalis*), kumkuma (*Mallotus philippensis*), kukbuta (*Mallotus tetracoccus*), kurigele (*Debregeasia longifolia*), etc. often appear in such cleared and disturbed evergreen and semi-evergreen forest areas. Abundance of *Mallotus philippensis* trees in Padinalkunad, Pattighat and Kadamakallu reserved forests in Kodagu district is an indication of heavy extraction of plywood and matchwood trees in the past from the accessible portions of these tropical evergreen forests.

5.15. It is a matter of gratification that many of Karnataka's evergreen and semi-evergreen forests are included in the national parks and wildlife sanctuaries. The management plans of these protected areas prescribe absolute protection to these pristine forests. It has also been ensured that the evergreen and semi-evergreen forests of the state which are not a part of the protected area network are invariably included in the 'Protection working circle' or 'Bio-diversity conservation working circle' of the working plans of the concerned forest divisions. This ensures that prescriptions almost similar to the prescriptions for protected areas are made applicable to these forests. Removal of even dead and fallen timber is prohibited from these areas. Considering the important role that these forests play in ensuring regulated water supply to our river systems, affording strict protection to these forests has been a splendid achievement.

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FUNDING IN THE FORESTRY SECTOR

Forests play an important role in the socio-economic scenario of any country, and this role is more pronounced in a developing country like India, which has a predominantly agriculture-based rural economy. Forests and trees play vital role in maintaining a stable environment conducive to sustained agricultural development. Forests are the foster mother of agriculture and unless the forest ecosystem is maintained in a protective and productive state, the future of agriculture itself is at stake. Forests protect and enrich the soil mantle by reducing soil erosion and nutrient loss, and by facilitating nutrient recycling and microbiological activities. They also protect hydrological systems and regulate stream flow, thereby augmenting water availability so vital for agricultural production. Forests also serve as a unique storehouse of plant and animal genetic resources and contribute significantly to the country's biological diversity which in turn serves as insurance against food crises and as an assurance for health care.

6.2. Forests meet a sizeable portion of India's energy needs, bulk of it in the rural sector through supply of fuel wood for cooking and heating. Fodder needs of a vast majority of our cattle population are also met from these forests. Forest products also play a very important role in the rural and tribal economy. Many of the non-timber forest products (NTFP) provide sustenance to the rural people, who collect a large part of their daily necessities, including food and medicines, from the forests. Most of these forest products represent a direct subsidy to the rural poor, and are integral elements in alleviating their poverty. For land-less families, forest related activities often represent an important source of income.

6.3. Since Independence, there has been inadequate investment in the forestry sector to compensate for the loss and degradation of forest due to various factors such as expansion of agriculture, development projects and growing population. In the past, investment decisions in the forestry sector have been influenced by the false notion that forests can regenerate on their own, free of cost to the country. Besides, in view of acute underdevelopment of the country, particularly in the fields of Agriculture, Energy and Industry, the thrust of the development planning process, as reflected in the Five Year Plans, right from 1951, had been primarily on these sectors. The allocation in the forestry sector has been, over the years, less than 1.0% of the total public sector outlay. Considering that forests occupy more than twenty per cent of the country's geographical area, the forestry sector outlay is abysmally low.

6.4. One of the underlying causes for poor investment in the forestry sector has been lack of proper appreciation of the economic value of goods and services derived from forests. Forests are generally seen as contributing to economic growth mainly through sale of timber, and as a source of land for conversion to other so-called productive uses. Many of the forest products are viewed as secondary byproducts of the timber production process and were, therefore, undervalued. Furthermore, many of these byproducts did not enter the formal market economy, and were therefore ignored. This view has gradually changed over the years partly due to the growing awareness of the importance of fuel wood as a source of energy and partly due to greater understanding of the importance of non-timber forest products (NTFP) in rural and tribal economy. There has also been increasing awareness of the vital role of forests in bio-diversity conservation, carbon sequestration and climate moderation. This has resulted in partial improvement in the budgetary allocations in the forestry sector. However, the overall investment scenario in the forestry sector continues to be modest.

6.5. One of the recommendations of the National Commission on Agriculture in its report of 1976 was regarding setting up of Forest Development Corporations (FDC). This recommendation was made in order to augment budgetary resources for forest development by reinvesting the revenues generated from sale of forest produce and by availing institutional finance for taking up extensive plantations. During the 1980s, many states floated FDCs to carry out scientific harvest and sustainable management of forest produce. Another recommendation of the Commission was with regard to taking up extensive Social Forestry projects, requiring substantial investment. A number of World Bank aided social forestry projects were launched in various states with financial assistance from the World Bank. Subsequently, India received financial and technical support for other forestry related projects including wildlife, forestry research, forest utilization, etc. from multilateral institutions like the World Bank, FAO, UNDP and EEC. On a bilateral basis, USA, UK, Japan, Canada, Sweden, the Netherlands and some other countries have collaborated extensively with India in the forestry sector.

6.6. As regards funding of the forestry sector in Karnataka, the scenario is almost similar to the national scenario depicted above. The forestry sector outlay over the years has been generally very low and within one per cent of the total state outlay. Starting from the 1980s, the state embarked upon a number of externally aided forestry projects to infuse more investment into the forestry sector. As regards setting up of Forest Corporations to augment resources, the core forestry activities were retained within the Forest department. However, a number of Forest Corporations

were set up to complement the forest development activities. The Karnataka Forest Development Corporation (KFDC) was incorporated in 1971 in order to raise industrial plantations like eucalyptus, rubber and cocoa in forest land. Subsequently, plantations of teak, bamboo, tea, bursera, etc. were also taken up on a modest scale. At present, the corporation's activities are limited to eucalyptus and rubber plantations. The Karnataka State Forest Industries Corporation (KSFIC) was incorporated in 1973. It is presently involved in carrying out logging operations, running of firewood depots, production and sale of flush doors, block boards and furniture. The Karnataka Cashew Development Corporation (KCDC) was incorporated in 1978 to raise and develop cashew plantations. The corporation manages cashew plantations over an extent of about 26,000 hectares of forest area in the districts of Dakshin Kannada, Udupi, Uttara Kannada, Shimoga and Chickmagalur. Both KFDC and KCDC have raised substantial plantations by availing institutional finance from the World Bank, NABARD, etc. The Forest wing of the Mysore Paper Mills, Bhadravathi, a state owned undertaking, has carried out a very successful captive plantation programme by raising 30,000 hectares of pulpwood species on degraded forest lands by availing external aid.

6.7. As regards contribution of the externally aided projects to the forestry sector, it was initially thought that it would herald a new phase of forest development with considerable increase in the allocation to the forestry sector which was generally starved of funds for forest development. However, it turned out that the external funding did not come as additionality to the department and the overall increment to the forestry sector allocation was only marginal. In other words, the normal state plan allocation of the forestry sector was squeezed and the external funding component was included in the forestry sector allocation. This resulted in shortage of funds for activities of the Forest department not covered under the projects. There was also skewed distribution of funds within various segments of the forestry sector. As the externally aided projects were area-specific and activity-specific, there was imbalance in the flow of funds into various areas and activities within the department. When the World Bank/ODA aided Social Forestry project was launched, attention of the department was focused mainly on areas outside the forest and as a result, the traditional forest areas received reduced attention and investment. Under the Western Ghats Forestry and Environment Project, focus shifted to three districts, namely, Uttara Kannada, Shimoga and Chickkamagalur. During the period of implementation of the Eastern Plains Forestry and Environment Project, the forests of the eastern districts received sufficient funds but the forests of the Western Ghats region were starved of funds. These anomalies were somewhat addressed during the

implementation of the Karnataka Sustainable Forest Management and Biodiversity Conservation Project (KSFMBC) which supported forestry activities throughout the state. However, as the funds from the project were stipulated for specific activities, with a major portion being earmarked for afforestation and related works, core forestry activities such as forest protection and forest consolidation received less attention.

6.8. Since the 1970s, centrally sponsored schemes (CSS) have constituted an important source of funding of forestry activities in the state. The CSS are mainly funded by the Government of India, although some schemes have a definite state component. Two important wildlife schemes, namely, 'Project Tiger' and 'Development of National Parks and Sanctuaries' were launched during the Fourth Five Year Plan (1969-74). A scheme called 'Social Forestry including Rural Fuel Wood Plantations' was launched during the Fifth Five Year Plan (1974-79). Subsequently, more CSS were launched, especially covering wildlife and social forestry sectors, and a few schemes on forest protection. With the setting up of the National Afforestation and Eco-development Board (NAEB) in the Ministry of Environment and Forests, a number of centrally sponsored schemes for assisting afforestation activities in the states were launched. Over the years, many of these schemes have undergone changes, some have been discontinued and some have been merged. At present, centrally sponsored schemes contribute to about 15% to 20% of the state's forestry sector plan outlay, bulk of it coming under wildlife schemes.

6.9. In order to supplement the resources available under various plan schemes for afforestation and associated activities, Karnataka Forest Development Fund was created in 1975. Forest Development Tax (FDT) was levied on forest produce sold by the Forest department and Forest Corporations. Until an amendment to the Karnataka Forest Act in 2016-17, FDT was levied at 12% when forest produce is sold to industries and 8% in other cases. During 2016-17, a uniform rate of 12% has been stipulated for any forest produce. FDT collected is initially credited to the consolidated fund of the state and subsequently transferred to the Karnataka Forest Development Fund. Funds required for afforestation programs are provided under the Karnataka Forest Development Fund (KFDF) scheme. Till 2010-11, collection of FDT was around Rs 10 crore per year and almost an equivalent amount was made available for afforestation works under the KFDF scheme. However, with the streamlining of the auction sale of iron ore extracted from the districts of Bellary, Chitradurga and Tumkur under the direction of the Hon'ble Supreme Court of India, substantial amounts of FDT are being recovered from the buyers of iron ore extracted from forest areas in these three districts (Mineral obtained from forest area comes

under the definition of forest produce). The word 'tax' in FDT has been changed to 'fee' by an amendment to the Forest Act in 2016-17. The average annual collection of Forest Development Fee by the Forest department is now of the order of Rs 400 crore. In view of increased collection of FDF, funds released by the Government to the Forest department under the Karnataka Forest Development Fund scheme have been progressively increasing since 2011-12. During the years 2014-15, 2015-17 and 2017-18, annual allocation under the scheme has been about Rs 300 crore. Infusion of FDF into the forestry sector has been a very positive development in the department in the recent years, as it has enabled the department to take up plantation and ancillary activities without depending upon external aid. It has also provided the department the necessary flexibility in deciding the model of planting to be adopted in the identified areas as per the local conditions and requirement.

6.10. Although raising plantation is an important activity of the Forest department, it has been increasingly realized that forest protection is the most cardinal duty of the department. Very good plantations have been found to have degraded or denuded for want of adequate protection. On the other hand, there are many examples where degraded forest areas have rejuvenated into excellent forest solely due to rigid protection given to the areas over a long time. One of the best and the easiest ways to develop a degraded forest is to ensure and enforce rigid protection from the various pressures working on it. Many of our forests, especially the ones near habitations, have been degraded due to intense biotic pressures caused by human need and human greed. It is therefore necessary to ascertain the pressures responsible for such degradation and take steps to withdraw or reduce these to reasonable limits. Withdrawal or reduction of these pressures itself is a big step towards restoring the forest to its original glory. Rigid protection from fire, illicit removals and excessive grazing will enable a degraded forest patch to bounce back to life.

6.11. As per section 98B (4) of the Karnataka Forest Act, 1963, 'the amount at the credit of FDF shall not be expended except for raising forest plantations and for such other purposes as are ancillary thereto.' Over the years the concept of forest development has been undergoing radical transformation; it has been increasingly realized that the goal of forest development cannot be achieved unless and until adequate provisions are made for forest protection, forest consolidation and forest infrastructure development in addition to raising plantations and ancillary activities. In view of this, it was felt necessary to review and amend the provision of section 98B (4) to enable utilization of FDF for a wider range of activities. The Karnataka Forest Act, 1963 was therefore amended on 23-12 -2015 vide Karnataka Act No. 41 of 2015. The scope of section 98B (4) was expanded to cover a much wider spectrum of

activities besides raising forest plantations and ancillary works of soil and moisture conservation. Additional activities permitted under the revised provision include consolidation of boundaries of notified forest areas, acquisition of private areas for the consolidation of forests, construction and maintenance of forest housing in rural areas for frontline staff, training, capacity building, research and technology, sustaining joint forest planning and management (JFPM) activities and the village forest committees/eco-development committees, rehabilitation and settlement of people from interior forest areas, and such other activities relating to forest development or management or wildlife protection and management as may be notified by the State Government from time to time. This amendment is quite significant in that it has provided flexibility to the department to utilize the FDF meaningfully and effectively for forest conservation and development. The Forest department is now in a position to carry out a large portion of forestry works with the FDF without having to look for external funding.

6.12. Based on the recommendations of the Thirteenth Finance Commission (TFC), Karnataka Forest department had received financial assistance of Rs 221.04 crore from the Government of India for five years (2010-11 to 2014-15). Seventy-five per cent of this assistance was to be utilized for development purpose and the remaining twenty-five per cent for preservation of forest wealth. Financial assistance received from the Government of India as per the recommendations of the Thirteenth Finance Commission (TFC) was a welcome development as it was possible to invest in certain sectors of the Forest department which were earlier not benefitted by the externally aided projects. Core forestry activities such as forest protection, forest consolidation, survey and demarcation, etc. received the required attention through TFC funding. However, while allocating funds under the Fourteenth Finance Commission, the Government of India did not make the sectoral allocations as was done under TFC; the state governments were given the liberty to decide allocations to various sectors. Thus dedicated allocation to the forestry sector has been threatened.

6.13. Since 2010-11, the Forest department has been receiving funds from the Government of India under the Compensatory Afforestation Fund Management and Planning Authority (CAMPA) for raising compensatory plantations in order to make up for the loss of forest lands which are diverted for non-forest purposes under the Forest (Conservation) Act, 1980. The present level of funding to Karnataka under CAMPA is of the order of Rs 100 crore per year. Prior to the constitution of the CAMPA and transfer of funds received from the user agencies to the central pool, the state was implementing a non-plan scheme, namely, 'Compensatory Plantations' under which funds recovered from the user agencies and credited to the consolidated fund of the state were provided to the Forest department for raising compensatory plantations.

6.14. While in the subject of forestry sector funding, mention must be made about a small but innovative scheme, namely, the 'Protected Area Management Fund (PAMF)'. This scheme was initiated for the wildlife wing of the department during 2002. The scheme provides for transfer of the amounts such as entry fees, room rents, etc. collected from national parks and wildlife sanctuaries from the revenue receipt head to a dedicated expenditure head titled PAMF. The amount allocated under this budget head is utilized for the management and development of protected areas. The money collected during one financial year is made available during the next financial year. A committee under the chairmanship of the Chief Wildlife Warden and comprising of representatives from Finance department, Tourism department and two NGOs nominated by the Government oversee the implementation of the scheme. The scheme continues to be operative with an amount of about Rs 4-5 crore annually. It is more commonly known as 'Protected Area Development Fund (PADF)'.

6.15. The Karnataka Zoo Authority, set up during 2002, is another example where the Forest department has been able to generate and mobilize funds for management of eight zoological gardens under its control. Earlier these parks were managed by the department with its departmental budget. Visitors' fees now constitute the bulk of the revenues generated which are ploughed back for maintenance and development of the parks with nominal funding in the form of grant-in-aid from the state government.

6.16. Incorporation of Chapter IVB in the Wildlife (Protection) Act, 1972 by an amendment in 2006 (Act No. 39 of 2006) ushered in a lot of improvement in the management of wildlife areas, especially the Project Tiger areas. Section 38X of the Act provides for establishment of a Tiger Conservation Foundation for tiger reserves to facilitate and support their management for conservation of tiger and biodiversity and for eco-development. The Act enables the Tiger Conservation Foundation to solicit financial support required for management and development of the tiger reserves. The Foundation is also empowered to augment and mobilize financial resources including recycling of entry and such other fees received in a tiger reserve. In view of these enabling provisions of the Act, the Tiger Conservation Foundations of the tiger reserves of the state have been able to raise additional financial resources for management and development of the reserves. Many wildlife NGOs and other benevolent organizations have also been providing financial and material assistance to the Tiger Conservation Foundations and these have greatly benefitted the Project Tiger authorities to manage the tiger reserves more effectively.

6.17. With regard to funding for various activities within the state forestry sector, about 75% of the funds are invested in the forestry wing and the remaining 25% are invested in the wildlife wing. This is reasonable as the wildlife areas now constitute about 25% of the state's forest area. Investment into the wildlife wing is fairly uniform across all the areas as most of the funding goes into works of general nature such as habitat improvement, general protection, fire protection, etc. However, in the forestry wing, distribution of funds is not uniform across the areas, as the department's core activities have been plantation-centric. A large share of the funds goes to plantation related activities. The current level of planting in the state is about 70,000 hectares per year. Considering that the department normally looks after the plantations for about three years after their formation, every year the department provides funds for about 2.1 lakh hectares which represent roughly about 5% of the state's total forest area. It is estimated that about 70% of the funds allotted to the forestry wing are invested in these plantations through various plan and non-plan schemes. Thus, about 5% of the state's forest areas receive about 50% of the state's funding. This in other words implies that out of every Rs 100 spent on forest and wildlife, Rs 25/- goes to wildlife areas representing 25% of the state's forest area, Rs 50/- goes to the recent plantations representing about 5% of the state's forest area and the balance Rs 25/- goes to the remaining forest areas which represent about 70% of the state's forest area. This clearly shows that investment for general protection of forest areas other than the wildlife areas is quite low. While plantations understandably require higher investment due to intensive nature of work involving material and manpower, there is absolute need for much higher investment in the forest areas which need to be protected as intensively as the wildlife areas. It is also necessary to review various plantation models with respect to their cost effectiveness. It is felt that cost intensive plantation models such as assisted natural regeneration (ANR) and artificial regeneration (AR) should be replaced by low-cost eco-restoration models, which have very limited planting activities and larger components of protection and soil and moisture conservation (SMC) works. Such models along with cultural operations like tending of natural regeneration will help bring more forest areas under treatment within the limited budgetary allocation.

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AFFORESTATION UNDER EXTERNALLY AIDED PROJECTS

In the chapter entitled 'Evolution of forest policy, law and management practices after 1956' we have briefly indicated that since the beginning of the 1980s the nation had taken laudable strides towards tree planting and wasteland development. An ambitious social forestry program was launched during the decade 1980-1990 with the main objective of producing fuel wood, fodder, small timber and other products to meet the needs of rural communities by raising plantations on wastelands including community lands, degraded forests, other government waste lands, private marginal lands and agro-forestry. As the availability of internal financial resources for taking up these activities was limited both at the center and the states, a number of externally aided social forestry projects were launched in a number of states during this period. As a result of these initiatives there was marked progress in afforeststion of degraded forest and community lands. Karnataka was one among the states which embarked upon the social forestry program by availing external aid. As paucity of internal resources continued to affect the state forestry sector, the Forest department availed the benefit of external aid for implementing a number of forestry projects during the following decades.

World Bank aided Social Forestry Project (WBSFP).

7.2. Karnataka Social Forestry Project was aided by the World Bank and the Overseas Development Administration (ODA) of the United Kingdom. Duration of the project was for ten years from 1-4-1983 to 31-3-92 and the total outlay of the project was Rs 84.95 crore. Out of this amount, the World Bank/ODA provided Rs 80.93 crore and the balance amount of Rs 4.02 crore was provided by the State Government. The thrust of the project was on afforestation of farm lands and community lands. Degraded forest areas in the vicinity of human habitations were also included. Plantations were raised over an extent of 41,750 hectares of non-forest and degraded forest lands. In addition, 50.75 crores of seedlings were distributed to the public for planting in their own lands. The project helped to increase the supply of fuel wood, small timber, fodder, fruit, bamboo, etc. to the rural and semi-urban areas, and for cottage industries. Apart from making villagers tree conscious it had helped to create assets for the community and provide gainful employment to the rural people.

7.3. Farm forestry gained tremendous momentum through this project in the state, especially in districts like Kolar, Bangalore Urban, Bangalore Rural, Mandya and Tumkur. These districts later became, and continue to be even today, the principal

suppliers of pulpwood to paper and pulp industries generating large income in the rural economy. This is in addition to the 'lops and tops' which are provided by these plantations for local consumption as fuel wood. It is estimated that such lops and tops constitute about 25-30 per cent of the total biomass of the plantations.

7.4. Another notable benefit of the social forestry project was that it brought forest and trees nearer to human habitations. Availability of wood biomass in these areas indirectly reduced the biotic pressure on the traditional forest areas thereby affording them relatively better protection leading to improved natural regeneration.

7.5 . The social forestry project was by and large a department driven programme. Most of the plantations were raised and maintained by the Forest department. Majority of the seedlings required by the farmers were raised by the department in departmental nurseries, although decentralized or *Kissan* nurseries, where farmers took to raising seedlings in their lands to supply to the neighboring farmers, were also being encouraged. Although the social forestry programme had achieved reasonable success in terms of the physical targets of tree planting, it had attracted some adverse criticism as lacking in active and participatory involvement of the local communities. It was also being criticized for allegedly propagating a model of 'community woodlots' on traditional grazing lands with fast growing tree species, including eucalyptus.

Western Ghats Forestry and Environment Project (WGFEP).

7.6. The Western Ghats Forestry and Environment Project was an ODA (UK) aided project. It was launched during 1992 with a plan outlay of Rs 84.2 crore spread over a period of six years (1993-1999). The project was initially launched in the district of Uttara Kannada and then extended to two other districts of Shimoga and Chickmagalur. The objective of the project was to conserve the biodiversity of the forests of the Western Ghats region of Karnataka and to sustain and enhance livelihoods. The project envisaged attainment of sustainable development of the forests with people's participation. The strategy adopted for the protection and management of these forests was based on the principles of joint forest planning and management (JFPM) with the local people through village forest committees (VFC) on joint sharing of the benefits. The project provided for involvement of NGOs to motivate the people in joint forest planning and management and to liaise between the villagers and the Karnataka Forest department. The project aimed at shifting the focus of forest management from the traditional methods by 'controls and commands' to that of co-operation and participation of all the people who have a stake in the forests. Therefore, it was a project of a 'process change' aimed at institutional

strengthening within the Forest department to develop JFPM strategies with local communities.

7.7. The result of the project was by and large satisfactory. Most of the physical targets of the project had been achieved. The project led to formation of a number of village forest committees (VFC) and many of these committees remained active and vibrant in the post-project period. The project also helped in formation of a number of self help groups (SHG) which empowered and emboldened the women, even from among the marginalized sections of the society, to take up income-generating initiatives. A number of eco-development committees were established around some of the eco-tourism spots of the districts and these committees have been able to function effectively and sustainably.

7.8. An important outcome of the Western Ghats Forestry and Environment Project was increased interaction between the Forest department and local communities resulting in mutual understanding. It also led to better appreciation of the concept of people's participation in forest management amongst the field level functionaries of the department. Constant dialogue and interaction between the department and the facilitator NGOs helped in better appreciation of each other's point of view. Overall, it provided a platform for positive consultations among the department, local people and the NGOs.

Eastern Plains Forestry and Environment Project (EPFEP).

7.9. In 1997, Karnataka Forest department initiated a JBIC assisted project covering 138 taluks spread over 23 districts of the state in order to afforest the eastern plains, which are deficient in forest cover. The project in fact covered the entire state excluding the Western Ghats region. The objective of the project was to implement a sustainable, community-participatory afforestation project (planting trees, extension activities, and others) in the continuously degraded forest lands of the state by preventing further degradation of the forest lands, revitalizing the degraded forest lands, promoting conservation of the region's biodiversity, and improving forest productivity, and thereby contributing to improving the region's environment as well as reducing poverty. The project was initially proposed to be implemented over a period of five years starting from 1997-98 (actually from December. 1996). However, it had been given extension of three years up to 2004-05. The reason for extension of the project was the extended term of works due to execution of additional afforestation works in view of increased fund availability stemming from currency exchange fluctuations over the project period. Original project outlay was 18,786 billion Yen (Rs 598.28 crore), but the final project cost was 17,395 billion Yen

(Rs 627.7 crore). Under this project 2.00 lakh hectares of degraded forest land, Government waste land, institutional land and road sides had been planted against a target of 1.705 lakh hectares. Seedlings were provided to the farmers under the farm forestry component and 3.58 lakh hectares of farm land were brought under farm forestry as against a target of 3.0 lakh hectares. The overall achievement of the project in terms of tree planting both in public and private lands was 5.58 lakh hectares against the original target of 4.705 lakh hectares.

7.10. In addition to afforestation, which was a major component of the project constituting 67% of the project cost, the project also consisted of multiple components such as providing support in research, extension and training, and development of infrastructure and information system, etc.

7.11. The JBIC project has been successful in involving people in the protection and management of forest and about 3000 VFCs have been formed under the project. Afforestation activities were carried out with the involvement of the VFCs in about 1.6 lakh hectares of land comprising of degraded forest lands, government waste lands, village common lands and tank foreshore areas.

7.12. Independent external evaluation has rated the Eastern Plains Forestry and Environment Project as highly satisfactory. The average survival rate of the planted trees under the project was found to exceed 70%. Out of about 340 million trees planted under this project, it was estimated that 250 million trees had survived after four to six years. The evaluation report also refers to increase in biodiversity and improvement in forest productivity in the project area. As regards the components of the project other than afforeststion, the evaluation report has mentioned about improvement in the training facility/capability of the department in training and educating the staff members as well as VFC members. In terms of research and development, improved nursery technology including tree breeding has helped in increasing the productivity of several tree species and higher productivity in the future is expected. The facilities and equipment provided under the project have been effectively used contributing to the efficient operation of the project. The report has also mentioned about the positive impact of the project on poverty alleviation through a number of benefits: increased application of forest resources, reduced expenditure in obtaining fodder and fuel wood, diversified means of livelihood, improved living standards, notably in respect of food, clothing, shelter, education of children, reduced burden on women engaged in collecting firewood and feed, upgrading of livestock quality, increased income from farming and livestock rearing,

and reduced dependence on the forest. The evaluation report has also mentioned about the beneficial impact of the project on women and tribal people.

Karnataka Sustainable Forest Management and Biodiversity Conservation Project (KSFMBC).

7.13. As a sequel to the Eastern Plains Forestry and Environment Project, Karnataka Forest department initiated another forestry project namely, the Karnataka Sustainable Forest Management and Biodiversity Conservation Project (KSFMBC) with the financial assistance of Japan International Cooperation Agency (JICA). The objective of the project was to bring about ecological restoration and, at the same time, to facilitate livelihood improvement of the inhabitants of the project villages by afforestation through joint forest planning and management (JFPM). Thus the project had twin objectives of preservation of the biodiversity of the forest ecosystem and alleviating poverty among the inhabitants living in and around the ecosystem. The project had a total outlay of Rs 745.00 crore comprising of Rs 613.266 crore (82.32%) as reimbursable loan component from JICA and Rs 131.734 crore (17.68%) was to be contributed by the State Government as state share. The project was started during 2005-06 with a project period of eight years up to 2013-14. Unlike the earlier JBIC aided project which covered the eastern plains comprising of 138 taluks spread over 23 districts, the new project covered the entire state comprising of 176 taluks in 30 districts. It was a more comprehensive project in the sense that in addition to afforestation, farm forestry, soil and water conservation works, the project also covered conservation of biodiversity and improvement of the management of protected areas as an integral component of the project. For this purpose, apart from village forest committees, eco development committees (EDC) have been formed with a view to assisting in the protection of one national park and four wildlife sanctuaries.

7.14. For the purpose of better implementation, the project area has been divided into Project-A and Project-B areas. Project-A areas comprise of twelve districts receiving relatively higher rainfall such as Belgaum, Dharwad, Haveri, Uttara Kannada, Shimoga, Chikkamagalur, Kodagu, Dakshina Kannada, Udupi, Hassan, Mysore and Chamarajanagara. Plantation models on timber species and restoration of mangroves are provided in Project-A areas only. Project-B areas cover the remaining 18 districts which receive relatively less rainfall. The districts are: Bangalore Urban, Bangalore Rural, Ramanagar, Kolar, Chikkaballapur, Bellary, Chitradurga, Koppal, Davanagere, Bidar, Gulbarga, Yadgir, Raichur, Bagalkot, Bijapur, Gadag, Tumkur and Mandya.

7.15. The main activities of the project are Afforestation (Ecological restoration through natural regeneration, Plantation for timber production in Western Ghats area, Plantation for fuel wood and small timber, Non-timber forest produce (NTFP) plantation, School plantation and Mangrove plantation), Soil and Moisture Conservation measures, Farm forestry and Agro forestry on private lands, Joint forest planning and management (JFPM), Bio-diversity conservation and Habitat improvement in Protected Areas, Income generation activities (IGA) for poverty alleviation, Research, Training, providing basic infrastructural support for field works, GIS-MIS, etc.

7.16. Considering the importance of mangrove forests which provide a critical habitat for a diversity of marine and terrestrial flora and fauna, the project has included a component for restoration and conservation of the salt-tolerant foreshore ecosystems in coastal Karnataka. With a view to promoting ecological awareness among school children the project has also given importance to environmental education of children.

7.17. A number of initiatives were taken under the project to strengthen joint forest management. A facilitation network of NGOs was created to form and build capacities of VFCs and EDCs. The NGOs have also supported VFCs and EDCs in developing micro plans for their respective villages as well as strengthening income generation activities by Self Help Groups (SHG). The Karnataka Forest department developed a comprehensive system for assessment of the performance of VFCs/EDCs. A mechanism of reward and recognition of best performing VFCs/EDCs was instituted to generate enthusiasm and competition for improved performance by these institutions. The Forest department also appointed volunteers and motivators to support the VFCs and EDCs after the completion of the project.

7.18. Against the total provision for afforestation of 1,85,000 hectares the achievement was 1,87,085 hectares; Soil and Moisture Conservation works were carried over 1,83,161 hectares. Biodiversity conservation and habitat improvement works were carried out in five protected areas, namely, Bandipur national park, Sharavathi valley wildlife sanctuary, Shettihalli wildlife sanctuary, Ranebennur wildlife sanctuary and Daroji Bear sanctuary. Under participatory management, 1222 village forest committees (VFC), 73 eco development committees (EDC) and 6066 self help groups (SHG) had been constituted / identified under the project.

7.19. The four externally aided forestry projects mentioned above were implemented almost in succession and they spanned over a period of more than three decades since the mid 1980s. Each project, during its period of implementation, also

became the flagship programme of the department, as a large share of the budgetary support to the department was routed through these projects. By and large, these projects had yielded mixed results. They were successful in terms of achievement of the physical targets of tree plantation, biodiversity conservation, capacity building and infrastructure development. The livelihoods of the rural people residing in and around the project areas have been directly and indirectly benefitted by the projects and their living standards have improved. The projects have also been able to considerably increase the awareness of the people about environmental conservation in general and forest conservation in particular. The distance between the department and the people has also narrowed down considerably, thanks to JFPM which was a common element in all the last three projects. However, the projects do not appear to have given the desired results in the farm forestry sector. As we have seen, the projects had fairly large farm forestry components. Under the World Bank aided Social Forestry Project, 50.75 crores seedlings were distributed to the public for planting in their own land. However, private tree planting got a boost under this project only in a few districts around Bangalore. Under the Eastern Plains Forestry and Environment Project (EPFEP), 3.58 lakh hectares of farm land were brought under farm forestry. The Karnataka Sustainable Management and Biodiversity Conservation Project (KSFMBC) also had a fairly robust farm forestry component which included development of demonstration plots over 2,150 hectares of farm land besides distribution of seedlings (7.60 crores) and seeds (500 tonnes) to the farmers to take up tree planting. But commensurate increase in the forest and tree cover has not been noticed during the subsequent assessments.

7.20. Implementation of the externally aided projects has not been free from criticisms. Planting of trees in degraded open lands neighboring habitations has been resented by some as an attempt to encroach upon traditional grazing lands. The policy of the Forest department / State Government to restrict joint forest planning and management (JFPM) to only degraded forest areas with canopy density less than 0.25 is being criticized by those who favor management of forests of all density classes by the community. The JFPM programme has achieved its objectives only to limited extent. The degree of involvement of the village communities at all stages of forest management has not been considered satisfactory. It is also alleged that many of the project activities were KFD driven and the VFCs had nominal or no role to play.

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DEVELOPMENT OF PLANTATIONS

The history of tree planting is as old as the history of agriculture. People initially had taken to planting of fruit yielding trees as a source of food. Kautilya's Arthashastra (4th Century BCE) not only mentions about protection of forests and but also about various types of land-use including grove, plantation of fruit plants, etc. This clearly indicates that while natural forests satisfied certain requirements of the community, planted trees satisfied certain other needs. It is very unlikely that in ancient times trees were planted for timber or firewood, as the same was readily available in the nearby forests. However, planting of trees for fruits and flowers was a common practice. Planting of trees was encouraged and patronized by the rulers, especially in villages and along road-sides for providing shade, and in parks and gardens for recreational and aesthetic purposes. It is said that teak planting was prevalent during the time of Shivaji.

8.2. Tree planting as a forestry activity gained momentum in India in the nineteenth century in order to replenish the depleted stock of over-exploited natural forests. As teak was the most sought after timber, its over-exploitation had resulted in its depletion and need was felt to regenerate the species. As and when other timber species were brought to use, their restocking in the forest became necessary. Both natural and artificial regeneration methods were adopted depending on species as well as forest types. Since it was found easier to raise teak artificially, teak plantations were raised in many places all over British India since 1842. Induced natural regeneration by opening of canopy helped in the establishment of kiralbogi (*Hopea parviflora*) in Mangalore division of Madras presidency. In Kodagu state, the blanks created by selection felling in Ghat forests were made good by dibbling of seeds with fairly successful results. Large extents of dry deciduous forests were clear felled for timber and fuel wood and then regenerated under 'simple coppice' or 'coppice with standards' system.

8.3. Tree planting in the country was intensified after the Independence. In order to bridge the wide gap between the supply and demand of forest produce, large-scale plantations of both indigenous and exotic species were raised in almost all the states of the country. Plantations were raised either by reforestation or by afforestation: reforestation refers to replacing the low yielding forests and less valuable species by high yielding and more valuable species; afforestation refers to increasing and improving the tree cover on the barren and degraded lands. The extent of area planted under important species in the country up to the end of 1965 was 9,34,000 hectares comprising of teak (1,91,000 ha), other broad-leaved species (6,42,000 ha), Eucalyptus (80,000 ha) and conifers (21,000 ha).

8.4. As regards Karnataka, extensive areas of moist deciduous forests were reforested by clear felling and planting mainly with teak and to some extent with eucalyptus. The dry deciduous mixed forests were also similarly treated but planted mainly with eucalyptus. In the evergreen forests, the silvicultural system adopted was generally selection system followed by artificial planting in gaps with species like, *Machilus macarantha*, *Artocarpus* species, *Mangifera indica*, etc. The dry thorn forests were worked usually under coppice system and were taken up for reforestation with *Eucalyptus tereticornis*, also known as Mysore gum. Afforestation was taken up on highly degraded forests, denuded hills and rocky sites mainly with *Eucalyptus tereticornis*.

8.5. In Karnataka, plantation activities on forest lands were financed by state sector schemes introduced from time to time. These included, Development of Degraded Forests, Fuel/Fodder scheme, Special Component Plan, Tribal Sub-Plan, Bamboo and Cane Planting, Tending and Exploitation, Devarakadu, Clonal Orchards and Seed Farms, etc. A number of schemes such as Karnataka Forest Development Fund (KFDF)-Teak, KFDF-Matchwood and KFDF-Other Plantations (OP) were implemented since 1975-76 for forest development with funds sourced from Forest Development Tax (FDT) levied on the sale of forest produce. During the last three decades, a number of externally aided projects such as the Western Ghats Forestry and Environment Project (ODA), the Forestry and Environment Project for Eastern Plains (JBIC) and the Karnataka Sustainable Forest Management and Biodiversity Conservation Project (JICA) have supported plantation activities in forest areas. The World Bank aided Social Forestry Project, which was mainly for afforestation outside regular forest areas, had a few components for development of degraded forests. A number of centrally sponsored schemes (CSS) were initiated by the Government of India from time to time to assist the state governments in forest development. These were, Area Oriented Fuel and Fodder scheme, Conservation and Development of Non Timber Forest Produce including Medicinal Plants, Seed Development, Aerial Seeding, Integrated Development of Chamundi Watershed, Association of Scheduled Tribes and Rural Poor in Regeneration of Degraded Forests on Usufruct Sharing Basis, Integrated Wasteland Development Project, Integrated Afforestation and Eco-development Project for Territorial Divisions, Conservation and Management of Mangroves, Modern Fire Control Methods, Integrated Forest Protection Scheme (later named as Intensification of Forest Management), etc. Some of these CSS have since been abolished or transferred to the state sector. Some schemes with similar objectives were later rationalized and merged into one scheme. The National Afforestation Programme (NAP) is one such

scheme which is in currency. In addition to the state sector, externally aided and centrally sponsored schemes, a number of schemes/programs such as Drought Prone Area Program (DPAP), Jawahar Rojgar Yojana (JRY) and Integrated Development of Western Ghats Region (IDWGR) schemes had forestry components, and afforestation works were carried out for rehabilitation of degraded forest areas under these schemes. Since 2010-11, the department has been raising compensatory plantations with funds received from the Government of India under the Compensatory Afforestation Fund Management and Planning Authority (CAMPA). Until recently, the Forest department had been receiving grants from the Government of India for forestry development under the Thirteenth Finance Commission (TFC) and the National Bamboo Mission (NBM). The department receives some funds under the Green India Mission (GIM). The Forest department has also been carrying out extensive plantations on roadsides, urban areas and institutional lands through its territorial and social forestry wings under a number of state sector schemes.

8.6. Important schemes/programs for reforeststion/afforestation presently being implemented by the Forest department in forest areas, roadsides, urban areas and institutional lands are: Development of Degraded Forests, Greening of Urban Areas, Krishi Aranya Protsaha Yojana, Raising of Seedlings for Public Distribution, Cultivation of Sandalwood Plantations, Special Component Plan, Tribal Sub-Plan, A sapling for each child and a Vana for each school, Roadside Plantation, Samrudha Hasiru Grama Yojane, Village Forest Committees, Tree Parks, Development of Devarakadu (Daivi vanas), Maintenance of Medicinal Plant Conservation Areas (MPCAs) and Medicinal Plants Development Areas (MPDAs), KFDF-Other Plantations, the Compensatory Afforestation Fund Management and Planning Authority (CAMPA), National Afforestation Programme (NAP), Green India Mission (GIM), Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), etc.

8.7. During the 1950s and 1960s, increasing emphasis was given to planting on farm, village and common lands. The National Commission on Agriculture (1976) gave further impetus to social forestry by clearly defining the objectives of the program. During the Fifth Five Year Plan (1974-79), a centrally sponsored scheme, namely, 'Social Forestry/Rural Fuelwood Plantations' was initiated by the Government of India to assist the state governments in rural afforeststion. Similar assistance was also provided by the Government of India for social forestry plantations established under the National Rural Employment Program (NREP), the Minimum Needs Program (MNP) and the Drought Prone Areas Program (MNP). Since early 1980s, social forestry activities were further intensified in the state by

taking up afforestation on public lands like Gomal lands, tank foreshore areas, C & D lands, etc. Funding for these activities came from the World Bank aided Social Forestry Project, Soil Conservation (Afforestation) scheme, School Nurseries scheme, Tribal Sub-Plan scheme, Special Component Plan, Soil Conservation in the Catchment of River Valley Projects (CSS), Roadside plantations, Integrated Wasteland Development Project (CSS), DPAP, JRY, etc. These schemes/programs were implemented by the Social Forestry wing of the Forest department. A few components of afforestation pertaining to the externally aided projects of the Forest department were also implemented by the Social Forestry wing. During the period 2007-08 to 2014-15, social forestry works were undertaken in some of the backward talukas of the state under the Special Development Plan (SDP) which was launched as per the recommendations of the Dr. D. M. Nanjundappa Committee Report for Redressal of Regional Imbalances in Karnataka. Since 2011-12, the Social Forestry wing has been carrying out block plantations on non-forest lands and roadside plantations with funds received under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNRES).

8.8. With regard to the species used for planting in Karnataka, initially the choice was limited to very few species. Teak was the main species for planting in the moist deciduous forests. The method of stump planting of teak had been standardized and it had given very good result especially in well-drained areas. The practice of planting other hardwood species was then not in vogue. Planting in the evergreen and semi-evergreen forests, which were worked under selection felling system, was limited to sowing of seeds or planting of seedlings of the indigenous species. The technique of raising container seedlings had not yet developed and bare seedlings with exposed roots did not do well in the field. Planting of softwood species in clear felled areas had not been successful except for the plantations of halmaddi (*Ailanthus malabarica*) and a few plantations of balanji (*Acrocarpus fraxinifolius*), mostly in Dakshin Kannada district and parts of Kodagu and Uttara Kannada district. *Casuarina eqisetifolia* was planted successfully in the coastal areas as well as around Bangalore as a fuel wood species. Eucalyptus gained popularity in the dry deciduous and thorn forests. It also became the main species for planting in the barren and wastelands outside forest areas. Initially bare eucalyptus seedlings were planted. Poly-bagged seedlings came to be in use in the 1970s with better results. During the late 1970s, *Acacia auriculiformis* was introduced in the moderate to heavy rainfall zone to afforest the grassy blanks, open and degraded forest areas, lateritic areas, etc. This gave fairly good result. It also proved to be a good source of fuel wood, pulpwood as well as timber. During the 1980s and onwards, the practice of raising most of the

native species in poly-bags of different sizes came to be in vogue. This not only helped in diversifying the species-mix in the plantations but also improved the survival-rate of the plantations. The department now raises tall and healthy poly-bagged seedlings of most of the indigenous species in the departmental nurseries. The technique of raising high quality seedlings in high-density poly-bags of bigger size for roadside and urban plantations has also been standardized.

8.9. As regards the performance of various plantation species, it is proposed to discuss teak, eucalyptus, *Acacia auriculiformis*, sandal and kamara (*Hardwickia binata*) separately in the following chapters wherein matters relating to management of the plantations will also be taken up in more detail. The performance of bamboo, an important crop of the forests of Karnataka, will also be discussed separately. In the following paragraphs, it is proposed to review the overall performance of the plantations developed by the Forest department in the recent past. For this purpose, the plantations are grouped into three broad categories. The categories are: (a) Roadside and Urban plantations, (b) Tree Park and Daivivana, and (c) Block plantations of mixed species.

ROAD SIDE PLANTATIONS AND URBAN PLANTATIONS

8.10. Raising of plantations on roadside and urban areas is not a new concept in Karnataka. Old Mysore state had excellent roadside plantations along most of the roads since a very long time. It is reported that during the 1870s, out of 3,766 miles of roads in the province, 3,575 miles were planted up with trees at distances varying from 12 to 60 feet. Remnants of the old trees are visible in some stretches of roads even today. Species such as bevu (*Azadirachta indica*), hunse (*Tamarindus indica*), ala, arali, goni (*Ficus* species), neralu (*Syzygium* species), hippe (*Madhuca* species), mango (*Mangifera indica*), etc. were some commonly planted roadside trees. Until the 1990s, there used to be some excellent stretches of road-side plantations between Birur and Shimoga along the Bangalore-Honnavar Road (BH Road) with tamarind as the main species and sprinkling of ficus and nerale. There were some beautiful avenue trees with saldhupa (*Vateria indica*) in the *malnad* taluks of Tirthahalli, Hosanagara, Sagar, Soraba, etc.

8.11. As regards urban area plantations, Lalbagh and Cubbon Park in Bangalore are two excellent examples from the past. Lalbagh Botanical Gardens were originally laid out during 1760 by Hyder Ali, the ruler of Mysore and further developed during the reign of his son Tippu Sultan. The Garden was originally 45 acres in extent and was progressively expanded and developed by the British administrators. It now occupies an area of about 240 acres. It houses over 1000 species of flora. The garden

has a number of trees which are over 100 years old. Cubbon Park, lung area of Bangalore city, was originally created in 1870 covering an area of 100 acres. Subsequently it was expanded to 300 acres. It was first named as Meade's Park after Sir John Meade, acting Commissioner of Mysore in 1870 and subsequently renamed as Cubbon Park after Sir Mark Cubbon, the longest serving Commissioner of Mysore. The Park is a mosaic of natural rocky outcrops with thickets of trees, bamboo groves, grassy expanses and flower beds and is dotted with monuments. Interspersed with a number of motorable roads and walking tracks, the predominantly green area of the park is a great attraction to morning walkers and nature lovers.

8.12. Raising of roadside and urban area plantations has become a very important component of the afforestation initiatives of the Forest department. This is more so in the *maidan* areas of the State, where it has become the most important and visible activity of the department. Being located on roadsides or near habitations, these plantations always attract the attention of the general public. As a result, public perception of the department to a large extent is formed by the quality of these plantations. These plantations in fact have become the face of the Forest department in the public eye.

8.13. Roadside plantations and urban area plantations constitute a plantation model which is different from other plantation models of the Forest department because of certain distinct features. These are: (a) both categories of plantations are generally raised outside forest area; (b) each planted seedling requires individual attention, protection and after-care; (c) seedlings of exceptionally high quality must be planted; (d) the success of the plantation depends upon the interest, assistance and co-operation of the neighboring individuals /community/ institutions, etc.

8.14. The roadside plantations of the state are being raised under a number of schemes such as Roadside Plantation (RSP), Rural Road Programme (RRP), Special Component Plan (SCP) – Roadside Plantation, Tribal Sub-plan (TSP) – Roadside Plantation, Afforestation in other areas (AIOA), Karnataka State Highway Improvement Project (KSHIP), Social Forestry (SF), Special Development Plan (SDP), etc. The urban area plantations have mostly been raised under the scheme Greening in Urban Areas (GUA). Some plantations have also been raised with funds received from the Karnataka Industrial Area Development Board (KIADB).

8.15. The performance of the roadside and urban area plantations in Karnataka in the recent years has been fairly encouraging. It has been observed that the need to plant tall and healthy seedlings for raising successful roadside and urban area

plantations has caught the attention of the forestry staff throughout the state. Nursery techniques for raising such seedlings have been standardized. Selection of species for the purpose of raising roadside and urban area plantations has also become near perfect. There are about 30-35 species which are being used in various combinations across the state depending upon the agro-climatic conditions of the area of planting. Commonly used species for roadside plantations are bevu or neem (*Azadirachta indica*), mango (*Mangifera indica*), halasu (*Artocarpus heterophyllus*), arali (*Ficus religiosa*), aala (*Ficus benghalensis*), holematthi or thorematthi (*Terminalia arjuna*), hippe (*Madhuca latifolia*), mahagony (*Swietenia macrophylla*), holedasawala (*Lagerstroemia speciosa*), saldhupa (*Vateria indica*), kaidhupa (*Canarium strictum),* gone (*Ficus mysorensis*), honge (*Pongamia pinnata*), hunase (*Tamarindus indica),* sampige *(Michelia champaca),* ranjal or bakula *(Mimussops elangi),* hebbalsu (*Artocarpus hirsutus),* kadamba or apathe (*Anthocephalus chinensis*), hebbevu (*Melia dubia),* nerale (*Syzygium* species), kadubadam (*Terminalia catappa*), bugari (*Thespesia populnea*), tapasi (*Holoptelea integrifolia*), sissoo (*Dalbergia sissoo*), kakke (*Cassia fistula),* raintree (*Samanea saman*), peltophorum (*Peltophorum pterocarpum*), spathodea (*Spathodea campanulata*), gulmohar or Mayflower (*Delonix regia*), basavanapada (*Bauhinia purpurea),* shivani (*Gmelina arborea),* aakasha mallige (*Millingtonia hortensis*), tabebuias (*Tabebuia argentea, Tabebuia rosea*), etc. For Urban area plantations, depending upon the extent of the plantation, species among the above are chosen, importance being given to flowering species and which attain medium heights. In the recent years, most of the roadside and urban area plantations have been able to register very good average height growth of about 2 m in one year and up to 3 m to 4 m in 2/3 years.

8.16. However, the main cause of concern in respect of roadside and urban area plantations is the survival rates of the plantations. The average survival rates of the roadside and urban area plantations after one year of planting vary between about 70% and 90%. However after three/four years of planting the average survival rates drop down to about 60% to 80%. This decline in survival rates is attributed to mortality of seedlings during the initial growing period of two-three years. The mortality of some of the planted seedlings is attributed to a number of factors:

(a) Lack of adequate protection and maintenance in the second and third year of planting leads to mortality despite success during the first year of planting. This shortcoming is common in some of the plantations raised under Social Forestry schemes where funding during the subsequent years is either not available or inadequate or not available on time.

(b) Plantations on roadsides often get damaged due to widening of roads occasionally resulting in removal of almost all the seedlings/ saplings/ trees.

(c) Plantations on roadsides of urban areas like new layouts get damaged during formation of side storm-water drains, asphalting/widening of roads, excavation of the ground for laying pipes for drinking water or for carrying sewerage, laying of overhead or underground electrical or telephone cables, etc. In a number of cases of urban planting, it has been noticed that planted seedlings/saplings in institutional lands have been damaged at the time of construction of new compound wall.

(d) In rural areas sometimes farmers extend their farming activities almost to the edge of the roads. Such farming activities have resulted in damage or death of the seedlings.

(e) Roadside plantations, especially in rural areas and near habitations like villages or hamlets, are often damaged by stray cattle roaming around in search of fodder. Cattle also cause damage to grown up saplings or small trees by scratching their bodies against the trunks.

(f) At times the tree-guards or other protective measures provided to protect seedling/sapling from being browsed become ineffective. In urban areas, it is common to see untreated wooden tree-guards decaying at the base and thereafter falling or slanting on one side forcing the sapling also to slant. This results in physical damage to the sapling leading to deformity. The plant also becomes easy victim of browsing.

(g) Success of a roadside or urban area plantation depends very much on the interest and co-operation of the neighboring individuals or community or institutions. It is very much necessary to have a dialogue or discussion with such neighbors before starting planting so that their co-operation and assistance can be enlisted for maintenance of the plantations. Lack of such dialogue or discussion beforehand may result in indifferent result or even failure of such plantation.

8.17. In order to reduce the mortality of seedlings and to further improve upon the survival rates of the roadside and urban area plantations it is recommended that the following steps are taken by the staff of the Forest Department:

(a) While planting trees on roadsides, especially in rural areas where roads normally abut agricultural lands, the neighboring farmers should invariably be consulted regarding species proposed to be planted and other aspects of planting. The benefits that may accrue from such planting, minimum care that may be expected from the farmers for their maintenance, etc. may be explained in detail to the farmers. Suggestions of the farmers, including that of species to be planted, may be kept in mind. Species yielding edible and non-edible fruits/seeds such as hunase, nerale, mango, bevu, honge, etc may be suggested. Species like aala, arali, goni, basari, etc. are also very popular in the rural areas.

(b) Introduction of Tree patta scheme at the initial stage of the plantation may go a long way in ensuring support of the adjoining farmers in protecting and nurturing the plants. This innovative scheme was conceived by the state government in order to consolidate on the gains of the JFPM process. The modalities of the scheme have been spelt out in a state government order dated 19-06-2002. The scheme provides for protection of trees planted on roadsides, canal banks and other similar areas by the farmers or land holders residing adjacent to such plantations and provides for sharing of produce between the beneficiaries and the government. The beneficiaries are entitled to 100% usufructs provided they protect the trees. The final harvest will be shared in the ratio 75:25 between the beneficiaries and the government. A nominal rent of Rs 10/- per tree and Rs 5/- per tree will be charged from the tree patta holder for slow growing species and fast growing species respectively.

(c) Similar consultations are also required with the neighboring community and institutions in respect of urban area plantations. The state government order dated 19-06-2002 provides for sharing of the benefits of forest produce from trees raised on lands belonging to institutions, communities and government

departments. Such plantations can be raised by the Forest department besides maintaining for three years. As per the government order, the usufructs shall wholly belong to the institution / community / department. The net income arising from the final harvest of trees raised under this scheme will be shared in the ratio 50:50 between the Forest department and the concerned institution / community / department.

(d) It is very necessary to continue with protection and maintenance of the plantations during the second and third year. Although this is part and parcel of the package of practices and should be scrupulously followed, at times it is not attended to on top priority because of pressure of work of the field staff in current year plantations. As the best seedlings of the nurseries are likely to be sent to the current year plantations, seedlings used for casualty replacement in the second year plantations may not be the best; even the time of planting may be late. It is advisable to take up casualty replacement of second year plantations with equally good seedlings and simultaneously with current year plantation.

(e) Social forestry plantations tend to suffer from chronic shortage of funds and it adversely affects maintenance of the 2nd and 3rd year plantations. It should be ensured that available funds are first earmarked for maintenance of older plantations and only after that the balance funds should be provided for new plantations. Simple activity like tying branches of Bellary Jali (*Prosopis juliflora*) or fronds of prickly palm known as Ichala (*Phoenix sylvestris*) around the saplings of the 2nd and 3rd year plantations may help in a big way in reducing the mortality of the planted trees.

(f) Watering is a very important activity in a Roadside or Urban plantation especially in the dry regions. Watering should be continued during the second and third years also. Watering should be intensive rather than frequent. Watering for seven to eight times in one dry season should give good result to boost growth and reduce mortality.

(g) The species cherry, also known as Singapore cherry (*Mutingia calabura*), has been planted in a number of places under the urban

greening programme. This is a fast growing plant and is quite handsome in the initial stages of growth. The tree attracts lots of birds and Bats because of the fruits which are also edible to human beings. However, the tree becomes crooked and also brittle after about ten-twelve years when perhaps it should be replaced by another plant.

TREE PARK AND DAIVIVANA

8.18. The schemes Tree Park and Daivivana were launched in the state during 2011-12. High quality plants of assorted species were proposed to be planted under these schemes in areas closer to towns (in case of Tree Park) and closer to places of worship (in case of Daivivana). Both the schemes envisage very good protection to the plantations by providing chain link fence or stone/brick wall so that the planted seedlings would get maximum protection from biotic interferences. The idea behind launching these schemes was to bring people closer to trees. A well maintained tree park will naturally attract people from the nearby town for recreation and they can enjoy the beauty of a forest near their homes. Similarly a Daivivana established by the side of a place of worship will attract the devotees visiting the place of worship and they can spend some time enjoying the beauty of Mother Nature. There are many species of trees which are associated with various Gods and Goddesses. It is a matter of coincidence, or may be a matter of ancient wisdom, that most of such species have ecological or economic value; many such species are also known to have medicinal properties. Ideally a Daivivana or a Tree Park should be like a simple arboretum of the tree species which are found in the nearby forest so that the people visiting such a place may appreciate the beauty of a grove of trees in the same way as they enjoy visiting a zoological garden which showcases animals.

8.19. The concept of Tree Park / Daivivana is a noble one, as it provides an opportunity to the people, especially from urban areas, to be closer to nature. The state government has an ambitious plan of having at least one Tree Park in the vicinity of every town or taluk headquarters. The scheme also enables the Forest department to protect precious forest lands adjacent to habitations from the clutches of encroachers and land grabbers. The department has already raised a number of plantations under the Tree Park and Daivivana schemes across the state. Because of providing secure barricade and planting of high quality seedlings, these plantations have performed well, similar to the roadside or urban area plantations. As these plantations are frequently visited by the public, the maintenance staff takes additional care to maintain the plantations.

8.20. The Forest department had during 2014-15 carried out an internal evaluation of performance of various plantations in the state. In respect of Tree Parks and Daivivanas, twenty-seven plantations (five Tree Parks and twenty-two Daivivanas) raised during the period 2011-12 to 2013-14 had been selected randomly for this purpose. Among these, 11 plantations were raised during 2011-12, 13 plantations were raised during 2012-13 and three plantations were raised during 2013-14. These plantations were mostly raised in districts having relatively less forest area. The evaluation report reveals that 20 plantations have survival rates above 75% and the remaining seven plantations have survival rates below 75%. As regards the 20 Daivivanas and Tree Parks which have registered survival rates above 75%, these have also registered good height growth. Two Daivivanas and a Tree Park of Ramanagara division, one Daivivana and one Tree Park of Mysore division and two Daivivanas of Haveri division are reported to have done exceedingly well. The future prospects of all these plantations are very good provided these are maintained with equal zeal and interest. These assets need to be looked after in a continuous basis like any recreation park.

8.21. One of the shortcomings of the Daivivanas and Tree Parks developed so far is the limited diversity of species introduced. The internal evaluation has revealed that only about ten to fifteen species, which are planted by the Department in regular plantations, are also planted in these special plantations. It is true that in some of these plantations, because of special interest of the concerned staff, a few additional species have been introduced. What is however required is a conscious and concerted effort at increasing the species diversity to a reasonable level. Although these plantations are not meant to be full-fledged arboretums, continuous attempts must be made to increase the number of species to a level that more or less represents the species diversity of the nearby forest areas. Introducing more and more species should be a part of regular maintenance of these plantations.

8.22. By and large, a Tree Park or a Daivivana should retain or recreate a sylvan surrounding. Attempt to change the landscape of the terrain should be minimum and, after development, it should give a natural appearance. It should look more like a natural forest than a horticultural garden. Creation of too many artificial structures should be avoided. The facilities provided for visitors' comfort should be adequate. All artificial structures should be simple and aesthetic, and these should merge with the natural surrounding. Overall, the park should be so developed that its recurring cost of maintenance is kept within reasonable limits. It is also necessary to ensure that there is a foolproof arrangement for maintenance of the Park for the coming years. As the department moves from one Tree Park to another, the older Parks should

continue to get undivided attention from the department so that they remain cynosure of the town and nearby villages enthralling the nature loving people for a long time.

BLOCK PLANTATIONS OF MIXED SPECIES

8.23. Block plantations of mixed species constitute the largest segment of plantations raised by the Forest department in a forest division / range. As a matter of fact, Tree Parks and Daivivanas also belong to this segment but these have been discussed separately in view of special attention required by them. The earlier practice of raising monoculture plantations in forest with species such as teak, eucalyptus, casuarina, acacia, etc. has been virtually given up. Even in fuel wood plantations where there is preponderance of one species, some of the native species are encouraged by planting, sowing, coppice regeneration and tending of existing saplings or seedlings. The block plantations are raised with funds sourced from various schemes of the department mentioned earlier. KFDF, CAMPA, NAP, MGNREGS, DDF, etc. are some of the major schemes presently under implementation in the state. The Thirteenth Finance Commission (TFC) was also an important source of funding till 2014-15.

8.24. In an internal evaluation of performance of various plantations (raised during the period 2011-12 to 2013-14) conducted by the Forest department during 2014-15, it has been revealed that the plantations raised in the *malnad* region have generally fared better in terms of survival and growth rate compared to the plantations raised in the *maidan* areas. Within the *malnad* area, performance of plantations of Kodagu, Mysore and Chamarajanagar circles was not very satisfactory. The evaluation report has pointed out that "One of the main reasons for the circles in the *malnad* region showing relatively better performance is more favorable rainfall and soil conditions which are conducive to growth of plants. Preponderance of *Acacia auriculiformis* has also raised the average survival rates of the plantations in these circles by a few points. On the other hand, the harsh agro-climatic conditions of north Karnataka, Hyderabad Karnataka and, to some extent, south interior Karnataka regions, have affected the survival rates of the plantations of the circles in these regions. The plantations of Mysore, Chamarajanagar and Kodagu circles have multiple problems such as wildlife damage, *Lantana* infestation and root competition from old Eucalyptus trees". The evaluation report has however pointed out that there are examples of excellent, very good, good and some poor performances across the state irrespective of the limitations imposed by rainfall and soil conditions.

8.25. There are a number of important criteria which determine the performance of a block plantation: (a) choice of species, (b) planting density (number of seedlings per hectare), (c) pre-planting operations (pitting/trenching/ripping/fencing), (d) quality of seedlings and (f) soil and moisture conservation (SMC) works. Decision on each criterion is taken on the basis of various parameters relating to the plantation area such as rainfall pattern, soil conditions, terrain, light conditions, stocking of existing crop, status of natural regeneration, prevailing biotic interference, etc. The field level forestry personnel including the Range Forest Officer (RFO) and the Assistant Conservator of Forests (ACF) should critically examine these parameters and, after consulting with the Deputy Conservator of Forests, decide on the pre-planting operations, planting density, choice of species, SMC works, etc. The Deputy Conservator of Forests (DCF) should also make it a point to visit the proposed site and satisfy himself about the plantation program before approving it.

8.26. As regards choice of species, the basic principle should be to follow the nature. If the plantation site is located in a forest area with good soil, the species growing in the area or in its vicinity should be considered on priority, as they are likely to perform better. Among the local species, choice should be made depending upon the hardiness of the species, response of the species to light conditions (light-demander / shade bearer / shade-tolerant), utility of the species (economic/ecological/local or other needs), etc. However, while taking up plantation in a degraded area, other indigenous species which are known to have responded well to such degraded conditions should also be considered. In highly degraded areas and refractory sites, planting of only indigenous species will not be enough. In such cases, in addition to a few hardy indigenous species, certain proven exotics or non-traditional tree species will have to be introduced with a view to clothing the area at the earliest and preventing further degradation. The choice of such species will depend on rainfall, soil type, etc. In degraded areas with high rainfall, indigenous species such as mango, saldhupa, garcinia, cashew, nelli, nerale, antawala etc. can be planted with *Acacia auriculiformis* filling the lateritic and the most degraded portions. In degraded areas with moderate rainfall, species like teak, mango, nelli, honge, nerale, tapasi, etc. should be planted and the much degraded portions may be planted with *Acacia auriculiformis*, *Cassia siamea*, etc. In degraded areas with scanty or less rainfall, native species such as bevu, kamara, tapasi, ficus, bage, etc. are ideal with *Gliricidia*, *Cassia siamea*, etc. being planted in the most degraded parts.

8.27. Planting density i.e. the number of plants to be planted per unit area is an important criterion that should be decided before taking up planting in a block plantation. Earlier, planting density of about 2500 seedlings per hectare

(corresponding to espacement of 2 m by 2 m) was adopted in most of the pure plantations of teak, casuarina and eucalyptus. This high planting density was desirable given that the objective was to get straight boled timber (in case of teak) and straight poles (in case of casuarina and eucalyptus). As the plants grow, there is stiff competition among the individual trees for light, water and nutrition. In case of teak, the plant density is progressively reduced by successive thinning operations so that competition for light, water and nutrition among the retained plants is regulated. In case of casuarina and eucalyptus, the trees are harvested in 8/9 years, before such a competition sets in and a new crop is introduced either by replanting (in case of casuarina) or by coppice regeneration (in case of eucalyptus). When *Acacia auriculiformis* was introduced in the late 1970s and early 1980s, planting density of 2500 seedlings per hectare was adopted in the beginning. However, unlike casuarina or eucalyptus, *Acacia auriculiformis* does not grow with a straight bole and it forms side branches at an early age. The branches of the tree carry a significant portion of its biomass. The planting density of 2500 seedlings per hectare was found to be crippling in view of the tendency of the species to spread laterally. Subsequently, the planting density was reduced to about 1100 seedlings per hectare (corresponding to espacement of 3 m by 3 m) and this gave encouraging results. However, even a planting density of 1100 seedlings per hectare is quite high if the trees are to be retained for say more than 8/9 years. In case of *Acacia auriculiformis* plantations, this problem is addressed by removing suppressed and branchy trees by partial thinning and trees with relatively better bole are retained to grow further to yield timber. The thinned material is used as fuel wood, pulpwood and small timber.

8.28. In case of a block plantation with indigenous species, where intermediate thinning/felling is not envisaged, planting density of 1100 plants per hectare is on the higher side, as there will be intense competition among the trees in about 10 years, and many of the planted trees would be suppressed rendering them redundant and without any future growth. Planting density of about 600 plants per hectare (corresponding to espacement of about 4 m by 4 m) is considered ideal for such plantations. By reducing the planting density, seedlings of better quality can be planted within the same cost per hectare. There will also be an overall reduction in the plantation cost. In other words, the focus should be more on quality of seedlings rather than on their numbers. With this approach, seedlings as good as the ones used in roadside plantations can be used in block plantations with splendid results. Planting density should be further reduced depending upon the presence of natural regeneration in the area. The existing natural regeneration, including coppice regeneration, competes with the planted seedlings for space above and below the

ground. This competition becomes stiffer in enrichment plantation model or assisted natural regeneration model due to the presence of grown up trees in the plantation area. In such situations, the planting density may have to be brought down to as low as 100 per hectare.

8.29. In a normal forest, the total number of trees per hectare is high. In such a forest, there is a distinct pattern in the distribution of trees of different age classes; the number of trees with the highest age class (or diameter class) is the least and the number of trees with the lowest age class (seedling stage) is the highest. The number of trees progressively decreases as the age class increases. The presence of trees of difference age classes makes it possible to accommodate more number of trees per unit area. In such a scenario, trees of different age classes occupy different spaces both above and below the ground and a state of dynamic equilibrium is achieved with optimum utilization of available resources (light, water and nutrition). The number of trees per unit area in such a normal forest depends upon factors such as rainfall, soil, drainage, etc. The number is high in the evergreen forests and comes down as we move to drier forest areas such as semi-evergreen, moist deciduous, dry deciduous, dry thorn forests, etc. in that sequence.

8.30. It is precisely because of the above nature of a normal forest that it is not desirable to plant too many seedlings in a block plantation, unless interventions such as periodical thinning are contemplated during the progress of the plantation. As all the seedlings planted in a block plantation are even-aged, there will be tremendous pressure on available resources as the plants grow. This results in suppression of many planted seedlings within a few years of planting. The best way to avoid such a situation is to plant relatively less number of plants so that all of them can grow unhindered. As already mentioned, this is not only cost effective but also enables planting of seedlings of better quality within limited budget. It is also necessary to ensure that the number of seedlings planted per unit area is kept lower in drier areas to avoid moisture stress during the dry summer season. As regards transformation of a block plantation into a normal forest, which is the ultimate aim of taking up such plantation with mixed species, it is likely to happen naturally over a long period of time through natural regeneration, although interventions such as sowing of seeds of indigenous species will hasten the process. It goes without saying that such a transformation is possible only when the plantation is adequately protected from all forms of biotic interferences including fire.

8.31. As regards pre planting operations in the plantation area, the method of pitting is quite common in forest areas receiving moderate to high rainfall and having

soil with good depth. This method also enables avoiding the existing naturally growing seedlings and coppice shoots. In forest areas with poor soil, the method of trenching along contour lines is practiced to raise trench-mound plantations, mostly in areas receiving moderate to light rainfall. These areas generally do not have much natural regeneration and therefore trenching causes minimum damage. It is also a common practice to sow seeds of native species on the mounds. In the dry and refractory areas of the state, preparing the soil before planting is a very important task. The use of mechanical devices for digging/ripping the soil for formation of pits and trenches has become quite common. Such mechanical methods help in piercing or ripping the ground to better depths thereby loosening the soil more effectively. It also helps in conserving whatever precipitation is received in the rain-deficient areas. Ripping and planting has also been carried out in the relatively less undulating grassy blank areas of the Western Ghats with very good result. In such areas, ripping has to be done precisely along the contour and formation of mounds and septa has to be done very meticulously. These mounds and septa are very effective in harnessing the precipitation from the pre-monsoon, post-monsoon and unseasonal rains.

8.32. Quality of seedlings to a great extent determines the success of a plantation. It is necessary that adequate numbers of seedlings of the chosen species are raised in the nurseries sufficiently in advance. Standard package of practices prescribed for nurseries should be followed for raising seedlings. Seedlings should be sufficiently hardened by regulating watering, frequent shifting and spacing (letting the seedlings stand alone). Height of the seedling is important, but more important is the woody development at the base of the seedling.

8.33. Soil and moisture conservation (SMC) works now constitute an integral part of a block plantation. Such works play very significant role especially in the dry and rain deficit areas by conserving most of the precipitation received. SMC works definitely help in ground water recharge thereby rejuvenating the surrounding vegetation. However, excavation of very large and deep trenches and ponds/tanks with the help of machines is not desirable and should be avoided. The percolation trenches/ponds should be of reasonable dimensions and should be distributed evenly in the entire plantation so that the benefits of SMC works are shared equally in the entire treatment area. However, intensive SMC works in the high forest areas by digging trenches, pits of very large dimensions (mostly with machines) for formation of percolation trenches/ponds, nala bunds, tanks, etc. must be avoided. In these forest areas, the eco-system comprising of trees, saplings, bushes, shrubs, weeds, grasses, leaf-litter and humus provides a very effective cushion for conserving rain water. Here, soil is generally stable unless disturbed by human activity. Digging large

trenches and pits in such areas renders the soil extremely vulnerable to erosion. Besides, such digging and cutting of the ground causes a lot of damage to the existing tree growth and other vegetation. What are recommended for these areas are moderate SMC activities/structures to trap the late monsoon showers, unseasonal rains and pre-monsoon showers. Such SMC activities/structures should be less intensive and more extensive and well spread out. It is also advisable to avoid use of machines for such low intensity SMC works which can be more skillfully executed manually. The tendency to go for large tanks/ponds must be curbed; while it is easy to dig big tanks or ponds, it is difficult to ensure storage of water in such tanks/ponds, especially during the dry season. Staggered contour trenches of moderate dimensions can be considered in over-exposed and degraded open areas. Gully checks with locally available material may be erected across stream and nala beds.

8.34. In the *malnad* region, block plantations are raised under the assisted natural regeneration (ANR) model. Such plantations are recommended in forest areas where tree stocking is less than normal and where natural regeneration is not satisfactory. Normally, planting under the ANR model is prescribed for a forest area after it has been worked under salvaging working circle (i.e. after removal of the dead and fallen trees). It is also recommended for areas which had been logged in the past and have not recouped thereafter, requiring enrichment planting in the gaps. However, proper selection of area for plantation under ANR model is very important. A forest area having good natural regeneration must not be selected for this purpose. For a planted seedling to survive and grow there must be adequate sunlight and it must also be free from intense root competition. Well wooded areas, semi-evergreen and evergreen forests, where there is competition among the naturally growing trees, must be excluded for plantation.

8.35. While deciding on the sites for taking up planting under the ANR model, the status of natural regeneration should be thoroughly studied. It must also be kept in mind that in many cases good natural regeneration appears only after closure of the area and after the area gets the benefit of the package of plantation activities such as planting, weeding, soil working, soil and moisture conservation works, fire protection works, etc. It is therefore suggested that in case of deciduous forest, the area proposed for planting is inspected during the months of September-October to have an assessment of the regeneration status and light conditions (canopy cover). It is also suggested that if the area proposed for planting is part of a logging (salvaging) working circle of the Working Plan in currency, it should be considered for planting only after removal of the timber as prescribed in the Plan. It will ensure that the area is not interfered with for about ten years after planting. Once it is decided to take up an

area for planting, care should be taken to list out the species most likely to do well in the area. Hardy species such as teak, kindal, matthi, nandi, hadaga, sissum (beete), tare, heddi, kalam, etc. should be given preference. It is better to restrict the number of seedlings to about 100 per ha and that too in the larger gaps within the forest area. The focus should be on the species to be planted, on the quality of seedlings and not on the number of seedlings. Under no circumstances should planting be done under shade. Planting should be invariably done with indigenous species. Planting with fast growing species in the core of the high forest areas should be scrupulously avoided. While planting in forest areas which have been evicted from encroachment or which are under threat of encroachment, fast growing species may be planted. Such planting should be restricted to the peripheral portions of the forest adjoining to habitations.

8.36. Raising of plantation in the semi-evergreen and evergreen forests in any part of the State should be restricted / regulated; thick, contiguous and unbroken forests in the evergreen and semi-evergreen zones should not be taken up for planting. However, portions of these forests in parts of coastal Karnataka as well as in parts of upper *malnad* areas, especially nearer to habitations, have degraded considerably because of severe biotic interferences. These areas need to be enriched preferably with indigenous species. Here also planting should be done only in the gaps and the number of seedlings should be limited to 100 per hectare. Local species such as mango, hebbalsu, antawala, halasu, kiralbogi, dhupa, saldhupa, kaidhupa, gulmavu, garcinia, bharanige, etc. should be preferred in the plantations. The use of *Acacia auriculiformis* in these areas should be limited to the outer periphery and very degraded portions of the forests.

8.37. *Acacia auriculiformis* plantations have given good results in the lateritic, degraded and open coastal areas where native species find it hard to survive due to harsh conditions such as poor soil and very dry condition during the summer months. Cashew has done well in certain portions of the coastal districts. Both these species need to be continued although some of the hardy indigenous species such as nelli, antawala, garcinia, khair, mango, saldhupa, etc. should also be tried in areas where soil profile is better. It will be a worthwhile experiment to encourage the existing native plants or to introduce a few native species in these plantations by manipulating the acacia plants; the acacias may serve as a nurse crop and provide an opportunity to improve the biodiversity of the area.

8.38. In the open degraded lands of Sirsi, Siddapur, Sagar, Hosanagar, Thirthahalli, Koppa, Balehonnur and Aldur areas of Kanara, Shimoga and Chikmagulur circles, *Acacia auriculiformis* plantations have been doing well. This

practice may be continued as there are no substitute indigenous species which can be directly introduced in such degraded areas. However, in relatively better areas, species like saldhupa, mango, antawala, hebbalsu, halasu, nelli, nerale, etc. should be introduced in varying proportions. As some of the Acacia plantations in the region are now being maintained for production of timber by taking up progressive felling, some of the native species like cane, saldhupa, hebbalsu, mango, neralu, etc. should be introduced in the plantations in the intermediate stages in order to improve the biodiversity of the region.

8.39. As regards the dry deciduous forests of Shimoga, Chikmagalur, Dharwad, Ballari, Hassan, Bengaluru, Mysore and Belagavi circles just abutting the *malnad* region, these areas are under tremendous biotic pressure. Certain areas have degraded considerably. These areas are to be treated with a combination of both hardy native species like honge, bevu, tapasi, teak, nelli, kamara, bage, medri bamboo, etc. and fast growing species like *Acacia auriculiformis, Cassia siamea, Gliricidia, Simarouba,* etc. The areas immediately abutting the *malnad* region should get special attention with regard to planting of teak, sandal and medri bamboo.

8.40. Regarding the vast expanses of very dry deciduous and thorny forests of the northern, eastern and north eastern parts of Karnataka covering Kalaburagi circle and parts of Belagavi, Dharwad and Ballari circles, the present system of planting hardy native species with fast growing species such as *Gliricidia*, *Cassia siamea*, etc. should continue. Species like kamara, honge, bevu, tapasi, somya, udevu, banni (*Acacia ferruginea*), etc. have done well in various sites in the region. Combinations of these species with the fast growing species such as *Gliricidia* and *Cassia siamea* may be worked out after seeing the soil condition of the area to be treated and performance of the above species in nearby plantations.

8.41. Kamara or anjan (*Hardwickia binata*) has proved to be a very promising species in the region. It has done quite well in parts of Ballari, Bagalkote, Gokak, Bidar, Raichur and other dry divisions. The species should be given maximum importance in planting. In certain regions of Ballari division, kamara seedlings planted about ten-fifteen years ago have transformed barren and degraded areas into impressive forest. It is found that about 250-300 trees per hectare are enough to cover the area. It implies that if the surviving plants in a plantation are distributed uniformly, even a plantation with 40%-50% survival rate will be fully stocked for an even-aged tree crop. If such a plantation is continuously protected from fire and other damages to assist natural regeneration, the purpose of raising the plantation can be said to have been achieved.

8.42. *Gliricidia* (*Gliricidia sepium*) has become the principal species of planting in Kalaburagi circle. It has also been found to be successful in parts of Ballari and Bengaluru circles. While the species may be very ideal to begin treatment of a difficult site, it should not be considered as the ultimate species of the terrain. The advantage with the species is that after establishment it starts regenerating from seeds. By covering the area it suppresses other unwanted growth and improves the moisture status of the soil. It does fairly well on rocky areas and ultimately adds humus to the soil. Being a leguminous plant it adds fertility to the soil. Overall, the species improves the micro-climate of the plantation and helps in natural regeneration of some of the local species over a period of time. However, artificial introduction of some of the native species inside the plantation progressively (by planting tall seedlings and also by sowing seeds) will definitely help in hastening this process of improving the biodiversity of the terrain.

8.43. Among the indigenous species faring well throughout Karnataka, mention must be made of bevu (*Azadirachta indica*) and honge (*Pongamia pinnata*). Bevu is perhaps the most versatile species of dry zone and grows in almost all types of soil including black cotton soil. It comes up well in the medium rainfall zone and in well-drained areas of high rainfall zone. It is an excellent tree for roadside and urban plantations. It is one of the most favored species among the farmers. It is an economically important oil-yielding tree which also gives valuable timber. Neem oil-cake is an excellent fertilizer. It has been propagated in large numbers under various plantation programs in the state including agro-forestry. Honge is a very hardy species and has done well throughout the state. Honge grows well near water bodies and prefers deep soil. In thrives in shallow soils but does not grow vigorously. It has performed extremely well in Bangalore and surrounding areas. It is also very popular among the farmers and is an economically important oil-yielding tree. Its leaves are extensively used for mulching and Honge oil-cake is a very good fertilizer. Tapasi (*Holoptelea integrifolia*) is also a very hardy species which comes up well in open areas and should be introduced in more numbers in the medium to dry rainfall zone.

8.44. Planting in black cotton (BC) soil is a challenging task in the *maidan* region of the State. There are not many tree species which can establish well in such areas. One way of identifying the most suitable species for planting in such areas is to take a cue from the tree species that have been thriving well in the adjoining or nearby areas having black cotton soil. Top quality (tall and hardy) seedlings of these species planted in the right time when there is sufficient moisture in the soil will definitely give good result. Some of the important species which are known to have done well in

black cotton soil are karijali (*Acacia nilotica*), bevu (*Azadirachta indica*), tapasi (*Holoptelea integrifolia*), bage (*Albizzia lebbek*), hippe (*Madhuca latifolia*), muthuga (*Butea monosperma*), banni (*Acacia ferruginea*), tupra (*Diospyros melanoxylon*), etc.

8.45. Quite often the Forest department, especially its social forestry wing, takes up block plantation on tank foreshore areas. A large number of such plantations have been raised in various parts of the state like Kolar, Bangalore, Chamarajanagar, Tumkur, etc. The species which have done well in these areas are karijali (*Acacia nilotica*), dowga bamboo (*Bambusa bambos*), holematthi or torematthi (*Terminalia arjuna*), honge (*Pongamia pinnata*), holedasawala (*Lagerstroemia speciosa*), muthuga (*Butea monosperma*), etc. Kadamba or Apate (*Anthocephalus chinensis*) also does well in such areas in the medium to high rainfall zone.

8.46. The species *Wrightia tinctoria* (hale) is quite common in the dry deciduous forests of Karnataka. Hale wood is very suitable for turnery, carvings, etc. The species has become quite rare because of over exploitation. It should be encouraged in the planting programme in dry deciduous forests, especially in Bangalore Rural, Ramanagar, Mandya and Mysore divisions in order to cater to the demands of Channapatna, a town near Ramanagar famous for toy making.

8.47. Raising successful plantation in areas having remnants of old eucalyptus trees has been a daunting task. Such areas are there in various parts of the State and more particularly in Mysore, Hassan and Bangalore circles. In most of these areas planted seedlings have not performed well both in terms of survival rate and height growth. The stumps of old eucalyptus trees tend to send out multiple coppice shoots with the closure of the area and as a result of the cultural and soil & moisture conservation operations initiated as a part of planting activity. In addition to facing severe root competition, the planted seedlings have to compete for light with these vigorous coppice shoots. The best way to raise successful plantation in such areas is to remove the eucalyptus trees and stumps along with their roots. However, it is a very difficult and expensive task. The next best option is to harvest all the standing eucalyptus trees for timber, pole, pulp wood and fuel wood and then prepare the area for planting after digging pits or trenches by mechanized devices. The pits or trenches should be dug judiciously, away from the eucalyptus stumps. Number of seedlings for planting should be kept limited in view of the existing vegetation. After planting of tall and hardy seedlings of suitable species, the plantation should be maintained well by repeated weeding. Eucalyptus shoots found to be interfering with planted seedlings should be removed. Good soil working, fertilizer application and effective

soil and moisture conservation works should be carried out. These initiatives should enable the planted seedlings to establish and grow side by side with some eucalyptus shoots.

8.48. Infestation by *Lantana* (*Lantana camara*) is another menace in some of the forest areas of the State, especially in parts of Kodagu, Chamarajanagar and Mysore circles. If not kept under check, *Lantana* can damage plantations to a great extent. Removal of *Lantana* can be a futile exercise if it is not followed by appropriate steps such as planting and repeated weeding till the establishment of the plantation. In the wildlife areas, attempts at converting *Lantana*-infested area into grassland even by uprooting the weed have failed, as *Lantana* has either bounced back or has been replaced by another menacing weed. *Lantana* primarily comes up in better soil; richer the soil, more vigorous is the growth of *Lantana*. Therefore, after its removal, if the soil is not immediately covered by an alternative crop, it is most likely to reappear. It is necessary to take up plantation in the *Lantana* eradicated land at the earliest. As far as raising plantation in such area is concerned, systematic approach such as removal of *Lantana*, planting tall seedlings of suitable species at closer espacement (2m x 2m or 3m x 3m) and repeated weeding carried out regularly for three years should enable the plantation to establish and suppress the weed.

8.49. Cane (*Calamus* species) plantations are being raised in the forest areas of the Western Ghats region of the state, especially in Canara, Hassan, Kodagu, Mangalore and Shimoga circles. The natural habitat of cane is evergreen or semi-evergreen forests with very good soil. For propagating the species by planting, site conditions have to be similar to those obtaining in an ideal evergreen or semi-evergreen forest. Generally, three species, namely, handi betta (*Calamus thwaitessii*), naga betta (*Calamus rotang*) and halu betta (*Calamus pseudotenuis*) are planted. It has been observed that due to continued protection given to our evergreen and semi-evergreen forests during the last few decades, status of natural regeneration of cane is by and large satisfactory in these forests. Therefore, it is better not to take up artificial plantation of cane in such forest areas. It is advisable to introduce cane in areas with inadequate stocking of cane and unsatisfactory natural regeneration of the species. It should also be planted in areas from where extraction and removal of cane is regularly done for departmental supply. Dibbling of cane seeds is also a cheaper and more effective option. Extensive plantations of *Acacia auriculiformis* have been established in the open and degraded forest lands of Kanara, Shimoga and Chickmagaluru circles. Some of these plantations located in the high rainfall zone with relatively better soil have also evolved an ambience akin to semi-evergreen forest. In the past, cane had been introduced through under-planting in some of these

plantations after their canopies had started closing. These have given encouraging results. It is suggested that similar attempts at introducing cane in older Acacia plantations should be continued. One of the common causes of concern regarding cane plantation is the damage caused to the seedlings (especially the young ones) by wild animals such as porcupines, hares, etc. It is found that the menace of wildlife damage is reduced to a considerable extent by planting tall (mature) cane seedlings. It may be ensured that seedlings which have been maintained in the nursery for at least two years are taken to plantation. Such tall and healthy seedlings will develop spines in the nursery stage and therefore will be able to withstand attack by wild animals.

8.50. Karnataka's afforestation works have been of high standard both in terms of quality and innovativeness. Independent evaluation reports regarding performances of plantations developed under various schemes have recorded with appreciation the superior quality of work with high survival rates. It is also a matter of pride that the Karnataka Forest department on a number of occasions has won the Indira Priyadarshini Vriksha Mitra Award instituted by the Ministry of Environment and Forests, Government of India for outstanding afforestation work. Bangalore Urban division was selected for the award in 1988 for splendid work of greening of urban areas. The award was given to the Kanara forest circle in 1989 for exemplary afforestation work, especially for plantations of miscellaneous species and bamboo. Chitradurga forest division received the award in 1997 for excellent afforestation work, especially for plantations of kamara.

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MANAGEMENT OF TEAK PLANTATIONS

Although the British had adopted an exploitative forest policy during their early rule in India and had resorted to heavy felling of teak in the Malabar region for trade and commerce, they were quick to realize the necessity of replenishing the dwindling stock of the valuable species. Therefore, they had initiated serious efforts at artificially regenerating teak in the depleted forests. The first successful teak plantation was raised in 1842 in Nilambur in the present Kerala state. It is reported that during the 20 year period starting from 1842 until 1862, more than 10 lakh teak plants were raised for plantation development in India. It is noteworthy that reasonable success was achieved in raising teak plantations even before the introduction of scientific forestry in India in 1864. Teak planting increased to significant levels from 1865 onwards.

9.2. In Karnataka, the earliest teak plantations were raised in the latter half of the nineteenth century. The first teak plantation of old Mysore state was raised during 1862-63 by Mr. Oswald in Lakkavalli forest by the side of the old Lakkavalli-Narasimharajapura Road in present Bhadra tiger reserve. Another plantation was raised during 1870-71 in the Muthodi forest by the side of the Somavahini rivulet. Besides, a number of plantations were raised around the same period in nearby areas at Ratwaladhalla, Velagutti, etc. In Bombay Karnataka, the earliest plantations were raised in 1865. Colonel Peyton had raised a plantation from 1865 onwards in Kalkatti in Gerusoppa range of present Honnavar forest division. This plantation extending over 40 acres was raised by dibbling of seeds and planting continued up to 1880. The total number of plants was 24,000. This plantation is more popularly known as Peyton's plot. During 1865, another teak plantation was raised in Bommanahalli (Block-IX, Copmartment-2) over an extent of 22.0 acres. This was followed by Shingatgeri (Block-VII, Compartments-18 &19) in 1866 over 98.9 acres and Birchi (Block-VI, Compartment-16) in 1871 over 206 acres. All these three plantations were raised in Northern Division, Kanara i.e. present Haliyal forest division. The earliest teak plantations of present Karwar forest division (earlier Western Division, Kanara) were raised in Kadra, Mardi and Sulgeri during 1865 to 1870 (288.39 ha). Most of these plantations (207 ha) have gone under submersion of Kadra reservoir. Planting of teak was taken up in Nagargali range of Belgaum division as early as 1881. In Yellapur forest division, the first teak plantation was raised in 1918. The oldest teak plantation in Coorg state was raised in 1870 over an area of 3.2 hectares in Kushalanagar range of Madikeri forest division.

9.3. Teak plantations were initially raised from seeds. However, as teak seeds have poor germination due to dormancy related problems, casualties were high. Continuous attempts were being made to improve upon the technique of planting in order to raise successful plantations. The technique of raising teak plantation through the stump planting method appears to have been standardized in the early 1920s, after the First World War. With the development of this technique (root-shoot cutting technique), it became possible to raise almost 100 per cent successful plantation. As a result, the pace of raising regular and systematic plantations of teak gathered momentum. Karnataka now has about 1,62,000 hectares of teak plantations. A large segment of these plantations (about 1,20,000 hectares) was raised on mixed deciduous forests after logging for timber and firewood, clear felling, burning of the left-over debris, followed by planting of teak stumps during the pre-monsoon showers. With the imposition of the ban on clear felling of forest for the purpose of regeneration in 1983, the earlier system of raising teak plantation in clear felled and burnt area was given up. From 1984 onwards, teak plantations have been raised mostly as mixed plantations with variable proportions of teak depending upon the openness and status of degradation of the plantation sites.

9.4. The practice of raising pre-sprouted poly-bagged teak seedlings for taking up large-scale plantation was started in Kanara circle (Uttara Kannada district) in the mid 1980s. The earlier practice of direct stump planting was in vogue for a long time since teak planting was started. Under the stump planting system, cuttings of teak seedlings raised in dry nursery beds were directly planted in the field. Each cutting, about 5-6 inches in length, comprised mainly the root portion of the seedling with a short portion (about1/2 inch) of the shoot. Although the method of stump planting was time-tested and had given excellent results in the past, it had certain limitations which became significant as the Forest department started raising teak plantations in degraded forest areas without resorting to clear felling and burning.

9.5. Stump planting was found to be very successful when it was done immediately after the pre-monsoon showers and well before the onset of the south west monsoon. There is a gap of about 20-25 days between the pre-monsoon showers and the onset of regular monsoon. Stumps planted during this gap period root well when the soil is moist but not soggy and the air is hot and humid. Stump planting done after the onset of regular monsoon does not give satisfactory result, as the stumps do not root and sprout well when the soil is fully soaked in rains. Earlier the plantations were of smaller extents and it was possible to complete the entire planting operation within the gap period before the onset of regular monsoon. Such plantations were almost 100% successful and there was hardly any casualty. However, as larger areas

were taken up for plantation, it became difficult to complete planting within the limited gap period and planting had to be continued during the regular monsoon resulting in higher casualties.

9.6. Earlier teak plantations were raised in well burnt soil; after removing valuable timber and firewood, the remnant growth including brushwood was clear felled, the resultant debris was sun dried and then burnt *in situ*. In such a well burnt area there was practically no or very little weed growth. This kept the teak stumps free from competition from weeds and grasses and this facilitated quicker shoot development. After the imposition of ban on felling of natural trees in the mid 1980s, it was not possible to give a good burn before planting for want of burning material. Even otherwise, from the point of biodiversity conservation, the practice of burning before planting was being gradually discouraged as it was increasingly felt that burning would not only damage the seeds of indigenous species lying in the ground but would also damage the existing root system of the species many of which throw up shoots in the spring.

9.7. As the department had started undertaking planting programme on degraded sites and teak was an ideal species for planting along with other species, it was found that the site conditions were not favorable for stump planting of teak. There is generally heavy growth of weeds and grasses which teak stumps have to compete with. As large-scale plantations were being carried out, it was not possible to complete planting before the onset of monsoon. It was realized that for teak to succeed in such situations, it would be necessary to plant tall seedlings with well-developed root system so that these can effectively compete with the weeds and grasses and their root system can hold on to the wet soil conditions during the monsoon days. In view of this the Forest department started raising pre-sprouted poly-bagged teak seedlings in nurseries. Planting of pre-sprouted poly-bagged teak seedlings also has a number of advantages:

- It is possible to select healthy seedlings from the mother beds for preparing stumps of the right size for putting in the poly-bags. This helps in raising healthy and vigorous sprouted seedlings thereby ensuring planting material of better quality.
- Having been raised and maintained in the nurseries for about six to nine months before planting in the field (the stumps are put in the poly-bags sometime during October to December), the pre-sprouted poly-bagged seedlings have the distinct advantage of having one season's extra growth.

- The poly-bagged teak seedlings are made hardy in the nursery by regulating / restricting water supply and by spacing the poly-bags (letting the poly-bags stand alone). This enables the seedlings to face harsh field conditions after planting.
- Planting of poly-bagged seedlings can continue during the monsoon season, as the seedlings have established root systems. Therefore, it is possible to raise large-scale plantations with assured success.

9.8. Of late, teak and other mono-crop plantations, which were raised in the past in the biologically diverse tropical forests, have been receiving adverse criticism as being responsible for bringing down the original bio-diversity of the tract. Pure teak plantations, which were raised and managed in the past with the specific objective of optimum return, admittedly face and pose a few problems which render these less conducive to growth and sustenance of bio-diversity.

9.9. As the leaves of teak are fairly large, the canopy of a fully stocked teak plantation allows limited sunlight on the ground surface during the period May-December. This restricts the growth of other indigenous species. During the period December-February, all the teak trees shed leaves thereby exposing the ground floor to intense tropical sunlight and resulting in severe desiccation and scorching of the ground flora. The dried up ground floor along with the thick carpet of fallen, dried leaves is very prone to fire hazards. Fire destroys seeds, kills or damages seedling regeneration, affects coppice regeneration and retards overall forest growth. Burning of leaf-litter and humus deposited on the forest floor slows down micro-biological activities which are so vital for a healthy forest eco-system. Absence of leaf-litter and humus from the forest floor also results in erosion of soil and loss of fertility during the ensuing monsoon season. Increased run-off and reduced infiltration affect the water-absorbing capacity of the soil surface which is rendered further susceptible to fire.

9.10. In spite of the likely adverse conditions obtaining in teak plantations, as mentioned above, we do come across plantations supporting considerable biodiversity. This has been possible where fire protection measures have been effective. It is common to see older teak plantations making space for indigenous species to regenerate and grow up. As a matter of fact, such plantations tend to give an appearance of natural forest dotted with teak trees here and there. This is indicative of the tenacity and versatility of the indigenous species in their native tract. Most of the indigenous species of the deciduous forest are hardy and they usually coppice vigorously. By and large they are light demanders, but some of the species such as

Terminalia paniculata (kindal/hunal), *Xylia xylocarpa* (jamba), *Lagerstroemia lanceolata* (nandi/nana), *Dalbergia latifolia* (beete/ sissum), etc. can tolerate partial shade. If a teak plantation is well protected from fire and other biotic interferences, these species show tendency of a come-back in these areas. This process can be further accelerated by taking up judicious thinning so that light conditions are favorable to the indigenous species including the light demanders.

9.11. Working plans written for the purpose of managing the forests of a division give specific prescriptions for the management of the teak plantations of the division. These prescriptions provide for carrying out a sequence of thinning operations in the plantations, the frequency and intensity of thinning being determined by the site factors of the locality where the plantation is situated. Normally, six to eight thinning operations are prescribed for a plantation during its life time of about 120 years during which the number of teak trees in the plantation is progressively brought down. In order to maintain uniformity of crop and to obtain maximum possible commercial return, it was generally prescribed that other indigenous species which come up by natural regeneration (from seeds or from coppice shoots) should be removed at the time of thinning of teak trees. It was therefore a common practice in the past to remove all naturally growing species, other than Rosewood, while carrying out thinning of teak plantations. As a result of this practice, the proportion of indigenous species in teak plantations was generally less. However, it should be conceded that many of our teak plantations were not regularly thinned. Generally the first two mechanical thinnings were carried out as per schedule. But subsequent silvicultural thinnings were not carried out regularly. In many cases, only a few plantations would be thinned out of the plantations due for thinning in the division in a particular year. Paucity of funds, other pressing works, lack of staff, etc. are cited as the reasons for not carrying out thinning of all the plantations as per schedule. Besides, many of Karnataka's teak plantations were included in the protected areas such as tiger reserves, national parks and wildlife sanctuaries. There are extensive teak plantations in Bhadra tiger reserve, Nagarahole tiger reserve, Dandeli-Anshi tiger reserve, Shettihalli wildlife sanctuary, etc. As removal of any material is prohibited from protected areas, thinning is not carried out in these plantations.

9.12. It has been observed that certain indigenous species have been able to reappear and grow side by side with teak in some of the plantations which were not thinned regularly or where teak had partially failed. These plantations now look like natural forest. Such plantations are encountered almost throughout the state, but more notably in the forest divisions of Belgaum, Madikeri, Koppa, Shimoga,

Bhadravathi, etc. It has also been generally observed that older teak plantations, where final or penultimate thinning had been carried out in the past (say, before 1980), have now considerable number of indigenous trees along with the planted teak trees, as during the last 30-35 years natural regeneration of indigenous species has come up in the openings of these plantations. Taking a cue from these plantations, it is suggested that silvicultural thinning of all the teak plantations in the territorial divisions should be carried out regularly as per schedule. However, considering the importance of indigenous species in the natural forest ecosystem, the primary objective of such an exercise will now be to transform the monoculture plantations into natural forest and this will have to be achieved by retention of the indigenous species, not their elimination as was the norm in the past. For this to happen, it has to be ensured that under no circumstances the naturally growing trees are removed during thinning and the existing natural healthy stems of indigenous species are also counted along with teak while determining the number of stems to be retained in the plantation.

9.13. As regards the teak plantations in the protected areas, there is considerable damage to teak trees in Nagarahole and Bhadra tiger reserves because of elephants who relish the bark of teak poles. It is said that during the summer months when water becomes scarce the teak bark also supplements their need to some extent. Therefore, thinning of teak need not be considered in these plantations. Strict protection of the plantations from fire and other biotic interferences may suffice and will induce growth of native species in the long run. It has been observed that indigenous species such as *Chukrasia tabularis* (kalgarige), *Adina cordifolia* (heddi), *Lagerstroemia parviflora* (channangi), *Pterocarpus marsupium* (honne), etc. have started emerging in some of the plantations of Nagarahole national park and Anechowkur areas of Mysore West division where teak poles are frequently damaged by elephants. Carrying out silvicultural thinning to some of the younger plantations of Dandeli-Anshi tiger reserve and Shettihalli wildlife sanctuary would have helped in the re-emergence of indigenous species. However, due to the restrictions on removal of any biomass from protected areas, this option is ruled out. The next best option is to provide maximum protection from fire and other disturbances and to carry out soil and moisture conservation works, so that there is gradual improvement to the forest ecosystem which may help in the appearance of some of the shade tolerant species such as *Terminalia paniculata* (kindal), *Xylia xylocarpa* (jamba), *Lagerstroemia lanceolata* (nandi), *Dalbergia latifolia* (beete), etc.

9.14. It has been mentioned that Karnataka has about 1,62,000 hectares of forest area under teak plantations and out of these about 1,20,000 hectares of plantations

were raised as pure plantations in clearfelled areas before the practice of clear felling was done away with in 1983. These plantations are by and large fairly successful plantations. Thinning operations were generally carried out in these plantations as per schedule up to the 1990s. With the transfer of the wildlife areas to the wildlife wing, large extents of excellent teak plantations were also transferred. These include the plantations in forest areas like Muthodi, Lakkavalli, Hunsur, Virnoli, Gund, Kulgi, Joida, Shettihalli, etc. With the Hon'ble Supreme Court of India's order dated 14-02-2000 prohibiting removal of any forest produce from the protected areas, thinning operations in these plantations were discontinued. Unfortunately, thinning operations were also not carried out regularly in many plantations with the territorial divisions; this has adversely affected the growth of the plantations. Even after transfer of large extents of teak plantations to the wildlife wing, the territorial wing still has considerable extents of teak plantations under its fold. These are located in Haliyal, Yellapur, Karwar, Honnavar, Sirsi, Belgaum, Dharwad, Sagar, Shimoga, Bhadravathi, Chickmagalur, Koppa, Madikeri, Virajpet and Mysore West forest divisions. Over the years, some teak plantations have merged with natural forest and in the absence of proper records it is difficult to identify such plantations in the field. However, about 75,000 hectares of teak plantations have been identified in the working plans of various territorial divisions for which appropriate management practices, including thinning regime, have been prescribed. Division-wise details of these plantations are as follows: Yellapur (21,000 ha), Haliyal (6,657 ha), Karwar (9,444 ha), Honnavar (6,532 ha), Sirsi (2,373 ha), Dharwad (3,057 ha) Sagar (9,500 ha), Shimoga (2,540 ha), Bhadravathi (1,534 ha), Belgaum (1,250 ha), Chickmagalur (698 ha), Koppa (3,280 ha), Madikeri (3,300 ha), Virajpet (2,309 ha) and Mysore West (700 ha). These plantations constitute a huge asset and there is need to ensure that it is managed efficiently for the state's welfare. It is absolutely necessary to ensure that thinning operations are carried out as per the working plan prescriptions so that the trees put on regular increment adding value to the invaluable dynamic asset. As most of these thinnings are silvicultural operations of middle-aged plantations, considerable quantities of medium sized timber are likely to be obtained generating substantial income to the state. In a preceding paragraph, it has been suggested that while carrying out thinning operations, care should be taken to retain healty and sound trees of indigenous species along with eligible teak stems so that the bio-diversity of the plantations is improved and it is possible to manage these plantations as natural forest dotted with teak trees.

9.15. During 2003-04, the state Government had assigned a project to the Karnataka State Remote Sensing Application Center (KSRSAC), Bangalore to

develop and generate comprehensive database using Geographic Information Systems (GIS) and Remote Sensing (RS) to be used for planning and management by the Karnataka Forest Department. As part of the project output, the KSRSAC has provided detailed land use-land cover statistics for each district. The land use-land cover classification is very detailed in respect of the forest areas. The extent of each forest type in each density class has been indicated. Similarly, in case of forest plantations, the extent in each category of plantation has been given. With regard to teak plantations, the distribution is as follows: Uttara Kannada (48,593.39 ha), Shivamogga (9,750.41 ha), Chickmagalur (5,296.54 ha), Kodagu (12,900.93 ha), Belagavi (163.86 ha), Kundapur (693.58 ha), Dakshina Kannada (2,124.89 ha), Hassan (70.72 ha), Mysore (2,713.83 ha), Dharwad (473.34 ha) and Ramanagar (14.19 ha). The total extent of teak plantations as per the assessment of KSRSAC is 82,795.68 hectares. This figure clearly indicates that out of about 1,20,000 hectares of pure teak plantations raised by the Forest department up to 1983, about 40,000 hectares have lost the characteristics of pure plantation and have merged with natural forest.

9.16. As regards final felling of the teak plantations, working plans of the forest divisions have generally prescribed rotation period of 120 years. Therefore, as of now, only the plantations which were raised before 1900 are eligible for final harvest. There are very few such plantations in the territorial divisions. While some of these plantations have achieved heritage status and therefore need to be preserved for the posterity, some are not identifiable in the field. It is however necessary to visit each identified plantation which was raised before 1900 and take appropriate decision regarding further course of action. Selection felling or rather improvement felling of some of the existing trees is a viable option. During the year 1986-87, improvement felling was carried out in the 1866 plantation at Shingatgeri (Block-VII, Compartments-18 &19, Barchi range) in Haliyal forest division over about 96 acres (a small portion of the original plantation of 98.9 acres had been released in the past for Shingatgeri railway station and siding). The best looking stems were retained and only dominated, malformed and suppressed trees were selectively and conservatively removed. A similar excersice in the form of elite thinning was carried out during 1987-88 in the 1871 plantation (206 acres) at Barchi (Block-VI, Compartment-16) in Haliyal forest division. Although relatively unsound trees were removed on selection basis, considerable quantities of timber were made available in the Government Timber Depot, Dandeli. The quality of timber was highly appreciated and very attractive prices were offered in the public auction.

9.17. As planting of teak in the state had actually picked up during the post 1900 period, more specifically after 1920, sizeable extents of plantation will start becoming due for final harvest from around 2030 onwards. A stage will come when out of the 75,000 hectares of plantations which are with the territorial divisions, on an average about 600 hectares of plantations will be due for harvest annually. Assuming a very conservative figure of 50 cum of timber per hectare obtained from selection-cum-improvement felling, a minimum of 30,000 cum of timber will be available. At the current price of teak at Rs1,00,000 per cum, the annual income from plantation teak will be about Rs 300 crore.

9.18. As far as new plantation is concerned, although the practice of raising pure teak plantation was discontinued from 1984-85, teak continues to be an important species along with other indigenous species for under-planting or gap planting in the degraded portions of the high forest blocks and teak pole areas of Kanara circle. Teak had done very well through under planting in a plantation raised on the right hand side of Haliyal-Yellapur Road near 'Dowgi nala' in Yellapur forest division. This plantation was raised sometime during 1974-76, perhaps under the guidance of Dr. K.A. Kushalappa. When the programme of under planting was introduced in Kanara circle during 1984-85, initially the average number of plants per hectare was about 1,000. Teak was a major component and it was planted in the relatively open gaps. Miscellaneous species were planted in partially open areas. Later on, the number of seedlings planted per hectare was brought down considerably in view of the fact that most of the species were found to give promising result only when planted in open areas with adequate light. Teak planted in larger gaps in Virnoli, Dandeli and Kulgi ranges of Haliyal division performed as well as in clear-felled areas and required thinning in certain patches in subsequent years. The performance of other miscellaneous species was found to be average and depended on the drainage of the tract and exposure to sun light. However, the overall impact on the treated area was very encouraging in that excellent natural regeneration, including bamboo regeneration, was noticed due to protection, soil & moisture conservation and cultural operations which were part and parcel of the package of planting operations. The Kanara model of under-planting or gap planting was adopted on a lesser extent, and with modifications as were considered necessary, in other circles such as Belgaum, Shimoga, Chickmagalur and Kodagu. The results of these initiatives have been mixed. But the overall improvement of the treated area due to protection and cultural operations has been a major takeaway from such initiatives. As far as teak is concerned, planting of pre-sprouted seedlings in well drained and exposed area has given fairly good results wherever adequate follow up measures such as weeding, soil working, etc. have been carried out.

9.19. Teak thrives well in relatively fertile soil with good drainage. It favors moderate rainfall. The dry deciduous forests just abutting the *malnad* region in Shimoga, Chickmagalur, Dharwar, Belagavi, Hassan, Ballari (Davanagere), Bengaluru and Mysore circles are ideal for the species. It must be remembered that teak is a native species of these forests and no stone should be left unturned in bringing the species back to its native tract. The dry deciduous forests of the semi-*malnad* region are under severe threat of extinction as is evident from the interpretation of the satellite imageries of these forests. Sizeable portions of these forests have been converted to eucalyptus plantations in the past. These forests are under tremendous pressure from biotic interferences and have degraded considerably. It is necessary to bring back these areas to their original state and composition. Mixed plantations of teak along with other hardy indigenous species such as bevu (*Azadirachta indica*), tapsi (*Holoptelea integrifolia*), honge (*Pongamia pinnata*), nelli (*Emblica officilanis*), bage (*Albizzia lebbek*), sandal (*Santalum album*) and medri bamboo (*Dendrocalamus strictus*) are ideal for such areas. However, the key to success will be on judicious soil and moisture conservation works, rigid protection and regular after-care.

9.20. Of late teak has gained prominence as an agro-forestry / farm-forestry crop. Teak is grown in the farmlands across the length and breadth of the state including the dry districts such as Bellary, Bidar and Kalaburagi. The Forest department has been supplying the stumps or seedlings to the farmers for this purpose.

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IMPACT OF EUCALYPTUS ON FOREST

Introduction of eucalyptus in India dates back to around 1790 when Tippu Sultan, the ruler of Mysore kingdom, had got a number trees belonging to different species of eucalyptus planted in his palace garden on Nandi Hills near Bangalore. It is believed that he had obtained the assorted seeds from Australia. Eucalyptus as a plantation crop was introduced in 1843 in the Nilgiri Hills (now in Tamil Nadu state) as an experiment to find high yielding species for fuel and timber. The species introduced then was *Eucalyptus globulus*. Soon it became a favored species of the colonial rulers. However, after trials on the Mysore Plateau, *Eucalyptus tereticornis* or Mysore gum was found to be more productive and became the more popular choice for planting and it was introduced to various parts of the country.

10.2. The pace of introduction of eucalyptus in the country was moderate in the beginning. Until the end of the nineteenth century, small blocks of plantations were raised mostly for experimental purposes. Eucalyptus gained popularity after independence. Under the reforestation programme, it was introduced along with other hardwood species in the dry deciduous mixed forests and dry thorn forests in Punjab, Haryana, Rajasthan and peninsular India. These areas were generally worked under clear felling system with artificial regeneration or coppice system. Under the afforestation programme, eucalyptus was introduced in degraded areas with skeletal soils, murramy soils, rocky sites, denuded hills, ravine lands, shifting sand dunes, etc. in various parts of the country such as peninsular India, Andhra Pradesh, North West region, Tamil Nadu and Kerala. Mysore gum (*E. tereticornis*) was planted in most of these areas. *Eucalyptus globulus* and *Eucalyptus grandis* gave very good results in the Nilgiris of Tamil Nadu and high level grasslands of Kerala respectively. The extent of area planted under eucalyptus in the country up to the end of 1965 was 80,000 ha.

10.3. Systematic attempts to raise plantations in Mysore kingdom started in the later half of the nineteenth century with species such as teak, sandal, etc. Around the same time, interest was evinced in introducing a few exotic species such as casuarina, eucalyptus, rain tree, sissoo, mahagony, etc. The first eucalyptus plantation was raised in 1877 at Malabavi (Devarayanadurga), Tumkur district. Eucalyptus was introduced in the dry deciduous forests of Tumkur, Kolar and Bangalore districts since the early 1900s to re-coupe the forests which were harvested under coppice with standards system for supplying firewood and small timber to Bangalore and other urban centers. The defence and civil establishments at Bangalore required substantial quantities of firewood. There was huge demand for firewood from the

Railways also. The decision to introduce eucalyptus was perhaps because of the fact that coppice regeneration from the natural tree species was not satisfactory due to various biotic factors and there was an urgency to restock the forests to meet future demand. During the period immediately before and after the Independence, Eucalyptus hybrid (then known as 'Chikkaballapur' variety) was gradually introduced in fuel wood plantations along with casuarina.

10.4. Although eucalyptus was introduced in Karnataka many decades ago, its planting was moderate in the beginning. The working plans written for the post independence period for forest divisions of eastern and central Karnataka had prescribed planting of eucalyptus under various working circles such as Plantation working circle, Fuel wood working circle, Afforestation working circle, etc. Areas covered under these working circles generally receive moderate to scanty rainfall. The main objectives of these working circles were to improve the vegetation of the highly degraded and refractory forest areas to prevent their further degradation and to meet the increasing demand for fuel wood from a growing population. Introduction of eucalyptus was considered inevitable that time in view of its phenomenal rate of growth and capability to adapt to highly degraded sites and also due to non-availability of planting technique of an alternative species of native origin capable of effectively tackling difficult areas under harsh conditions. Planting was done mainly by trench-mound method, the trenches being aligned along the contours; pit planting method was also adopted in the beginning but was later given up, as it was found to be unsatisfactory. Sowing of seeds of local species on the mounds was prescribed.

10.5. The tempo of planting eucalyptus in Karnataka picked up between 1960 and 1980. During this period, in addition to the dry and degraded forests of the state, some of the high forests receiving moderate to heavy rainfall were also brought under eucalyptus plantation after clear felling the existing tree growth. After 1980, planting was restricted only to areas receiving moderate to low rainfall. However, the extent of planting in such areas increased due to the World Bank aided Social Forestry project which had afforestation of degraded areas as one of its project components. About 1,31,411 ha of eucalyptus plantations had been raised by the Forest department until 1992-93. Since then, there was gradual reduction in the extent of forest area brought under eucalyptus plantations by the Forest department. The total extent of eucalyptus plantations raised by the Forest department up to the end of 2014-15 was about 1,52,000 ha.

10.6. The large-scale plantations of eucalyptus raised by the Forest department, mostly in degraded forest areas, met the firewood and small timber requirements of

the people to a great extent and for a fairly long time extending over a few decades. Besides, a number of wood based industries were able to meet their pulp wood requirements from these plantations. More importantly, these plantations acted as buffer and reduced pressure on natural forests from biotic onslaught. But for these plantations, which were maligned by many as being ecologically undesirable, vast extents of our natural forest would have vanished during the last fifty years.

10.7. As regards supply of pulp wood to industries, the departmental plantations catered to their needs only in the beginning. Subsequently, the Karnataka Forest Development Corporation (KFDC) took up development of plantations of high yielding varieties of eucalyptus and *Acacia auriculiformis* on forest land taken on lease. Pulp wood raw material required by the industries is being supplied from the KFDC plantations. In addition, the Social Forestry project, initiated by the Forest department during the 1980s, had boosted farm forestry programme in the state encouraging the farmers to take up planting of millions of seedlings in their farmlands. This programme became very successful, especially in the districts of Bangalore, Tumkur and Kolar. Now, these districts alone meet bulk of the raw material requirements of the industries producing paper, rayon, etc. in the state. As a result, the plantations raised by the Forest department have been exclusively catering to the fuel wood and small timber needs of the people.

10.8. The pace and extent of planting eucalyptus in Karnataka, which picked up from 1960 onwards, slowed down since the mid 1980s. This was as a result of decisions taken by the Forest department to limit its planting only in low rainfall areas. This decision was partly influenced by the general opposition from sections of the public and environmentalists who perceived eucalyptus as being ecologically undesirable. Another reason was closing down of Karnataka Pulpwood Limited (KPL) as a result of public agitations culminating in Court verdict. This joint sector enterprise between the state government and M/s Harihar Polyfibres, a private sector pulpwood based company, was established to boost the production of pulpwood species in degraded forest lands. In view of these developments, although there is no convincing and conclusive rationale against introduction of eucalyptus, the department reduced emphasis on eucalyptus in favor of more and more indigenous species in its planting programs. Planting of eucalyptus was restricted only in areas where other species were not likely to survive and grow. The Karnataka Government in 2010-11 ordered suspension of planting of eucalyptus in forest areas. Subsequently in 2012, Karnataka Forest Development Corporation (KFDC) was exempted from the purview of this order. The policy was reviewed and it was decided on 23rd February, 2017 to discontinue eucalyptus cultivation on forest as well as

private land. Several farmer groups have challenged this order of the Government in the Hon'ble High Court of Karnataka.

10.9. We have seen that about 1,52,000 hectares of forest land have been utilized for raising eucalyptus plantations in the state by the Forest department. Many of these plantations are more than forty years old and have been repeatedly harvested under coppice system. Therefore these plantations have outlived their utility. There has been considerable social felling too, especially in areas adjoining habitations. Replanting mainly with indigenous species has been done on substantial portions of these areas after completion of the final harvest of eucalyptus. Therefore, it is necessary to assess the present ecological status of the forest lands and to prescribe, if necessary, appropriate measures to rehabilitate the forests. The forest areas which were brought under eucalyptus plantations by the Forest department can be broadly classified into four categories: Plantations developed on (a) very high rainfall zone, (b) heavy to moderate rainfall zone, (c) moderate to low rainfall zone and (d) low to scanty rainfall zone. These areas roughly correspond to semi-evergreen, moist deciduous, dry deciduous and very dry & scrub forests. Within each category of plantations in a rainfall zone as indicated above, there are variations in the ecological status largely determined by the soil conditions. Although information regarding the extent of plantations in each category is not available, a rough estimate would put the figures at about 5%, 15%, 50% and 30% respectively of the total extent of the plantations.

10.10. In the initial years of large-scale introduction of eucalyptus in the 1960s, a number of plantations were raised in the very high rainfall areas of the state mostly in Uttara Kannada, Belgaum, Dakshina Kannada, Shimoga, Kodagu and Chickmagalore districts. These plantations were soon found to be not doing well because of heavy rain and pink disease. The practice of raising eucalyptus in areas receiving very high rainfall was discontinued in view of its failure. Secondary growth had come back in some of these plantations, while some areas had degraded due to laterisation. Most of these degraded areas were subsequently afforested, mainly with *Acacia auriculiformis* and to some extent with Cashew, and further degradation has been halted. These areas now give the look of near natural forest with patches of *Acacia auriculiformis* and lonely Eucalyptus trees standing here and there. These are fairly safe areas now. No cultural operations are required in these areas, except for thinning of *Acacia auriculiformis* to decongest the area and introduction of tall poly-bagged seedlings of indigenous species in the gaps.

10.11. During 1960-1980, considerable extents of eucalyptus plantations were raised in the moist deciduous high forests, mainly in the districts of Uttara Kannada, Shimoga, Chickmagalur, Mysore and Kodagu. These areas receive moderate to heavy rainfall and also have good to very good soil cover. The earlier forestry practice adopted in these areas was clear felling and planting with teak. This practice was replaced in some forests by new models of planting, some with eucalyptus as a pure crop, and some with teak and eucalyptus mixed in various combinations. Eucalyptus by and large did well in these plantations due to favorable and conducive conditions. Most of these plantations have been harvested for eucalyptus as per prescribed rotation periods of 8/9 years. One redeeming feature about these plantations is the resilience shown by the original forest crop. While eucalyptus grew in these plantations, some of the hardy coppicing species such as matti (*Terminalia tomentosa*), beete (*Dalbergia latifolia*), kindal (*Terminalia paniculata*), honne (*Pterocarpus marsupium*), nandi (*Lagerstroemia lanceolata*), dindiga (*Anogeissus latifolia*), jamba (*Xylia xylocarpa*), etc. were able to coppice and survive in the available inter-spaces among the fast growing eucalyptus poles. As eucalyptus poles were successively harvested in intervals of 8/9 years, these saplings of indigenous species grew from strength to strength and were able to establish despite competition from the vigorous coppice shoots of eucalyptus. It has been observed that in these plantations, the productivity of eucalyptus slowed down considerably after subsequent rotations due to resurgence of the miscellaneous species. These areas now look like regular moist deciduous forest with all the representative species including teak along with remnant eucalyptus trees here and there. It may be worthwhile to mention here that the growth of miscellaneous species in some of the eucalyptus plantations belonging to the Karnataka Forest Development Corporation (KFDC) in Shimoga district was so vigorous that these areas were returned to the Forest department for maintaining as natural forest. The forest area included in the Tyavarekoppa Tiger and Lion Safari located by the side of Shimoga-Sagar Road is an example of how eucalyptus plantations have transformed into a regular forest of matti and dindiga in a span of about thirty years.

10.12. Most of the eucalyptus plantations raised in the moist deciduous forests have been restored to a state of natural forest, thanks mainly to the coppicing vigor of the original crop. Wherever there were larger gaps, these have been planted up in subsequent afforestation programs. These areas now do not require intensive silvicultural intervention except for rigid protection from fire and other biotic interferences. The eucalyptus trees scattered here and there are of little consequence and their retention should not be hindrance to the existing forest. However, these can

be removed, if considered necessary, after proper planning and obtaining approvals from competent authorities.

10.13. A vast majority of eucalyptus plantations of the Forest department were raised in the dry deciduous forests of the state, mainly in the districts of Bangalore, Mysore, Mandya, Tumkur, Kolar, Hassan, Chickmagalur, Shimoga, Dharwad, etc. These areas receiving moderate to low rainfall and having average soil were considered ideal for eucalyptus because the existing vegetation was in degraded condition due to biotic pressures and it was necessary to increase the productivity of the land by introducing fast growing species. Plantations were raised mainly through trench-mound method. The plantations had by and large succeeded and contributed to the supply of fuel wood and small timber besides industrial raw material. However, unlike in the moist deciduous forests, the original species of the terrain could not make a come-back in these areas. This was primarily because the native species, due to continuous hacking and lopping in the past, were in degraded condition and had lost the vigor of coppicing. The soil and moisture conditions were also not adequately supportive of the native species. On the other hand, these conditions were just adequate for eucalyptus. As a result, the planted eucalyptus seedlings came up well and virtually suppressed any other vegetation in the area. Most of the older plantations have been harvested as per the rotation of 8/9 years. However, remnants of old eucalyptus trees continue to dominate the terrain. Substantial portions of these areas have been replanted mostly with native species after the final harvest of eucalyptus. However, results have been mixed. While the newly introduced plants have established well in areas free from old eucalyptus trees or stumps, they have suffered in the areas still dominated by eucalyptus. In these areas, planted seedlings have not performed well both in terms of survival rate and height growth. The stumps of old eucalyptus trees tend to send out multiple coppice shoots immediately after closure of the area. The established root system of eucalyptus appropriates most of the benefits of cultural operations as well as soil and moisture conservation measures carried out as a part of replanting activity. In addition to facing severe root competition, the planted seedlings have to compete for light with the vigorous coppice shoots of eucalyptus. In spite of these difficulties, it is absolutely necessary to find ways to raise successful plantations with native species in these vast stretches of forest lands so that these areas can be restored to their original status in the long run.

10.14. The earliest plantations developed in the very dry deciduous and dry thorny forests in the districts of Gulbarga, Raichur, Bidar and Koppal were primarily with eucalyptus. The working plan written by Mr. Munawar Hussain for the period

1955-1965 for the management of these forest areas had recommended trench-mound plantations with planting of eucalyptus seedlings in the trenches and sowing of seeds of local miscellaneous species on the mounds. Eucalyptus continued to remain the principal species for planting in the subsequent years, although various other species such as *Gliricidia*, *Cassia siamea*, bevu and kamara have also become popular. The eucalyptus plantations in these areas were subjected to severe biotic pressure and their growth was not encouraging except in some patches. As the extent of natural forest in this region is very low, these plantations were not subjected to rotational felling with the intention of retaining some vegetation. Even when the working plans prescribe some limited felling of eucalyptus trees, the field officers prefer to defer the felling. Felling of over-mature road-side eucalyptus tree is also avoided unless there is a complaint from the adjoining farmer regarding damage to his crop. Evidently the focus in these tree-starved areas is to retain as many trees as possible irrespective of the species. As the distribution of the remnant eucalyptus trees in these areas is thin, introduction of other native species has not been a problem provided adequate care is taken regarding choice of species, quality of seedlings, preparatory soil working, timely planting and after care, soil and moisture conservation measures and above all, rigid protection. Extensive areas in the districts with residual eucalyptus population have already been tackled under various afforestation programs by trench-mound planting or ripping and planting method. Species such as bevu (*Azadirachta indica*), kamara (*Hardwickia binata*), honge (*Pongamia pinnata*), etc. have been introduced in these plantations with encouraging results. Extensive soil and moisture conservation (SMC) measures adopted in the plantations have also contributed to their success.

10.15. The land use-land cover classification prepared by the Karnataka State Remote Sensing Application Center (KSRSAC), Bangalore (2006) on the basis of interpretation of satellite imageries (1999-2000) has identified an extent of 2,11,958.84 hectares of Eucalyptus plantations in the state. Districts having sizeable extents of eucalyptus plantations are: Belagavi (4,437.94 ha), Shivamogga (13,414.79 ha), Chickmagalur (12,663.17 ha), Hassan (8,033.58 ha), Mysore (1,898.52 ha), Dharwad (5,913.16 ha), Gadag (2,904.13 ha), Haveri (12,646.84 ha), Davanagere (12,646.84 ha), Chitradurga (4,482.38 ha), Tumkur (21,303.20 ha), Bangalore Urban (14,884.94 ha), Bangalore Rural (26,380.66 ha), Ramanagar (3,584.82 ha), Mandya (13,416.74 ha), Bagalkote (2,792.85 ha), Ballari (6,045.26 ha), Kolar (22,545.94 ha) and Chikkaballapur (19,344.53 ha). Some of these plantations, especially in Bangalore (Rural), Bangalore (Urban), Tumkur, Kolar and Chikkaballapur districts, are private plantations. Some plantations in forest areas

have been raised and managed by the Karnataka Forest Development Corporation and Mysore Paper Mills Limited. Although the tempo of planting of eucalyptus by the Forest department came down since the mid 1980s, the species is quite visible in the forest areas because of its tenacity and coppicing vigor. In the *malnad* districts, its presence is mainly in the drier taluks of Belagavi, Shivamogga, Chickmagalur, Hassan and Mysore districts where agro-climatic conditions are quite favorable for eucalyptus. It had been planted quite extensively in the semi-*malnad* districts where similar agro-climatic conditions prevail and these plantations are visible even now. In the *maidan*-districts, although eucalyptus was planted widely, its presence does not appear to be very dominating now partly because of hostile climatic conditions, which inhibited vigorous growth of the species, and partly because of high biotic pressure which resulted in frequent removal of whatever had grown. As already mentioned, it became a popular species for planting in farmlands in a number of districts around Bangalore.

10.16. The best way to raise successful plantation in areas with significant presence of residual eucalyptus is to make a new beginning by removing all the eucalyptus trees and stumps along with their roots. However, it is a very difficult and expensive task. The next best option is to harvest all the standing eucalyptus trees for timber, pole, pulp wood and fuel wood and then prepare the area for planting after digging of pits or trenches by mechanized devices. The pits or trenches should be dug judiciously, away from the eucalyptus stumps. Wherever possible, mechanical ripping of the area is recommended. Number of seedlings for planting should be kept limited. After planting of tall and hardy seedlings of suitable species, the plantation should be maintained well by repeated weeding. Eucalyptus shoots found to be interfering with planted seedlings should be removed. Good soil working, fertilizer application and effective soil and moisture conservation works should be carried out. These initiatives should enable the planted seedlings to establish and grow side by side with some eucalyptus shoots. As the native species establish themselves, the eucalyptus shoots may be gradually removed.

10.17. From what has been narrated above, the performance of eucalyptus in the forests of Karnataka has been mixed: it has failed in the high rainfall zone and has been virtually suppressed by indigenous species in the moist deciduous forests. In dry deciduous and scrub forests, it has suppressed almost all the native species. The success of the species in dry deciduous forests has come at a heavy price – the basic composition of the natural forests has changed and the road to recovery has been slow and difficult. It is true that eucalyptus has served the specific purpose of meeting the biomass needs of the population for a considerable length of time and, as a result, vast

extents of natural forests have been saved from degradation or decimation. However, considering that much progress has been made in the farm forestry front in the intervening period, and also that the Forest department has been able to successfully introduce many indigenous species in the degraded forests, it is necessary to forge ahead, away from eucalyptus, and strive towards revival of the original composition of the dry deciduous forests with appropriate indigenous species.

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MANAGEMENT OF ACACIA AURICULIFORMIS PLANTATIONS

Acacia auriculiformis (Australian wattle) was introduced in the plantation programme of Karnataka Forest department in the late 1970s and early 1980s. Earlier, sometime during 1965-66, a few degraded and open patches of forest of Honnavar division in Uttara Kannada district were planted with the species. In Puttur Rubber division in Dakshina Kannada district, *Acacia auriculiformis* was grown in 1972 by dibbling of seeds along the periphery of rubber plantations in order to obtain future fence posts. The main purpose of introducing this species was to rehabilitate the open, denuded and degraded areas of the Western Ghats region of the state by bringing such lands under tree cover. Although these areas receive heavy to very heavy rainfall during the monsoon season, the open lands become very dry immediately after the withdrawal of the monsoon due to poor water retention capacity of the soil. During the months from November to April, the desiccating effects of the dry weather are so severe that seedlings planted in open and exposed areas fail to survive. Attempts in the past to afforest such areas with indigenous species had little success because of very high mortality during the dry season. Halmaddi (*Ailanthus malabarica*), a hardy deciduous species of the evergreen forests, was introduced in various degraded sites such as Salur, Tenginakoppa, Jambetallur, Konandur, Yogimalali, Baswani, etc. in Thirthahalli taluk of Shimoga district but the casualties were very high; even the surviving seedlings did not put on any increment in height. In order to find appropriate species for planting in such areas, the Research wing of the Forest department in 1976 had planted twenty-five species in an experimental plot in degraded open forest area near Hosur village in Megaravalli (Agumbe) range in Thirthahalli taluk. Similar trials were also conducted in a few other research plots such as Mense (1979), Neeluvagilu (1982), Nagatirtha (1982), Heggarakudige (1985), etc. Among the species tried, two had shown promising results in terms of rate of growth and percentage of survival. These were *Acacia auriculiformis* and *Casuarina equisetifolia*. Both these species were therefore taken up for plantation in the open and degraded lands of the Western Ghats region, primarily in Shimoga, Chickmagalur and Uttara Kannada districts. However casuarina was found to be very sensitive to fire and its performance was good only in areas with relatively better soil. On the other hand, *Acacia auriculiformis* was able to grow in varieties of soils including shallow and poorer soils and was found to be more tolerant of fire. Hence gradually *Acacia auriculiformis* got more prominence in the planting programme.

11.2. Native to Australia, Indonesia and Papua New Guinea, *Acacia auriculiformis* has been introduced to many countries in Africa, Southeast Asia and Pacific islands. This fast growing tree species which grows well even on poor soil has been introduced to a number of states in India including West Bengal, Odisha and Karnataka. The seedlings for the initial batches of plantations in Karnataka were raised from seeds procured from West Midnapur forest division in West Bengal where large-scale plantations of the species had already been established. It is perhaps for this reason that the species is also known as Bangali Jali in Karnataka.

11.3. *Acacia auriculiformis* (Family: *Fabaceae* or *Leguminosae*) is a medium sized, evergreen tree that grows up to a height of 15-30 m and up to a diameter of 30-50 cm at breast height. It has dense foliage with an open, spreading crown. The tree trunk is crooked with vertical fissures on the bark. The bark is grey or brown. Roots are shallow and spreading. Leaves are narrow, oblong, slightly curved or sickle shaped; these are not true leaves but are flattened, green leaf stalks known as phyllodes which function as leaves. Phyllodes are in fact an adaptation by leaves in dry and hot climatic conditions. Flowers are tiny, yellow and fragrant and crowded in axillary spikes. Fruits are wide, flat, oblong, hard and almost woody pods which get twisted into irregular coils on maturity. The pods are initially green but turn yellow to brown on ripening. The seeds, black in color, hang from short curled orange stalks when the pods split open on ripening.

11.4. *Acacia auriculiformis* is a non exacting species capable of growing under various climatic conditions: dry or moist or wet. With practically no maintenance, it can grow on a wide range of deep and shallow soils, clays, sandstone, laterites and unstable slopes. The rapid early growth of the species even on infertile sites coupled with tolerance of both highly acidic and alkaline soils (pH value of 3.0 to 9.5) make it popular for stabilizing and re-vegetating highly degraded sites including mined areas. Acacia protects soils from erosion because of its spreading, superficial and densely matted root system and thick leaf litter. It is also able to survive fire, dry spells and seasonally waterlogged conditions. The tree also contains nitrogen fixing bacteria which helps rejuvenate the poor soils by improving their mineral content. Plantations of acacia improve physical and chemical properties of soil such as water-holding capacity, organic carbon, nitrogen and potassium through litter fall.

11.5. By retrieving nutrients to poor soils and providing shade for other plants to take hold, Acacia plantations recover wastelands. Although acacia trees seed early (within 2-3 years) and seeding is plentiful, natural regeneration of the species within the plantation is not good, as the seedlings do not grow well in the shade and in

competition with weeds. However if the plantation is clear felled good natural regeneration from seeds is noticed. The regeneration is even better if the clear felled area is given a light burn.

11.6. The abundant seed supply of acacia trees is a valuable source of food for animals (mainly birds and also small mammals), particularly in dry places. These plantations also provide shelter for varieties of birds and some animals such as jackal, hare, etc.

11.7. One negative attribute of *Acacia auriculiformis* is its invasiveness. Because of its high reproductive potential and high adaptability to different environmental conditions, the species can spread on its own if light conditions are favorable in the vicinity. Therefore, the species is not very popular in agro-forestry. However, block plantations within farmlands or planting on the boundary of farmlands can be a very good source of fuel wood, small timber and mulching material to the farmers provided care is taken against its spreading to the open farm lands. For similar reasons, the species is not recommended for planting in high forest areas where the species may invade available open areas. Fortunately, the inability of the species to grow in shade has come in the way of its spreading into closed forest.

11.8. *Acacia auriculiformis* is now primarily planted in the open and degraded lands of the districts of Uttara Kannada, Shimoga, Chikmagalur, Dakshina Kannada, Udupi, Hassan (Sakleshpura taluka) and Belagavi (Khanapur taluka). It has been found that although the species survives dry conditions, its growth in terms of development of biomass under such conditions is limited and therefore the species is not being encouraged in such areas. In addition to the *malnad* districts mentioned above, the species is planted only in certain portions of Dharawar, Haveri, Dhavanagere and Chitradurga districts which are adjoining to the *malnad* districts where rainfall is favorable.

11.9. As already mentioned, the main objective of introducing *Acacia auriculiformis* in plantations in Karnataka was to rehabilitate and improve the degraded and denuded lands in the Western Ghats region (*malnad*) by bringing these areas under fast growing tree cover. Another important objective was to make available good quality fuel wood to the neighboring villagers for their domestic use. With a calorific value of 4700-4900 Kcal/kg, acacia wood is an ideal fuel wood and is in demand. Collection of fallen branches, twigs, pods and leaves of acacia from the floor of the plantations by the people from adjoining towns and villages for use as fuel is quite common. Although acacia wood gives excellent charcoal (it is not very heavy, burns well and does not smoke and spark), its use in Karnataka is limited.

Another important derivative of acacia wood is good quality pulp. Some of the acacia wood grown in plantations raised by the Forest department was supplied to the paper and other pulp based industries. However, the State Government undertakings, namely, the Mysore Paper Mills and the Karnataka Forest Development Corporation have been raising extensive plantations of high yielding Acacia hybrid (*Acacia mangium* x *Acacia auriculiformis*) on leased forest lands for supply of pulpwood to these industries. After removal of the pulpwood billets, considerable quantities of lops and tops and brushwood material are left in these plantations which are collected by the adjoining villagers for use as fuel wood. Acacia trees are also good hosts of lac insects (*Laccifer lacca*), which produce a resinous secretion that is harvested to produce lacquer. This potential should be explored further by farmers of Karnataka who are keen on lac cultivation, as growing of acacia trees is relatively easier and much quicker. *Acacia auriculiformis* can also be used as a host in the nursery propagation of sandalwood; it is also used as a secondary or tertiary host when sandalwood is established in the field.

11.10. Acacia timber was not in demand earlier because its use as timber was not known. During mid-1980s, the Institute of Wood Science and Technology, Bangalore had tested Acacia wood and found it comparable to teak in several aspects. During the late 1990s it was noticed that some of the sound billets of acacia sold as fuel wood in the fuel wood depots used to find way to the saw mills. It was revealed that these billets were sawn into small sizes and were used for making furniture. Gradually, over the years, acacia has been accepted as a source of good quality timber in Karnataka. The Forest department has been supplying considerable quantities of acacia timber through public auction in the timber depots and good response has been received. The sapwood of acacia is yellow and the heartwood is light brown to dark red and straight grained. The heartwood is typically hard and durable, but the sapwood is susceptible to termite and borer attack. The wood has specific gravity of 0.6-0.75, is fine-grained, often attractively figured and takes a good finish. The wood has been found to be useful for turnery articles, toys, handicrafts, furniture, joinery, tool handles and even for construction if timber logs of suitable girth are available. Planks of Acacia timber are prone to warping and splitting.

11.11. Increasing use and acceptance of acacia wood as timber has been a positive development in Karnataka where a very conservative policy has been adopted towards management of natural forests. In view of the existing ban on felling of natural green trees, logging in the state is limited to salvaging of only dead and fallen timber from the deciduous forests. This has considerably brought down the quantity of timber harvested from the natural forests. However, the fall in the

production of indigenous timber has been substantially made good by the arrival of acacia timber in the market made available by the Forest department through its timber depots. Acacia timber is also reasonably priced at an average rate of about Rs 10,000-12,000 per cubic meter as compared to some other traditional timber species such as teak (Rs 1,00,000/-), honne (Rs 43,000/-), matthi (Rs 30,000/-) and nandi (Rs 28,000/-) per cubic meter.

11.12. At the time of introduction of *Acacia auriculiformis* in Karnataka in the beginning of the 1980s, planting was done by two methods: In the pitting and planting method, 2m distance was kept between two seedlings in a row and the distance between rows was kept at 2m. In the ripping and planting method, the ripped lines were kept 4m apart and seedlings were planted 1m apart along the ripped lines. In either case the number of seedlings planted was about 2,500 per hectare. Much degraded sites were planted with only acacia seedlings. However, in sites with relatively better soil, about 10-15% seedlings of indigenous species were also planted along with acacia seedlings. However, the growth of acacia being much faster, it was found to suppress most of the indigenous species. Besides, after 4-5 years of fast growth, most of the acacia trees, except the ones in the boundary of the plantation, showed signs of slow growth due to intense competition for light and moisture. In order to give a better chance to the indigenous species to survive and grow and also to ensure continuous growth of the acacia trees, the espacement of planting was subsequently increased to 3m x 3m or 4m x 2m corresponding to about 1100-1250 seedlings per hectare out of which about 1000-1100 were acacia seedlings and the remaining 100-150 were seedlings of indigenous species. It has been noticed that some of the indigenous species like mango, nelli, saldhupa, hebbalsu, balanji, etc. which were planted in such plantations along with acacia have come up well in certain patches. It has also been noticed that tall and healthy seedlings of indigenous species raised in bigger polythene bags and planted in bigger pits have given better results. In addition, in certain plantations where branches of the acacias overtopping miscellaneous seedlings were pruned to prevent suppression by the acacias, the miscellaneous seedlings have grown well. It goes without saying that while introducing indigenous species along with acacia, special attention must be given to the indigenous plants in terms of their quality, height and after-care. Saldhupa (*Vateria indica*) has done quite well in many plantations of Siddapur range of Sirsi forest division. NRPura range of Koppa division also has a few successful plantations raised under this model with seedlings of hebbalsu, halasu, mango, etc.

11.13. Extensive plantations of *Acacia auriculiformis* have been established in the open and degraded forest lands of Kanara, Shimoga and Chickmagalur circles.

Some of these plantations located in Siddapura, Hosanagara, Sagar, Thirthahalli, Koppa and Balehonnur sub-divisions have relatively better soil and have also evolved an ambience akin to semi-evergreen forest. In the past, cane seedlings had been introduced as under-planting in some of these plantations of Kyadgi range of Sirsi forest division after their canopies had started closing. Cane is found to be doing well in such plantations. Seedlings of indigenous species introduced in a thinned acacia plantation near Halagiri nursery of Sirsi division showed good growth. In an acacia plantation raised during 1982 in Salur in Thirthahalli taluk, the Research wing had introduced a number of native evergreen species and around 8-10 species such as saldhupa, kiralbogi, garcinia, sampige, balagi, etc. gave promising result. It is suggested that similar attempts at introducing cane and other species in acacia plantations should be continued in those sub-divisions and similar plantation areas in other sub-divisions. Seedlings of balagi (*Poeciloneuron indicum*), introduced in the openings of an old acacia plantation at Bhagavathi nature camp in Kudremukh national park, have given encouraging results.

11.14. An important feature of the acacia plantations in the coastal areas of Uttara Kannada district is that there is profuse natural regeneration of the species from seeds. Such regeneration has been noticed in some plantations in other districts also. This phenomenon of natural regeneration of the species can be taken advantage of in regenerating the plantation in its next cycle by judicious singling/thinning over a period of time.

11.15. As one of the objectives of raising acacia plantations was to supply fuel wood or pulpwood, rotation period of eight/ten years was fixed for harvesting the plantations. However, as the plantation areas had already shown signs of recovery with the emergence of some indigenous plants and these plants required lateral shade for further growth, it was considered necessary to retain some acacia trees as nurse crop. Besides, in view of the increasing demand for acacia as a timber species, it became desirable to retain some well-grown trees and to allow them to put on more girth. Even in the areas where indigenous species had not been planted or had not come up because of suppression by acacia, it was considered desirable to introduce indigenous species suitable to the locality after removing some acacia trees on selection basis and retaining the balance trees for further growth. This was done in view of the fact that the plantation sites had shown signs of improvement in terms of soil quality, moisture status, light conditions, etc. thereby favoring introduction of indigenous species.

11.16. Details regarding the extent of *Acacia auriculiformis* plantations raised so far in the state are not available, as the species is not separately indicated in the Annual Reports of the Forest department. As per the land use-land cover classification done by the KSRSAC, there are 54,915.69 hectares of plantations out of which 49,708.16 hectares are in the *malnad* region, 3,240.91 hectares in the semi-*malnad* region and 1,966.62 hectares in the *maidan* region. The presence of the species is quite conspicuous in the districts of Shivamogga (20,422.82 ha), Uttara Kannada (17,009.04 ha) and Chickmagalur (6,858.20 ha). However, the actual extent of plantations raised in the state would be higher than what has been reported in the KSRSAC assessment, as plantations are felled and replanted with a rotation of about 8-10 years. Besides, acacia plantations planted in smaller gaps within forest look like natural forest. In some acacia plantations, indigenous species have been introduced in the intermediate stage (after partial removal of some acacia trees); such plantations also appear like natural forest.

11.17. One significant outcome of introducing *Acacia auriculiformis* in the Western Ghats region of Karnataka has been the rapid increase in the availability of biomass in the form of fuel wood, timber and leaves which are very much required by the people living in the neighboring villages and towns. Another important outcome is the increased availability of pulpwood required by the pulp based industries. The plantations raised and managed during the last thirty-five years have contributed a lot in satisfying these needs of the society. Without these plantations it would not have been possible to protect the nearby natural forests which would have had to bear the brunt of the severe biotic pressures. By employing methods of trial and error, the Forest department has also been able to evolve innovative planting techniques to improve the quality and nature of the plantations in keeping with the requirement of improving the site conditions to a level conducive to growth and regeneration of indigenous species.

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INTRODUCTION OF KAMARA IN DRY ZONE AFFORESTATION

Kamara or anjan (*Hardwickia binata*, family *Fabaceae* sub-family *Caesalpiniodeae*) is a common tree species in the dry deciduous and scrub forests of Karnataka. Its natural range in the state extends across the eastern plains, from Belagavi in the north to Chamarajanagar in the south. It occurs in the forests of the districts of Belagavi, Bagalkote, Gadag, Ballari, Chitradurga, Davanagere, Tumakuru, Bengaluru, Mandya, Mysore and Chamarajanagar. In its natural home, kamara is perhaps one of the most dominating species among its associates. The species often occurs in gregarious patches. It is a moderate-sized to large, hardy, handsome and graceful tree with drooping slender branches and bilobed, greyish-green leaves (red when young) and can grow up to 25-30 m. It has a clean cylindrical bole that can be up to 15 m high. However, in poorer soils the tree branches low and produces a shorter bole.

12.2. Kamara is a characteristic tree of the dry deciduous forests and can grow on shallow, gravely soils. It grows best on sandstone, conglomerate, quartzite, granite and schist, with an overlying soil of sandy loam. The species thrives in a dry climate characterized by a long drought, scanty to moderate rainfall and intense heat during the hot season. It prefers a mean annual rainfall of 500-1000 mm and grows best in areas where annual daytime temperatures are within 16-38°C. However, this resilient and hardy species is capable enough of surviving in as scanty rainfall as 250 mm per annum and can withstand as high a temperature as 45°C. The species has the unique ability to thrive on a dry climate and to establish and grow on dry shallow soil and rocky ground where most other species would struggle, wither or succumb. Kamara is a moderately light demanding species although the young trees can withstand some shade. The species tolerates acidic to neutral soils.

12.3. One very significant characteristic of kamara is its taproot system which has the ability to penetrate hard soil and fissures in solid rock. Because of this special ability, the species does not require deep overlying soil to establish. In case of a naturally regenerated seedling, the shoot (stem) usually dies back annually during the early years of development of the taproot. Young seedlings of the species are sensitive to fire, but recovery is good thanks to the robust taproot system. The species is known to be sensitive to frost; however, frosty weather being almost non-existent in Karnataka, there is no threat to the species.

12.4. With a specific gravity of 0.73, kamara is one of the hardest and heaviest timbers found in India [Nagasampige (*Mesua ferrea*) or Iron wood, considered to be the hardest and heaviest in India has specific gravity of 0.83-0.85]. The timber is close-grained, durable and termite resistant. It is used for beams and mine props,

bridge and house construction, agricultural implements like cart wheels, oil mills, pestles and ploughs. The tree provides excellent firewood and good charcoal. The leaves, succulent stems and twigs serve as fodder for livestock. Oleo-resin extracted from the heartwood is used in manufacture of varnishes. The bark of the tree yields a strong fiber and is used for making ropes. Branches are much lopped for manure; leaves can be used as mulch. As kamara tree has a deep rooting system, it does not compete much with agricultural crops grown near it. It therefore has a potential as an agro-forestry species.

12.5. The soil and climatic conditions obtaining in extensive parts of the vast eastern plains of Karnataka are ideal for kamara, as the ecological needs of the species are largely met with in these areas. The success of the species can be further enhanced by taking up good soil preparation before planting. In the dry and refractory areas of the state, the use of mechanical devices for digging/ripping the soil for formation of pits and trenches has become quite common. Such mechanical methods help in piercing or ripping the ground to better depths thereby loosening the soil more effectively. It also helps in conserving whatever precipitation is received in the rain-deficient areas. This type of soil preparation facilitates the development of the taproot system of the kamara seedlings which can establish well with ease.

12.6. Because of its hardiness and resilience to survive in adverse conditions, kamara has become an important species for afforestation in the eastern plains. Very good results have been obtained in Bagalkot, Belagavi and Ballari districts where kamara has been planted since many years. In Ballari forest division, kamara has become the principal species for afforestation. The decision to introduce kamara was perhaps owing to its visible success in a large number of plantations raised during the last 15-20 years in the division. The species has come up well despite adverse biotic factors and harsh climatic conditions. In certain regions of Ballari division, kamara plantations have transformed barren and degraded areas into impressive forest.

12.7. Kamara is now being increasingly introduced in other districts such as Chitradurga, Davanagere, Tumakuru, Chikkaballapur, Ramanagara, Kolar, Mandya, Bidar, Raichur and Chikkamagaluru (Kadur). The species may also be tried more liberally in the districts of Gadag, Haveri and Bengaluru Rural, and in parts of Hassan (Arasikere) and Chikmagaluru (Kadur-Ajjampura-Shivani) districts where the soil and climatic conditions are favorable to the species.

12.8. Although kamara seedlings may initially suffer some damage due to grazing and browsing, the usual protection measures like fencing and watch and ward provided to plantations for three/four years can keep the problem in check. Going by the success of the plantations in Ballari and other districts where pressure

from cattle, especially from goats and sheep, is quite high, this problem appears to be manageable. After four-five years of moderate protection, the species can withstand adverse biotic and climatic conditions quite well. Subsequently, fire protection measures during the hot, dry season and having a check on lopping of the trees for fodder will ensure development of the plantation into a forest. Although the species is gregarious in nature, it does not come in the way of regeneration of other species in the area. Hence, the species can be mixed with other species considered suitable for the area of planting.

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DEVELOPMENT AND MANAGEMENT OF SANDALWOOD

Sandalwood (*Santalum album*) occupies a place of pride in Karnataka. It is a valuable tree associated with Indian culture. The fragrant wood is a highly revered commodity for religious purposes. It has been an important commodity for export for centuries. Traditional artisans (*Gudigars*) fashion the wood into exquisite handicrafts. Its aromatic oil is widely used in perfumery and pharmaceutical industries.

13.2. Sandalwood came into prominence during the rule of Tippu Sultan, the ruler of Mysore kingdom (1782-1799). Recognizing the economic importance of sandalwood, he had declared sandalwood tree as a royal tree and took over sandalwood trade of the state on a monopoly basis. Sandalwood continued to be the property of the state during the subsequent rule of the Maharajas of Mysore. This practice was continued at the time of formation of Karnataka and a provision making sandal tree exclusive property of Government was incorporated in the Karnataka Forest Act, 1963 at the time of its formulation. It was only from the year 2001 that by an amendment to the Karnataka Forest Act, 1963 (Act 20 of 2001) the ownership of sandalwood has been vested in the owner of the land.

13.3. Extraction of sandalwood was an important economic activity in the princely state of Mysore. Prior to the establishment of the Forest department in 1864, there was a separate Sandalwood department which had supervised extraction and disposal of sandalwood. With the formation of the Forest department, the work of extraction and disposal was taken over by the Forest department which streamlined the entire process of collection, transportation, preparation, dressing and auction. At that time, only dead and diseased sandalwood trees were extracted. Realizing the value of sandalwood, the department changed the method of extraction from that of cutting to uprooting of trees. The department also introduced a new classification comprising of eighteen classes depending upon quality, soundness, proportion of heartwood/sapwood, root/stem, etc. The system of giving bonus for the extracted sandalwood was introduced as an incentive to the land holder. Considering the importance of sandalwood and the need to protect the species, a number of forests having good stocking of sandalwood were notified as 'Sandal Reserves'.

13.4. The Forest department took interest in organized management of sandalwood and its propagation. Major Hunter, the first Conservator of the Forest department was one among the first to have recognized the need of host plants for the

growth of sandal. (Sandal is a semi-parasite and depends on other plants through haustorial connection for partial fulfillment of its nutritional requirement). The department was also concerned about the large-scale mortality of sandalwood trees that had taken place because of the 'Spike disease'. Serious efforts were made by the department in encouraging research works to control the dreaded disease.

13.5. Sandalwood was found in most of the deciduous forests of Mysore kingdom. As such, extraction of sandalwood was carried out throughout the state. Most of the working plans written for the sandal growing forests had a sandal extraction working circle with a number of felling series prescribing harvest of dead, dying and spike infected sandal trees. Generally a felling cycle of five years was prescribed. Artificial regeneration was mostly by dibbling of seeds.

13.6. Although Mysore kingdom was the principal producer/supplier of sandalwood, other areas which later integrated to form Karnataka also had forest areas harboring sandalwood. The dry deciduous (teak pole) forest areas of Nagargali (Belgaum division), Haliyal (Haliyal division), Mundgod (Yellapur division), Dharwad and Kalaghatgi (Dharwad division), etc. of Bombay presidency had fairly good distribution of sandalwood trees. Similarly, Bellary district of Madras presidency had sandal trees mostly in Hospet and Sandur taluks. Dr. Dietrich Brandis, Inspector General of Forests, who had toured the forests of Bellary during 1881, had advised that sandal should be reserved along with teak and kamara. Kollegal areas of Madras presidency were very famous for sandalwood. Kodagu state had sandalwood trees mostly in Kushalnagar, Somwarpet and Shanivarasanthe areas. All the sandal bearing forest areas of the two presidencies and Kodagu state were worked under respective working plans wherein sandalwood extraction/plantation working circles and felling series had been constituted. The working circles had given prescriptions for extraction of dead, dying and diseased sandalwood trees with a felling cycle of five years. In some of the working circles, provision was made for clear felling of forest followed by artificial regeneration of sandalwood by dibbling of seeds along with hosts. Dibbling of sandal seeds in bushes was also prescribed. The results of artificial regeneration were reported to be unsatisfactory. The districts of Bidar, Raichur and Gulbarga of old Hyderabad state had very sparse distribution of sandalwood trees in some of their relatively better deciduous forests. Organized working of sandalwood was not prescribed in the earlier working plans for these forest areas due to non-availability of sufficient material for harvest.

13.7. As we have seen, management of sandalwood bearing forests in the pre-integration era mostly consisted of organized exploitation of mature sandalwood and disposal of the material. Serious attempts at artificial regeneration of the species do not appear to have been made during those days. Although prescriptions had been made in the working plans for artificial regeneration, these were either not followed properly or adequate follow-up measures to nurture the incoming crop were not taken. As a result, no report about splendid performance of the species in plantations is available on record. Another reason for not carrying out extensive artificial regeneration could have been because of the fact that natural regeneration of sandal is quite satisfactory in any sandal bearing forest which has been protected well from fire and excessive grazing.

13.8. The trend of management of sandalwood in the post independence era also continued in the same lines as before. Extraction of sandalwood was carried out as per prescriptions given in the working plans. Detailed and consolidated guidelines for the entire state were incorporated in the Karnataka Forest Code, 1976 outlining the procedure regarding exploitation of sandalwood including enumeration, marking, extraction, conversion, weighment and delivery. Propagation of the species was mainly through dibbling of sandal seeds in sandal extracted pits as well as under bushes. Planting of container-raised seedlings was also done in limited scale. Dibbling of seeds was carried out in the mounds of trench-mound plantations in some areas, which initially gave very promising results and continued to fare well only in areas protected from fire and grazing.

13.9. Due to increasing demand of sandalwood from various users, its non-availability in the open market and limited availability in the government depots (sandal kotis), the price of sandalwood had been rising sharply. This had led to sharp increase in smuggling of sandalwood from the forests. Because of the scattered distribution of mature sandalwood trees in the vast forest areas, the trees were exposed to illicit cutting and removal. Sandalwood smuggling became very rampant in the prime sandal growing areas of the state including Shimoga, Bhadravathi, Sagar, Bangalore, Mysore, Chickmagalur, Hassan, Kodagu, Dharwad, etc. In spite of strengthening of the enforcement and protection wings of the department supported by appropriate amendments to the Karnataka Forest Act, 1963, the efforts made by the department to control smuggling had partial success. As a result, the occurrence of sandal in various forest divisions came down sharply. All the mature trees had either been extracted in the past or were smuggled out. During the 1980s, availability of mature sandal trees in the forest had become so scarce that much of the departmentally extracted sandalwood comprised of stumps of already

removed/smuggled sandal trees or mature trees extracted from private lands including coffee estates. The cost of uprooting of old stumps was earlier very low. The rates of departmental extraction had not been revised for a long time. Besides, the rates prevalent were only for smaller stumps and there were no rates for stumps of bigger size. This had resulted in the staff not evincing sufficient interest in the extraction and removal of sandalwood stumps from the forest. Stumps of bigger size had simply been left in the forest due to prohibitive cost of extraction. With the revision of the schedule of rates (SR) for such activities in the early 1980s, there was spurt in extraction of sandalwood and it sustained the sandalwood depots for a number of years.

13.10. While increased smuggling activities had drastically reduced the availability of sandalwood in Karnataka's forests, which only a few decades ago were abundant with the species, there were other factors that had contributed to its depletion. They include uncontrolled grazing and browsing by domestic cattle especially goats, repeated fires, lopping for fodder, diseases and pests, etc. Besides, naturally growing sandalwood trees sometimes require intervention in the form of climber cutting, pollarding of over-topping branches of adjoining trees. These cultural operations were carried out in very limited scale in identified sandal areas or plantations, but the vast forest areas harboring sandal growth here and there were generally neglected.

13.11. In order to encourage propagation of sandalwood in the forest, the Forest department had introduced a scheme in the early 1980s called Sandal Estate scheme which focused on artificial regeneration of sandalwood in potential sandal growing areas. A few posts of RFOs were also created specifically for supervising execution of the scheme. The department took initiatives in developing nurseries for raising sandal seedlings in poly-bags. Plantations were raised in some of the well-known and potential sandal growing areas. Dibbling of sandal seeds was also carried out under the scheme. Besides, the field staff members, especially the forest watchers, were encouraged to take up dibbling of seeds under bushes and in hilly areas during the pre-monsoon season. The result of the 'Sandal Estate" scheme was mixed. While plantations came up well in some areas, they were not so encouraging in others. Besides, the funds provided under the scheme were not sufficient to raise and manage the plantations in the 'estate management' concept. There was not much scope for nurturing the plantations after three-four years. The most glaring draw-back was the absence of a fool-proof barricading system. The traditional barbed-wire fencing which lasts for three-four years was not sufficient for the sandal plantations which were to be managed as estates. The 'Sandal Estate' scheme was discontinued after a

few years. However, the department continued with the practice of raising sandal seedlings either for pure plantation or for mixed plantation under various schemes.

13.12. Although re-establishment of sandalwood has been an important goal of the Forest department, attempts at developing pure sandal plantation from poly-bagged seedlings have given mixed results. The number of successful pure sandalwood plantations raised from nursery-raised seedlings is not many. Sandal has done reasonably well when introduced in mixed plantations in ideal, well drained terrain with moderate rainfall. But the best result in case of sandal so far has been from dibbling of seeds in its natural habitat. There are also numerous examples of sandal naturally regenerating into handsome and luxuriant patches across the state. The department made a renewed effort in reviving the concept of raising sandal trees in the form of an Estate about a decade and a half ago with the objective of protecting the existing natural sandal stands and assisting these in further propagation and growth. The result of this initiative has been quite encouraging. At present the department under a new scheme titled 'Siri Chandana Vana' has been focusing on such sandal areas and improving their status further by providing very secure barrier such as chain-link fence or stone/brick wall and also by planting and/or dibbling seeds wherever necessary. The plantations are provided rigid protection by engaging a number of watchers who keep watch throughout day and night. In some of the plantations, protection is further strengthened by engaging squads of native dogs.

13.13. The new concept of forming sandal estates has become popular throughout the sandal growing areas of the state. Some of the successful sandal estates so far developed in the state are: Bellary circle (Gunda RF in Hospet range), Belagavi circle (Jalaga in Khanapur range and Kadabagatti in Gokak range), Bengaluru circle (Sulalappanadinne SF of Chickkaballapur range, 2011/2012 plantations of Bangarapet range and Turahalli plantation of Bangalore Rural division), Canara circle (Oralgi of Katur range), Chamarajanagar circle (Chengadi in Kollegal division), Chickmagalur circle (Tangli sandal reserve in Kadur range and Karkeshwara plantation in Koppa range), Dharwad circle (Gungargatti plantations of Dharwad range and Kalikatti plantations of Dhunshi range), Hassan circle (Kamalapura SF of Kunigal range and Madhugiri SF of Koratagere range), Kalaburagi circle (Honnekeri plantations in Bidar range), Mysore circle (Elawala and sandal oil factory compound in Mysore range and Mummadikaval of Periyapatna range) and Shimoga circle (Yerekatte in Shikaripura range and Mavinakatte in Bhadrapura SF of Shanthisagar range). The list of areas given here is not exhaustive but indicative of the efforts made by the Forest department in preserving and developing some of the sandal growing areas in the state.

13.14. In view of the success achieved in the new method of developing sandal estates, it is desirable that similar efforts are replicated in more and more sandal bearing forest areas in the state. All the areas in the forest divisions where sandal has been found to regenerate profusely should be identified, surveyed and mapped. Important operations to be carried out in such areas are protection from fire, grazing and theft. The identified areas should be effectively fenced with chain-link mesh embedded in concrete foundation or with concrete wall. As this item of work is quite expensive, it will not be possible to barricade all the identified areas in one go. Areas with relatively older sandal trees should be barricaded early. For each such unit, day and night watch and ward should be provided. The requisite ration should be provided to the watchers. Accommodation should be provided within the area for the watchers to take rest in turn. Sandal saplings/seedlings, which are suppressed because of over head shade or due to the presence of undesirable growth, should be made free. Excess over head branches of other trees should be pruned to ensure sufficient light to the saplings/seedlings. Climbers should be cut and obnoxious weeds hindering the growth of sandal should be removed. The seedlings, which are young, may be provided with soil working and manuring. If the density of existing sandal seedlings and the natural growth of the host plants are not found sufficient, dibbling of seeds of sandalwood and planting of sandal seedlings with host plants may be taken up in the open areas.

13.15. Sandalwood tree starts flowering quite early in its life, within five/six years. It flowers and fruits twice a year i.e. in September/October and in March/April. The seeds of both the seasons perform alike. Birds are fond of the ripe fruits of sandalwood. Natural dispersal of seeds and spread of the species effectively takes place through birds, provided the area is free from recurrent fire and browsing animal. Seed that finds its way into a thorny bush has a better chance of growing into a tree because of the protection afforded by the thorns. While a sandalwood tree starts producing viable seeds within five/six years, formation of heartwood takes place quite late, after the tree is at least fifteen years old. Thus a sandalwood tree is quite safe from the axe of a smuggler during its early age up to about fifteen years. This practically ensures that every healthy sandalwood tree will be able to flower and fruit at least for ten years (twenty times). This special attribute ordained by nature is very significant for the survival and propagation of sandal against heavy odds.

13.16. The benefit of natural regeneration of sandal is not restricted to forest areas only; any sylvan ecosystem, even a small garden with a tree, may be good enough for a sandal seed to germinate and grow, provided there is adequate protection. Profuse regeneration of sandal is visible in and around Bangalore city in

extensive non-forest areas which have been protected by some form of barricading. Most of the defence establishments, public sector undertakings, educational institutions and other public / private institutions which have expansive lands covered with gardens, tree parks, woodlots, etc. have sizeable population of sandal trees of all ages. The same is true for all the non-forest areas in Karnataka which have sandal-bearing forest areas in the vicinity.

13.17. In an earlier chapter (chapter 3), a number of steps taken by the Forest department to popularize planting and protection of sandalwood trees in private land have been highlighted. A number of amendments have been made to the Karnataka Forest Act, 1963 and the procedure of extraction and disposal of sandalwood has been streamlined. The need of filing declaration by the private owner with the Forest department about the sandalwood trees standing on his land has been removed. The obligation on part of the owner to report all cases of damage or theft of sandal trees in his land to nearest Forest or Police Officer has also been done away with. A time frame has been fixed for the Forest department for giving permission to the owner for felling sandal trees. It has also been laid down that permission for felling of trees which are wind-fallen, trees that constitute a danger to life or property, trees that are required to be removed for extension of cultivation shall not ordinarily be refused. The grower/owner has been given the freedom to sell his sandalwood either to the state government or to any state government undertaking notified from time to time. Provision has been made for extraction, stacking and transport of sandalwood by owner himself under supervision of the Forest department. It has been stipulated that the value of sandalwood shall be paid to the owner as soon as possible but not later than three months from the date of receipt of the material in the depot. The rates at which value of sandalwood has to be paid to the owner have to be fixed for each financial year based on average prices obtained for sandalwood in the auction sales. The above initiatives of amending the provisions of the Forest Act and Rules and streamlining the procedure of extraction and disposal of sandalwood were with a view to removing people's fear and apprehension of owning the species and popularizing its planting in private lands. These initiatives appear to have born fruits as people are taking increasing interest in planting sandalwood in their lands. Although the Forest department will continue to pursue development and protection of the sandal growing areas of the state under the programme 'Siri Chandana Vana' or similar schemes, it is felt that the best option to raise sandal is through private planting with supply of good quality seedlings and provision of incentives under the "Krishi Aranya Protsaha Yojane".

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DEVELOPMENT AND MANAGEMENT OF BAMBOO

In Karnataka, bamboo is found mainly in the moist and dry deciduous forests from Uttara Kannada and Belagavi districts in the north to Mysore and Chamarajanagar districts in the south. In Bidar, Raichur, Gulbarga, Bagalkot and Vijayapur districts, its presence in the natural forests is negligible except along some stretches along the banks of Tungabhadra, Krishna and other rivers. In Karnataka, bamboo does not occur as a pure crop, although in some dry deciduous forest patches such as in Joldal area of Bhadravathi division, it occurs almost gregariously. It is found to occur even in low rainfall area of Sandur taluk of Bellary district. It is found distributed from sea level up to 1300 m.

14.2. In Karnataka, bamboo occurs mostly as a mixed crop along with various deciduous tree species. It is an important associate of teak. On a rough estimate, about 60% of the bamboo bearing area is covered by medri bamboo (*Dendrocalamus strictus*). Dowga bamboo (*Bambusa bambos*) occupies about 35% of the area. The remaining area is covered by other species including Shamegala (*Oxytenanthera* species). One variety of bamboo locally known as Garte (*Oxytenanthera* species) used to occur in the Gangooru / Ubrani forest areas of Bhadravathi division. In the working plan for old Hunsur division written by Mr. U.T. Alva, there is a mention of the presence of Garte bamboo in the higher reaches of Doddaharave and other forests. One very tall variety of Medri bamboo occurs in certain forest areas of Tanigebylu range of Bhadravathi division which was earlier in great demand from the farmers of Tumkur, Arsikere, etc. This bamboo was popularly known as 'coconut plucking bamboo' as it was used for that purpose. The farmers used to transport these long bamboos in bullock carts, as it was not possible to transport in trucks.

14.3. Bamboo is also found growing in farmlands and homesteads. What are found in the farmlands, mostly along stream margins and boundaries, appear to be relics of old forests. In the coastal districts of Uttara Kannada, Udupi and Dakshina Kannada, farmers cultivate *Oxytenanthera* species. In the Marihal village near Belgaum, *Oxytenanthera* species is grown in the homesteads and farmlands. It is locally called Marihal bamboo. In Kodagu district *Dendrocalamus brandisii* and *Dendrocalamus gigantia* are cultivated and are becoming popular. Of late planting of *Oxytenanthera stocksii* is becoming popular in the districts. Species such as *Bambusa tulda*, *Bambusa balcooa*, *Bambusa polymorpha*, etc. have also been introduced by the Forest department in experimental plots. Yellow bamboo (*Bambusa vulgaris*) is planted for its attractive color and green stripes. This is a common plant grown in the compounds of many houses and gardens in Karnataka.

14.4. As per the State of Forest Report 2011 published by the Forest Survey of India, Dehradun, Karnataka had an area of about 8,18,600 hectares under bamboo, constituting about 21% of the State's recorded forest area. The distribution of bamboo bearing area by density was as follows: (a) Pure bamboo (Nil), (b) Dense bamboo (1,92,500 ha), (c) Scattered bamboo (4,39,000 ha), (d) Clumps hacked (29,700 ha) and (e) Bamboo regeneration (1,57,400 ha). The equivalent green weight of bamboos in the state was 151.60 lakh metric tonnes (MT) comprising of 104,36,000 MT of green bamboo and 47,24,000 MT of dry bamboo. As per the State of Forest Report 2017, the bamboo bearing area within forest area of the state has registered increase to 10,442 square kilometers. The total green weight equivalent of bamboos has been assessed as 165.38 lakh metric tonnes.

14.5. Considerable extents of bamboo bearing forests of Karnataka are included in the protected areas of the state such as tiger reserves, national parks and wildlife sanctuaries. It is estimated that more than 60% of the bamboo forests are in the protected area network. As extraction of any forest produce is prohibited from such areas, a large share of the growing stock of bamboos is not available for traditional bamboo management. In any case, bamboo is an important source of food/fodder for elephants and other herbivores. The management plans for the protected areas aim at protection and development of the bamboo forests so that the food and fodder needs of the herbivores are met to a considerable extent.

14.6. The growing stock of bamboo in the forests outside the protected areas is about 50 lakh metric tonnes (MT). Considering a harvesting cycle of three or four years, the annual yield should have been about 12-15 MT. However, the present annual yield is not even one lakh MT. Working in bamboo forests is limited to extraction of green bamboos for supply to the Medars and Buruds. Some quantities of dead and dry bamboos are salvaged for supplying to the Mysore Paper Mills (MPM) at Bhadravathi.

14.7. There are adequate bamboo resources in the state. However, working of the bamboo forests has not always been ideal. Some of the bamboo forests have been over-exploited leading to depletion of stock; some have not been worked at all, or worked inadequately, resulting in congestion and retarded growth of the crop. Some bamboo forests have been worked inappropriately resulting in a lot of damage to the crop. The present condition of bamboo growth is not very good due to congestion and faulty extraction. Bamboo clumps have been hacked indiscriminately by various users. (The term 'clump' refers to the entire group of bamboos coming out of one root system commonly known as 'rhizome'. Each individual bamboo in the clump is known as 'culm'.) People have a tendency of removing bamboo culms by cutting at

considerable height as it is difficult to approach the base of the clumps because of congestion (as in the case of medri bamboo) or because of thorns (as in the case of dowga bamboo). Due to congestion, large quantities of bamboo dry up posing a serious threat to the resource. Fires have often occurred in these areas affecting the natural regeneration. Grazing has also seriously affected the regeneration status of our bamboo forests.

14.8. Scientific management of bamboo is faced with certain inherent problems like difficulty in supervision over a fairly large area and consequent failure to ensure correct treatment to each clump. The most ideal way of harvesting a bamboo clump is to selectively cut and remove the mature culms and retain the immature culms for further growth and future harvest. A three year old culm is considered as mature and ready for harvest. The correct method of cutting of culms from a clump is as important as the felling cycle for the treatment and development of the clump. 'Felling cycle' refers to the frequency with which a clump should be approached during its lifetime for harvest of culms. For intensive management of bamboo, as in the case of bamboo plantations or bamboo grown in private lands, a felling cycle of one year may be adopted, as each clump may be worked every year intensively by removing the mature culms and making place for new recruitments. For extensive bamboo forests, it is not possible to approach each clump on a yearly basis for harvest of mature bamboo culms. Therefore, the working plan of the forest prescribes a felling cycle of 3/4/5 years considering the distribution, growth and quality of bamboo in the forest and administrative convenience. Under this arrangement, the forest is divided into 3/4/5 equi-productive parts and the bamboo clumps in each part are worked for harvest on a rotation of 3/4/5 years.

14.9. Earlier the paper industry in the state was allowed to harvest bamboo directly from the forest. The paper mills such as the Mysore Paper Mill, Bhadravathi, the West Coast Paper Mill, Dandeli and the Mandya National Paper Mill, Mandya were allotted forest areas from various forest divisions for bamboo extraction. The forest area allotted for extraction of bamboo in a forest division was worked by the paper mill under the guidance and supervision of the Forest department in a manner prescribed in the working plan. The paper mills were responsible for protecting the forest allotted to them from fire. The West Coast Paper Mill, Dandeli had taken up fencing of some of the potential bamboo growing areas to assist growth and regeneration. They had also taken up bamboo planting in some forest areas.

14.10. In the beginning, the paper mills were allowed to work for bamboo extraction on long-term lease basis at fairly concessional rates. This arrangement was quite favorable to the paper mills and they were able to extract and transport the raw

material even from forest areas situated far away from the factory sites. This ensured that almost all the bamboo bearing forests of the state were worked for bamboo extraction and supply to the paper factories. Extraction of green bamboos required by the Forest department for supply to Medars and Buruds was also done by the extraction agencies. They transported the green bamboos to the government depots at pre-decided rates.

14.11. The Karnataka Forest Act, 1963 was amended in 1981 (Act No. 1 of 1981) enabling the state government to recover realistic value for forest produce supplied to industries irrespective of past commitments regarding rates. This resulted in the withdrawal of the concessional rates at which the paper mills were earlier able to procure bamboo. With the rise in the cost of the raw material, the paper mills became choosy in extraction and transportation of bamboo from the forest. They concentrated only on the forest areas located near the factories in order to peg down the transportation cost. As a result, the areas far away from the factories were not worked for bamboo extraction. The Forest Act was further amended in 1984 (Act No. 11 of 1984) by virtue of which all forest leases to industries were abridged to five years and the supply of raw material was made 'subject to availability' instead of the quantity committed earlier. In 1989, the government decided to stop all concessions to wood-based industries and they were required to obtain their requirements in open auction.

14.12. The new policy of the government of not allowing extraction and removal of raw materials directly from the forest affected all the forest based industries, but the paper industry was the worst hit. This was mainly because of the fact that bamboo is a 'high-volume and low-value' product as compared to timber. After introduction of the ban on direct supply of bamboo from the forest, the Forest department started departmental extraction of bamboo and its transportation to the government depots for auction. However, the up-set price of the material for auction, which included the cost of extraction, loading, transportation, unloading, stacking and seigniorage rate, was high compared to what the paper mills were ready to pay. The base price fixed was not economical to the paper mills considering that the entire process now involves double handling of the material and there is also considerable loss of weight of the material due to its drying up during the lengthy process starting from extraction to auction sale to lifting of the material from the depot. The department also faced a peculiar situation in which material extracted and brought to the depot at considerable expenses could not be disposed off and there were no alternative takers for such material. Being a fast perishable commodity, especially when exposed to the sun and rain, the bamboo stacks with shrinking volume became a cause of concern

and audit objections. Under these circumstances, departmental extraction of bamboo for supplying to paper mills became a non-starter. Departmental extraction was therefore limited to supply of green bamboos to the Medars and Buruds.

14.13. Not being able to procure bamboo at a price of its choice, the West Coast Paper Mill, Dandeli gradually switched over from bamboo-based paper technology to pulp wood based technology. The factory now procures about 10 lakh MT of farm grown material such as eucalyptus, acacia and casuarina. The Mandya National Paper Mill which was taken over by the Hindustan Paper Corporation (HPC) in 1974 was closed down during 1993. The Mysore Paper Mill, Bhadravathi, was permitted by the state government to procure specifically allotted quantity of dry bamboo directly from the forest. This special permission was given to the paper mill in view of the fact that it is a government owned company and the extraction of the allotted quantity of bamboo is done under the supervision of the company's forestry wing which is manned by forest officers drawn on deputation from the Forest department. The Forest department also permits the Karnataka Forest Development Corporation (KFDC) and the Karnataka State Forest Industries Corporation (KSFIC) to undertake extraction of bamboo from the forest and supply to the paper mills. However, such supplies have been very limited and not comparable to what is harvestable from the forest.

14.14. One of the challenges of management of bamboo forest is the management in the post-flowering period in which the entire crop dies and dries. Dowga bamboo flowers in a cycle of 30-45 years. The flowering cycle of medri bamboo is less predictable, varying from 20 to 65 years. The last flowering of dowga bamboo in Karnataka started during 2008-09 and continued for over four/five years across most of the dowga bearing forests of the state. Medri bamboo flowering has been taking place during different years in different parts of the State. In Bangalore areas it flowered during 1990s while in Kanara circle, it flowered in the early 2000s. Flowering cycle of Medri bamboo has also been altered by the fact that it was introduced in certain areas through artificial regeneration. Besides, the species quite often exhibits the behavior of sporadic flowering which results in some bamboo regeneration in the surrounding areas.

14.15. Flowering or no flowering, strategy of management of a bamboo forest in the wildlife zone has to be to protect it by any means. No doubt, post flowering, very strict measures have to be adopted in the wildlife areas to ensure that the dead bamboos do not catch fire. Protection has to be foolproof for about four to five years until the dry bamboos decay into soil. This also ensures excellent regeneration of the incoming bamboo crop besides enriching the forest floor.

14.16. As regards the bamboo bearing forests outside the protected area network, flowering poses very serious threat of forest fire, as these forests are more vulnerable to human interference. During this period, the Forest department gears up for higher level of extraction of both green and dry bamboos, but given the constraints of departmental extraction already mentioned, such efforts are restricted to the demands of the day. Consequently, large volumes of dead bamboo have to be left in the forest and all-out efforts are made by the departmental staff to prevent the dead bamboos from catching fire. By and large, the department has been successful in this effort since the last flowering of dowga bamboo started in 2008-09 and very good regeneration of the species has been noticed in most of the forest areas. The assessment of bamboo areas published in the SFR 2017 confirms that bamboo areas of the state are by and large safe.

14.17. One area of major concern is the gradual depletion of medri bamboo (*Dendrocalamus strictus*) in our forest. After every flowering season, some of the traditional medri bamboo growing areas do not harbor the species as they did before the flowering. The species by nature grows in drier localities. These areas, being generally located near habitations, are very prone to repeated fires, over-grazing and human interferences. If such areas are not adequately protected from fire and grazing after the flowering season, they tend to lose out in their ability to hold on to the species. By comparison, the moist deciduous forests are relatively less prone to fire hazards, have better soil and are less severely affected by damages due to grazing. As a result, natural regeneration of dowga bamboo is by and large quite satisfactory throughout the state. As against this, many of Karnataka's forest areas which were known to be rich in medri bamboos in the past either do not have any trace of the species now or have very scattered presence. The species has become very scanty in the drier forests of the state such as in the districts of Chamarajanagar, Mysore, Bangalore, Haveri, Dharwad, etc. The species almost vanished from the forest areas of Haliyal range in Uttara Kannada district in the 1970s although it had very prolific presence in the adjoining forest areas of Sambrani and Bhagawathi ranges. However, after the last flowering in the early 2000s, the species appears to have become sparse in the Sambrani-Bhagawathi areas also although these areas were famous for high quality medri bamboos and used to cater to the needs of green bamboos required by the Medars and Buruds of Hubli-Dharwad areas. The only solution to this problem is to re-introduce the species by means of artificial planting as well as sowing, and to provide rigid protection to the areas from fire and other forms of biotic interferences. Fire and over-grazing appear to be the chief causes for depletion and eventual decimation of the species. How the species has bounced back on its own after the last flowering in the protected environments of the Bannerghatta national park is to be seen to be believed.

14.18. As regards taking up plantations of bamboo, it may not be necessary in the forests where the species already exists in adequate proportion. It is also noticed that whenever any forest area in the bamboo bearing zone is given protection by closure, the first species to respond positively is bamboo. To enhance productivity of bamboo, soil working to the existing crop may be good enough for such areas. However, while taking up plantation under the 'assisted regeneration' model, planting of seedlings or rhizomes of bamboo may be carried out along with other species if the plantation site is deficient in bamboo. It is advisable to take up intensive plantation of medri bamboo in those forest areas where the species was known to have existed in the past. The Forest department has also taken up plantations of shamegala or marihal bamboo (*Oxytenanthra* species) in certain parts of northern Karnataka and good results have been achieved. It is however necessary to plant the species in relatively better soil and to ensure continuous maintenance of the crop for better and sustained yield.

14.19. In spite of bamboo being a product of multi-purpose utility and of vital importance to the rural economy, popularity of bamboo as a farm forestry or agro forestry crop has not picked up in the state. Except for shamegala which is traditionally cultivated in the homesteads and edges of gardens in the coastal belt and in a few *malnad* taluks, instances of bamboo having been planted in farmlands by choice are rare. While bamboo can be cultivated around agricultural lands which receive moderate to heavy rainfall, the peripheries of irrigated lands are very ideal for taking up bamboo cultivation, especially with species such as shamegala or medri bamboo. Clumps of these species do not occupy large space; their culms are easy to harvest and, being easy to work with, are also user-friendly.

14.20. Earlier in the *malnad* areas, there was a practice of raising dry bamboo nurseries in open forest patches. This practice was somewhat akin to the practice of raising dry teak nursery beds. Bamboo seeds were sown in raised beds during monsoon season and seedlings were allowed to grow in the beds for at least one year. The seedlings were grown on raised beds as it facilitated easy removal of the bamboo rhizomes. Well-developed rhizomes would be removed from the beds during rainy seasons for next 2/3/4 years for planting in various localities. Such rhizomes, on planting, used to throw up vigourous bamboo shoots with culm-size corresponding to the age of the rhizomes. Once abandoned, the nursery sites transformed into luxuriant bamboo patches due to the residual bamboo rhizomes. It is suggested that this practice be revived and continued.

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FORESTRY RESEARCH

The Karnataka Forest Department has a fairly long tradition of forestry research. In the early 1900s, the then Conservator of Forests and ex-officio Secretary to the Government of the princely state of Mysore, Mr. Muthanna had encouraged research works to control the dreaded 'Spike disease' which had seriously affected the sandalwood trees. During the year 1938, the Forest Research Laboratory was set up in Bangalore, which was the second forest research institute in the country after the Forest Research Institute at Dehradun established in 1906. The Forest Research Laboratory, Bangalore had carried out research works on various subjects including, investigation on Spike disease, finding alternative wood such as yethyaga (*Adina cordifolia*), buruga (*Bombax malabarica*) and sampige (*Michelia champaka*) for Battery Separators, development of tool handles with dindiga (*Anogeissus latifolia*) and dhaman (*Grewia tiliaefolia*), development of *Eucalyptus* hybrid, decorative small wood work, use of bamboo cellulose for rayon, work on lac development with host plants such as jalari (*Shorea talura)*, kusum (*Schleichera trijuga)*, bore (*Zizyphus jujuba*) and *Ficus* species, essential oils from *Bursera delpechiana* and *Pogostemon patchouli*. The Forest Research Laboratory was transferred to the Central Government in 1956. It is now under the Indian Council of Forestry Research and Education (ICFRE), Dehradun and has been renamed as Institute of Wood Science and Technology, Bangalore.

15.2. After Independence, the State government decided to have an officer exclusively to conduct and supervise forestry research and related works in the state. One State Silviculturist with headquarters at Bangalore was appointed during 1948. During early 1970s, two more posts of Silviculturists were created and the jurisdictions of the three Silviculturists were re-organized as follows: (1) Silviculturist, Southern Zone, Headquarters-Mercara (Madikeri), (2) Silviculturist, Central Zone, Headquarters-Bangalore, and (3) Silviculturist, Northern Zone, Headquarters-Dharwar. The Silviculturists were forest officers of the rank of Deputy Conservator of Forests (DCF). They were working under the supervision of the Conservator of Forests (CF), Research and Utilization with headquarters at Bangalore. Subsequently, one more post of DCF, Research with headquarters at Bellary was created by reorganizing the zonal jurisdictions of the Silviculturists. During the last two decades the Research wing has undergone significant transformation. It is now headed by an officer of the rank of Additional Principal Chief Conservator of Forests. The posts of Silviculturists / DCF, Research have been upgraded and re-designated as Conservator of Forests (CF) / Chief Conservator of Forests (CCF), Forest Research. There is also a Deputy Conservator of Forests with

headquarters at Bangalore who looks after various aspects of production, development and certification of seeds. In addition, there is an Assistant Conservator of Forests, Forest Utilisation with headquarters at Bangalore. The number of sub-divisions and ranges dedicated to forestry research has also increased over the years in keeping with the expansion of research activities of the department.

15.3. As per the recommendation of the third Silvicultural Conference held at Dehradun in the year 1929, concerted efforts were made to lay Tree Increment Plots in various parts of the country in order to study the composition and growth parameters of tropical rain forests. The idea of establishing permanent Preservation Plots representing various forest types for the purpose of scientific studies was also mooted in the same conference. During the period 1937-1940, seven Linear Tree Increment (LTI) Plots were established in the wet evergreen forests of Uttara Kannada, Shimoga and Kodagu districts of Karnataka. These LTI plots were located at Agumbe, Devimane, Katlekhan, Malemane, Kodkani, Bannadpare and Chippehole. During 1950, sixteen LTI plots were established in the moist deciduous forests around Dandeli of Uttara Kannada district under the guidance of Mr. Quereshi, the then Siviculturist, Pune. One of these plots has gone under submersion. The remaining fifteen LTI plots were located at Raulwada, Usoda, Shingatgeri, Karka, Bailpar, Veerampalli, Aurla, Shiroli, Phansoli, Jambagali, Kulgi, Bhagwathi, Adkehosur, Bhagwathi and Mainal. Five preservation plots were laid out in 1987 at Telageri, Devimane, Katlekan, Malemane and Kodkani. All these LTI and Preservation plots have been maintained by the Research wing by fixing number plates, boundary stones and name boards. Growth data is recorded from the trees in all the plots once in five years. The object is to study the diameter increment of different species under natural conditions. Besides, status of natural regeneration is also being studied in these plots. Studies like leaf litter collection have also been taken up in some of the LTI plots.

15.4. The Research wing had in 2016 carried out total enumeration of the tree species in the LTI plot at Agumbe. It has been found that as against 799 trees belonging to nine (9) species recorded during 1940, there are now 2,068 trees belonging to forty-seven (47) species in the plot. Earlier, the dominating species were *Poeciloneuron indicum*, *Dipterocarpus indicus*, *Palaquium ellipticum* and *Diospyros paniculata*. Now *Humboldtia brunonis*, *Poeciloneuron indicum, Litsea floribunda, Dipterocarpus indicus, Dimocarpus longan, Mastixia arborea,* etc. are dominating the plot. Hence over a period of time (75 years), many new species have appeared in the plot.

15.5. During the last few decades, the Research wing of the Forest department has made multidirectional efforts in tree improvement programme and has been able to achieve far reaching results. **Plus trees** (phenotypically superior trees i.e. trees with visible superior traits) of various economically and ecologically important tree species in different agro-climatic zones in the state have been identified for seed source as well as for mass multiplication through vegetative means. **Seed Mother Trees** of important species have been identified in the state to obtain good quality seeds. **Clonal orchards** for various species have been created for production of good quality seeds, conservation of superior germplasm and also for collection of material for vegetative propagation. The species include teak, tamarind, jackfruit, wood apple, seetaphal, *Carissa carandas*, nelli, bore, jamun, mango (Appemedi variety), honge, bevu, anjan, casuarina, eucalyptus, antawala, cashew, cane, sandal, garcinia, shivani, etc. **Seedling seed orchards** have been established for a number of species such as jackfruit, nelli, tamarind, jamun, bela or wood apple, sandal, bevu, bore, seetaphal, seege, antawal, wate, saldhupa, hebbalsu, hippe, bage, bilwara, nagasampige, mohagany, tare, honne, tapasi, matthi, beete, ashoka, hebbevu, balangi, etc. These are orchards raised with seedlings obtained from seeds of selected phenotypically superior trees. **Germ Plasm Banks** of a number of species such as tamarind, bore, seetaphal, teak, cane, undimara (*Calophyllum inophyllum*), Marihal bamboo, honge, Faizabad nelli, shivani, etc. have been established by bringing the species from different parts of the country and from within the state. Germ plasm banks are established by multiplying phenotypicaly and genetically superior parents by vegetative methods. This is done to preserve the genetic base of the species. These clonal banks form valuable source of superior genetic material for future multiplication. **Seed Production Stands** have been selected for a number of species with the object of collecting good quality seeds from identified climatic areas for use within the state and also to supply outside the state. Vegetative production methods like grafting, budding, air layering, cutting, etc. have been standardized for many economically important species and are being used for mass multiplication. **Provenance trials** of species like eucalyptus, acacias, sandalwood, subabul, glyricidia, jackfruit, shivani (*Gmelina arborea*), seetaphal, nelli, etc. have been taken up in different locations of the state. **Progeny trials** for teak, tamarind, wate (*Artocarpus lakoocha*), neem, kamara, catechu, *Garcinia morella*, etc. have been taken up in order to screen the Plus trees to get superior and selected germplasm for specific characters.

15.6. The Research wing has been carrying out various trials regarding introduction of species. These trials include, introduction of bamboos from

Arunachal Pradesh, *Ceiba pentandra*, *Acacia auriculiformis* (straight growing provenance), introduction of *Garcinia cambogia* in grassy lands in high rainfall zone (Aiyengeri-1997, present survival 75.36%), *Hopea parviflora* (Muchinadka-Uppinangadi range: 1911 plantation, 82 trees, average height 20.634 m, average girth 1.950 m recorded in May, 2015), *Cinnamomum verum* (near FRH Thitimati-1972, survival 33.5% recorded in 2000-01 and 13% recorded in 2014-15), *Diospyros ebenum* (adjacent to Koinadu nursery of Madikeri Research range -1999, survival 79.38% recorded in 2014-15), Cane under-planting in older plantations of *Acacia auriculiformis*, irrigated plantation of teak and rosewood, under-planting of evergreen, semi-evergreen and deciduous species in old *Acacia auriculiformis* plantations, introduction of various *Ficus* species (Kalkere plot-1989), introduction of Indian *Acacias* (Chalkere plot-1989), development of typical moist deciduous vegetation in a clear felled area, study of teak coppice, dibbling of seeds in *Acacia auriculiformis* plantations, trial plots of dry zone species, study of performance of species in various rainfall zones and different localities including under-planting/clear felled/degraded areas, etc. *Acacia auriculiformis* which was planted in a number of trial plots in the high rainfall zone has proved to be very successful in grassland afforestation along with some hardy native species such as mango, nelli, jackfruit, saldhupa, antawala, jamun, etc. A number of species trial plots with multiple indigenous species have been established in different localities with different environmental conditions to check the suitability of the species. Such trial plots are located in Belagavi, Dharwar, Badami, Shimoga, Dandeli, Tirthahalli, Sirsi, etc. Importance has been given to rare, endangered and threatened (RET) natural species which are becoming endangered in the Western Ghats region and with this objective, a number of trial plots have been established in Chakra, Malali, Hunsekoppa, Varanda, Kumbeli, etc. where these species have been introduced.

15.7. Varieties of exotic species were introduced for trial purposes in the research plots and their performances were also observed. Among these species, *Pinus caribaea* var. *hondurensis* and *Pinus oocarpa* were found to be suitable for grass lands of high rainfall zone. Species such as *Terminalia ivorensis*, *Terminalia mantalay*, *Khaya grandiflora*, *Khaya anthothica*, *Agathis alba*, etc. which were introduced in Lakkunda research plot near Thirthahalli during 1966 had shown good growth of more than one meter girth at breast height (GBH) during 1990. In Sampaje range, 250 seedlings of *Terminalia ivorensis* had been introduced in 1979 in a failed *Pinus caribaea* plantation (1978). As on March 2001, 189 plants were found to survive and the average height was more than 25 m with a few good trees having more than 18 m clear bole. The trees are seeding well. The wood appears to be good

hardwood. *Chlorophora excelsa* (named as African teak) was introduced in a trial plot at Thitimati during 1972. The performance of this species was found to be very good during 2001 with an average girth of more than 1.2 m and average height of about 24 m. Another *Chlorophora excelsa* trial plot with 303 seedlings was raised in 1972 in Chennangi near Polybetta in Kodagu district. It had recorded a survival percentage of 51% during 2006 but it decreased to 28% in 2015, apparently due to fire during 2014. The existing trees are reported to be of very good growth. In Majjigehala research plot of Thithimathi, exotic species such as Andaman padauk, *Chlorophora excelsa and Khaya senegalensis* had been introduced during 2003-04. Andaman padauk and *Chlorophora excelsa* failed due the biotic interference but *Khaya sengalensis* has established well. Varieties of American dry zone hard wood species were planted in Kamarakaval research plot in Bellary research unit during 1986. Many of these species had shown promising growth of about 15 cm GBH during 1991. More varieties of exotic species were introduced in trial plots in Jarakabande (1987) and Hosakote (1989). During the period 2001 to 2008, a number of species such as Acacia hybrid, *Acacia auriculiformis* Springvale Provenance and Eucalyptus (ITC Bhadrachalam clones) have been introduced in trial plots located in Hosur, Managundi, Tadas, Salakinkoppa, Halabavi, etc. and fairly good growth and survival have been observed. It is necessary for the Research wing to take up a comprehensive survey of all the research plots in the state where large numbers of species including exotic species were introduced in the past and bring out a compendium about their performance.

15.8. Establishment of Medicinal plots or gardens has been another achievement of the Research wing of the Forest department. These gardens or 'Vanas' of medicinal herbs, shrubs and trees associated with Ayurvedic and herbal systems of medicine have been set up in the 1990s in various parts in Karnataka. These gardens serve as source of seeds, plants and literature on herbal cure. Many medicinal Vanas such as Triphala Vana, Panchavati Vana, Panchpallya Vana, Ashoka Vana, Saraswati Vana, Antidiabetics Vana, Krishna Vana, Pushpa Vana, Chavana Vana, Ramachandra Vana, Kalpavruksha Vana, Mandara Vana, Dhanavantri Vana, etc. have been established. The nursery techniques for most of the species have been standardized. Publications and awareness programs through mass media are done to convey the importance of conserving and developing our rich biodiversity and its usages to the people. During 2013 and 2014, a number of plots have been established in Shimoga and Sirsi divisions with species such as *Saraca ashoka*, *Canarium strictum*, *Mappia foetida*, *Garcinia gummigutta*, *Dysoxylum malabaricum, Myristica malabarica*, *Salacia oblonga*, etc. The Forest department has carried forward the concept of

medicinal plant conservation through its plantation programs such as Tree Parks and Daivivanas. The department is also maintaining a number of medicinal plants conservation areas (MPCA) which were established in the state in collaboration with the Foundation for Revitalization of Local Health Traditions (FRLHT) for the purpose of in-situ conservation of medicinal plants. The Karnataka State Medicinal Plants Authority (KaMPA) was set up in 2002 for the conservation, development and utilization of medicinal plants in the state.

15.9. The Research wing has also carried out experiments to assess the impact of moisture conservation on teak plantation, effects of different soil preparations on moisture conservation, effect of soil conservation works such as check dams and gully plugs on dry zone afforestation works and Agave plantations on degraded sites of hillocks with very high slope. It has also carried out experiments to improve the germination percentage of some of the species such as hirda (*Terminalia chebula*), kadgeru (*Semicarpus anacardium*), tumri or tendu (*Diospyros melanoxylon*), nelli (*Emblica offilinalis*), etc. The system of raising seedlings from root-shoot cuttings has also been developed in respect of some hardwood species to achieve better results in dry zone afforestation. Experiments have been conducted for biological control of Teak Skeletoniser. Productivity studies have been carried out in respect of species such as tamarind, subabul, Bellary Jali (*Prosopis juliflora*), *Acacia auriculiformis*, bamboo, *Calliandra calothyrsus*, etc. Nutrient cycling studies have been conducted by assessment of leaf litter fall in wet evergreen forests, moist deciduous forests as well as in plantations of various species such as *Acacia auriculiformis*, *Casuarina equisetifolia*, *Cassia siamea*, *Anthocephalus cadamba*, *Gmelina arborea*, *Lagerstroemia lanceolata* and *Duabanga sonneratioides*. A number of shade bearer species such as murugal, rampatre, ashoka, devadaru, nagsampige, cane, saldhupa, etc. have been introduced through underplanting in older *Acacia auriculiformis* plantations. Among all species nagbetta, handibetta and saldhupa have shown promising results. A survey on agro-forestry practices in Karnataka was done to take stock of the existing situation of the whole state so as to take up suitable measures in respect of future research needs and developmental activities.

15.10. Nursery research works undertaken by the Research wing include (a) species performance under different water regimes, (b) species performance under different proportion of ingredients, (c) species performance under different doses of fertilizers, (d) standardization of nursery techniques for different species and (e) correlation between root and shoot ratio of different species. Some of the forestry species including important NTFP species have very poor germination percentage and germination takes a long time when sown by usual methods. The Research wing

carries out trials to increase the germination percentage and to reduce the germination period of such species by using different methods of treatment including application of chemical solutions. The species include hirda, kadgeru, tupra, *Calophyllum inophylum*, *Canarium strictum*, *Dysoxylum malabaricum*, *Swietenia mahagony*, *Syzygium jambos*, *Garcinia indica*, *Garcinia cambogia*, *Myristica malabarica*, *Mimusops elengi*, *Persea macrantha*, *Elaeocarpus tuberculatus*, etc. Trials are also done in order to induce flowering and fruiting in species. A number of chemical and other treatments were carried out in Terkanahalli and Hirekai research stations for inducing fruiting / flowering in Appemidi mango (*Mangifera indica)* during 2015-16 and 16-17 and encouraging results have been obtained.

15.11. The Research wing has been carrying out works on the use of bio-fertilizers. Trials are conducted on the efficacy of using vermicompost as manure. Vermicompost is produced in a number of Research nurseries to meet the requirements of manure for raising seedlings in departmental nurseries. Nitrogen fixing bacteria like Rhizobium, Azolla, Blue green algae, Phosphorus solubilising Micorrhiza are some of the important biofertilizers being used for forestry species. Studies are also conducted in order to find effective control measures for the pests and diseases in forest nurseries.

15.12. With an objective of studying the effectiveness of aerial seeding for afforestation in difficult and inaccessible areas, the Research wing had taken up this method on experimental basis in collaboration with the National Wasteland Development Board. The study area comprised of about 3,100 hectares of forest areas in Chamarajanagar, Bangalore Rural and Bangalore Urban divisions and Bandipur national park. Germination of many species, particularly, bamboo, Tamarind, *Acacia nilotica* and sandal was found to be encouraging. However, heavy biotic interference and intervening dry spells caused heavy mortality. It was concluded that re-stocking of degraded forests through this practice is unlikely to be a success. Aerial seeding has been discontinued in the state since 1992.

15.13. The Research wing also carried out collaborative research projects with international agencies such as Oxford Forestry Institute and Institute of Hydrology, Roorkee on 'Karnataka Trees and Environment Project' and 'Fast growing species Project'. Collaborative research activities were carried out with the Universities of Boston and Massachusetts on Population Dynamics and rate of growth of species in tropical evergreen forests. Collaborative studies were conducted with the UNESCO and Government of India Institute of Hydrology, Roorkee on comparative role of natural forests, coffee plantations and Acacia plantations on regulating water flow in

dry months. It also carried out research projects on areas such as Provenance trials, Silvicultural research, Clonal propagation, Water use efficiency of Eucalyptus and Productivity research in collaboration with the Forestry wing of M/s Mysore Paper Mills Limited, Bhadravathi.

15.14. During 2001-2004, a number of sample plots were laid by the Research wing (Southern zone) in order to conduct bio-diversity studies in different types of natural forests including mangrove forests. The extent of each sample plot is 1 hectare with dimensions 100 m x 100 m. All trees above 30 cms in girth have been enumerated, measured and fixed with aluminum number plates. Measurements are being recorded at regular intervals. The above plots are maintained and last recording was taken during the 2015-16. Biological studies will be carried in the above sample plots.

15.15. Climbers are one of the most interesting but much neglected groups of plants. They occur in all woody ecosystems of the world. High climbers play important ecological role in forest ecosystem dynamics and functioning. They contribute substantially to canopy closure after tree fall and help to stabilize the microclimate underneath. Lianas in particular add considerably to forest plant diversity and provide valuable habitat and connections among tree canopies that enable arboreal animals to traverse the tree tops. Climbers also form an essential part of diet of many animals in times of scarcity of flowers and fruits. Some climbers are also important medicinal plants. In order to comprehensively study climbers, three climber plots have been established in 2015-16 at Basavapura, Agumbe and Terakanhalli in Shimoga and Uttara Kannada districts. The numbers of climber species planted in the three plots are 22, 24 and 28 respectively.

15.16. In order to conduct long term monitoring of the effect of anthropogenic activities and climate change on the ecosystem, permanent ecological plots of one hectare area have been laid out during 2016 in four places, namely, Chakra, Agumbe, Talakaveri and Seethanadi. The main objectives of such study are: to quantify long term changes in forest biomass, to relate current forest structure, ecophysiology, biomass and dynamics to local climate and soil properties, to understand the relationships between productivity, mortality and biomass, to analyze the diversity of documented herbs, shrubs, climbers and lianas and trees statistically, and to know about regeneration status of the tree species. Each plot is of dimension 100 m x 100 m. The main plot is divided into four subplots of size 50 m x 50 m and named A, B, C and D by leaving one meter path at centre. Each subplot is divided into 100 quadrants of size 5 m x 5 m (Total 400 quadrants). Details of all herbs, shrubs, climbers, lianas,

poles and trees in each quadrant have been recorded. In the Chakra plot, 32,621 individuals belonging to 196 species of herbs, shrubs, climbers, lianas, seedlings, saplings, poles and trees have been recorded. The corresponding figures for the Agumbe plot are 28,741 and 161. In the Seethanadi plot, a total of 67,618 individuals belonging to 135 species were documented. The department has taken up collaborative research with Sri Jagadguru Chandrashekhara Bharathi Memorial (JCBM) College, Sringeri with an aim to have continuity of observation for undertaking long term monitoring of the ecological plots.

15.17. The Karnataka Forest Department through the Research wing has been sponsoring research projects by providing funds under the CAMPA to institutions such as Institute of Wood Science and Technology (IWST), Bangalore, Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore, universities and colleges to carry out research and conduct studies on various topics on forestry primarily related to field issues and problems. Such projects are selected by a Research Advisory Committee. The numbers of projects selected and sanctioned during the recent years are as follows: 2013-14 – 17 projects, 2014-15 – 7 projects, 2015-16 – 12 projects and 2016-17 – 20 projects.

15.18. The Research wing supplies substantial quantities of seeds required by the department for raising seedlings for its plantation programs. The wing is well-equipped with various machineries and equipments such as seed grader, seed drier, sieving machine, specific gravity separator, seed treater and seed germinator. Quality seeds are collected from different seed sources identified and maintained by the Research wing. The collected seeds are cleaned, graded, certified and packaged under the supervision of DCF (SF), Research and distributed to various forest divisions as per indents placed by them in advance. Since 2014, teak seeds collected from known sources are scarified and then sent to various forest divisions. This has increased the germination by 50% and reduced the transport cost du to reduction of volume. The Assistant Conservator of Forests, Forest Utilization, Bangalore is raising and distributing medicinal plants under different Plan and Non-Plan schemes. Funds are also released by the AYUSH Department for this purpose.

15.19. As a part of its extension programme, the Research wing regularly publishes 'Silva's News Letter' and 'My Forest' (a quarterly journal) besides brochures on various topics on forestry research.

15.20. The focus of forestry research in the state has so far been primarily species-centric. It is felt that while such research should continue, there is need for increased focus on ecological research. There is need for scientific and systematic

documentation of the existing flora and fauna. Even now, we do not have complete details of all the species available in our forests. Our present method of documentation for the entire forest division in the working plan should give way to comprehensive study of the floral diversity of each and every state forest. Such scientific and systematic studies will form the basis of further studies on forest ecosystems and research on forest ecology. In this context, the initiatives taken by the Research wing to collaborate with educational institutions such as JCBM College, Sringeri for undertaking long term monitoring of the ecological plots established at Chakra, Agumbe, Talakaveri and Seethanadi are steps in the right direction.

15.21. One area of concern in Forestry research is in respect of wildlife research. The department does not have a dedicated wing or cell to carry out, co-ordinate or monitor wildlife research. The department's inability in the past to focus on wildlife research can be attributed to the absence of a full-fledged wildlife wing for a long time. In the initial years after its establishment in the early 1990s, the wildlife wing was primarily engaged in strengthening the organization for effective management of wildlife. Besides, the officers have been fully engaged in administrative and management related challenges. The department's inability to initiate wildlife research on its own created a vacuum which over the years has been filled by organizations or individuals dedicated to wildlife research. From the beginning, the department has been permitting outside organizations or individuals to conduct wildlife research on subjects of their choice. These permissions have been almost unconditional. Some of the organizations such as Ashoka Trust for Research in Ecology and Environment (ATREE), Wildlife Conservation Society (WCS)-India, Center for Wildlife Studies (CWS), Nature Conservation Foundation (NCF), etc. have done pioneering works in their respective fields of research. At present, there is no mechanism within the Forest department to co-ordinate and monitor the progress of research works in wildlife conducted by various organizations or individuals. As a result, the department has access to the results of such research works only to the extent that these organizations or individuals intend to share or reveal. The department on its own has sponsored very few wildlife research projects. In recent years, some young officers having passion in wildlife or trained in wildlife have shown interest in taking up studies or research on subjects of their interest. It is on account of such interest that they have been able to develop certain software such as 'Huli' and 'Hejje' which are being used by the department to monitor the movement of frontline staff and wild animals in tiger reserves and other forest areas. The Research wing has also taken up a few wildlife studies through camera traps in order to quantify the abundance of wildlife in and around some of the research stations such

as Shimoga, Thirthahalli, Tumkur, Hosakote, Kolar, Mandya and Sirsi. The results are encouraging with recording of various animals and birds. This is now being done on a regular basis so that the status of wildlife in areas outside protected areas can be assessed.

15.22. It is necessary for the department to have a dedicated wildlife research cell under the control of the Chief Wildlife Warden, Karnataka to monitor all wildlife research works being carried out in the forests of the state irrespective of whether these are sponsored by the department or not. Certain funds should also be allocated to the wildlife wing so that specific studies or research works identified as per the department's requirement are sponsored by engaging experts in the concerned field. All researchers should mandatorily share their research findings and publications with the wildlife research cell, so that such findings and publications can be made use of by the department in field applications. It goes without saying that setting up of a wildlife research cell within the wildlife wing will require a batch of highly dedicated and trained forest officers who are prepared to spend considerable time in the forest.

15.23. It is gratifying to note that the State Government has on 30-06-2017 accorded approval to set up an Institute for Forest and Wildlife Policy Research, Climate Change and Training for the Karnataka Forest Department. The institute, to be established at Jharakbande, Bangalore, will take up studies and research on various issues covering forest policy, forest law, climate change impacts, vulnerability of forest ecosystems from fire, encroachment, man-animal conflict, etc., and provide solutions and specialized training. It will also provide a platform for studying and sharing the best practices of other State Forest Departments on common issues and problems.

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FOREST PROTECTION

People have been dependent on forest since ages. This dependence was perhaps total in the beginning when they obtained all their requirements including food from forest. As the need for more food grew, people started cultivating food crops on forest land on a temporary / cyclic basis – a system which still continues as shifting cultivation in some pockets of forest. With the introduction of settled agriculture, people's dependence on forest for food gradually came down; but it came at a heavy price – loss of forest land for cultivation. While forest was lost temporarily under shifting cultivation, it was lost for ever under settled agriculture. For centuries, as human population increased, more and more forest lands were cleared for taking up agriculture and settlements. Clearance of forest land for cultivation was encouraged by the rulers too, as it provided avenues for collecting more land revenue. The British Indian administration encouraged clearance of forest for similar reasons. They also encouraged plantation crops in addition to cereal crops, which put more demand on forest land. They adopted a forest policy in which forest had no intrinsic right over land and agriculture was given precedence over forestry. The policy of encouraging agriculture over forestry continued even after India attained Independence. In view of severe shortages of food grains against a steadily rising population, the Government had no option but to take all necessary steps to maximize production of food grains for the people, and large chunks of forest lands were released for agriculture, under the "Grow More Food" campaign. Besides, diversion of forest land for other development purposes continued quite liberally until the enactment of the Forest (Conservation) Act in 1980, which slowed down the unabated loss of forest because of imposition of strict restrictions / regulations on diversion of forest land.

16.2. While pressure on forest land for being diverted for non forest purposes through official / legal channel has drastically come down with the enactment of the Forest (Conservation) Act, 1980, hunger for land continues and is reflected in acts of **forest encroachment** for cultivation, housing, etc. Such unauthorized acts are quite common in forest areas adjacent to habitations such as villages, townships, etc. Eviction of fresh forest encroachment is a relatively easy task, but if the encroachment is not detected immediately, its eviction at a latter date becomes very cumbersome, as the encroacher progressively develops a stake in the land by making more and more investment. Encroachers, especially those extending cultivation, tend to garner support from various influential quarters and this makes the Forest department's task even more difficult. Encroachment of forest land near the limits of

Bengaluru city for obvious real estate purpose is a matter of serious concern. While encroachment of forest land covered with tree growth is immediately detectable, the same is not true in respect of forest lands which have remained barren for a long time, unless the field level functionaries are quite conversant with the forest boundaries and are extremely vigilant. In many cases, revenue records do not properly reflect the forest status of the land which results in wrongful land grant and protracted litigation. Protection of forest land from permanent loss is the most important duty of any forest officer. While a degraded forest land can be restored to its original glory, it is very difficult to retrieve a parcel of forest land lost to encroachment or wrongful grant; at times it becomes a permanent loss. Officers of the Forest department are empowered under Sections 24 and 64A of the Karnataka Forest Act, 1963 to take appropriate legal action against forest encroachers.

16.3. It must however be conceded that in spite of the legal provisions in Acts and Rules, the department has not been able to complete the process of eviction of forest encroachments for various reasons. As of now, about 80,000 hectares of forest lands are under encroachment in the state. Attempt to evict encroachment is stiffly resisted by the encroachers who generally have the support, at times very vocal, of powerful people and political leaders with vested interests. Encroachments carried out by the rich and the powerful are also difficult to remove. In a high profile case of encroachment in Tatkola state forest in Chickmagalur district, removal of the encroachment was possible because of the intervention of the Hon'ble Supreme Court of India. In the past, encroachments of all types of government lands for dwelling and for extension of cultivation were regularized by the governments from time to time. As a result, such an act was considered normal and inoffensive, and this had emboldened the people to encroach more and more lands. The practice of regularizing encroachment of non-forest (revenue) land is in vogue even today. As regards forest lands, the Karnataka Government in 1974 had amended section 28 of the Karnataka Forest Act, 1963 and empowered only the two Houses of the State Legislature to de-reserve a reserved forest or any portion thereof (Act 23 of 1974). Earlier, it was possible to de-reserve any forest land by a simple government notification. The Act was further amended in 1978 (Act 15 of 1978) categorically stipulating that regularization of encroachment taking place after 27-04-1978 must have the approval of the State Legislature. This made the process of regularization of forest encroachments difficult. At the national level, the enactment of the Forest (Conservation) Act, 1980 and the promulgation of the National Forest Policy, 1988 put a brake to the earlier practice of regularizing forest encroachments. However, removal of old encroachments continues to be a difficult task at the field level

generally escalating into law-and-order situations. At times the forest officials, especially the field-level functionaries, are harassed or trumped-up charges are filed against them on atrocities cases. For the exercise of eviction of forest encroachments to be successful, it is absolutely necessary that the field-level functionaries get unstinted and wholehearted support from the top. It is also necessary that in all cases involving eviction of forest encroachment, which are always very sensitive in nature, the department, the government and the political leadership are all on the same page. Conflicting signals emanating from these quarters lead to demoralization of the staff and, in the long run, the entire mission becomes counterproductive.

16.4. In the recent years, there has been growing awareness regarding protection of forest from the clutches of encroachment. This has enabled the Forest department to get favourable judgments from various courts. The Hon'ble High Court of Karnataka has also been monitoring the progress of eviction of forest encroachments by the Forest department. This has emboldened the younger generation of officers to take up eviction of forest encroachment cases head on and bring these to their logical ends. It must however be admitted that many encroachers stake their claim to land under the provisions of the Forest Rights Act. This seriously hampers the process of eviction and it is becoming a protracted exercise for the department to dispose of such claims. More than two lakh applications have been received under the Forest Rights Act. These are being examined and legitimate claims are being settled. There is a tendency among the communities to clear and burn more forests and occupy the land with the sole motive of claiming the title under the said Act. Serious efforts are being made to contain them. Settlement of rights and disposal of all applications is likely to take considerable time.

16.5. Next to loss of forest on account of agriculture, settlements and other development works, the most important factor responsible for rapid contraction and decline of forests is **heavy withdrawal of biomass** in the form of firewood and small timber. Much of such withdrawals are unrecorded removals from natural forests and plantations. At individual level, these removals appear as insignificant, such as people carrying firewood on head loads, bicycles or bullock carts, often for domestic consumption and sometimes for sale. However, when such removals take place everyday and everywhere, the overall implications are too serious to be ignored or dismissed as insignificant. These make a huge dent to the forest resources.

16.6. The intensity of damage to forest due to excessive removals was quite high during the 1970s and 1980s when it was quite common to see people, including women, coming out from forest with head loads of fuel wood any time during the day

and even during night hours. This situation was triggered primarily by two factors: There was acute shortage of firewood for cooking and other purposes in the households, especially in towns and bigger villages. This prompted people to go to the nearby forest to fetch their daily requirements of firewood. Secondly, poverty level was quite high as employment opportunities were less. People had more time at their disposal to get firewood from forest and make a living by selling part of the material. During the last two-three decades, this scenario has to some extent changed for the better. Alternative sources of energy for cooking and heating such as, electricity, LPG, bio-gas and solar energy have become readily available throughout the state including in rural areas. Farm forestry also has made some positive impact with regard to availability of fuel wood. People have become conscious and they use more and more agricultural waste material as firewood. They also use more energy efficient devices for cooking and heating. These have to some measure brought down the use of firewood sourced from forest for cooking and heating. Secondly, due to various welfare schemes of the Government, enhancement in educational and professional qualifications and opening up of more employment opportunities, there has been relative betterment in the standards of living even in rural areas. As a result, there are fewer people who now have the time or the need to go to forest to make a living by selling firewood from forest.

16.7. Instances of **timber smuggling** were also very high during the 1970s and 1980s. Smuggling was quite rampant in some of the teak growing areas of the state, notably in Shimoga, Bhadravathi and parts of Sagar and Koppa divisions. Certain forest areas became notorious for organized smuggling, especially for teak and rosewood. This led to constant conflict of the field functionaries of the Forest department with the smugglers, resulting in severe assault cases, some times even death. Repeated struggle by the limited and ill-equipped but zealous staff of the department with the marauding smugglers brought to the fore the urgency of strengthening the protection wing of the department in terms of staff, vehicles, arms and ammunitions, communication, etc. During the last two-three decades there has been tremendous improvement in the capability of the field level staff of the department in taking on the smugglers: many of the vacancies have been filled, there are more number of vehicles for the staff to move quickly, there are more arms and ammunitions to give moral strength to the staff, there are strike forces/rapid action forces stationed in sensitive areas and there are many forest protection camps (FPC) and anti-poaching camps (APC) at various vantage points in the forest areas. These have improved the capability of the department in tackling cases of smuggling and poaching more effectively. While there will always be attempts at smuggling or

poaching in forest areas, the department is now much well prepared to handle such situations. Special mention must be made about the APCs/FPCs which have performed well in very difficult situations. These camps are situated in deep forest areas and each camp is manned by four/five persons on daily wage basis along with one or two forest watchers. They do extensive patrolling of the forest area designated to the camp. Each camp works under the guidance of a forest guard. The daily wage persons are drawn from nearby villages and many of them are from tribal families. Free ration is provided to each camp besides other facilities such as solar lighting, wireless communication, etc. These camps have not only been helpful in controlling poaching or smuggling, but also in assisting the department in controlling forest fire during the fire season.

16.8. **Unrestricted grazing** by domestic cattle has had very adverse impact on the forests of Karnataka. Large herds of cattle, mostly unproductive, roam about daily in the forests for grazing and browsing. As a result, the forests have borne their onslaught. The results are far too evident. Grazing is heavy along the fringes of forests which are situated near the villages causing severe degradation. Grazing / browsing by goat, which is on the rise, causes very severe damage to the forests. Uncontrolled grazing in forests, often beyond their carrying capacity, has adversely affected the regeneration status, quality and growing stock of our forests. Overgrazing also affects soil properties adversely. The negative impacts on soil include loss of top soil, formation of gullies, compaction of soil and reduction of porosity. Pressure on forest reserves is increasing since the adjoining pasture lands and meadows which were traditionally reserved for grazing are also being put to other uses. The cattle herdsmen relentlessly hack green trees to provide fodder to their herds. Even trees by the roadside are not spared. Excessive grazing has caused disappearance of useful fodder grasses which are replaced by unpalatable ones.

16.9. In the *malnad* region, grazing is mostly by unproductive bulls and cows. Grazing by goats is on the rise in certain areas. Milch animals (cows and she-buffaloes) and draught animals (used for tilling land and pulling carts) are generally not let loose into the forest. In parts of Uttara Kannada and Belagavi districts, there are *Gowli* families who maintain large herds of buffaloes. Originally from Maharashtra, the *Gowlies* migrated to Karnataka sometime in the early 1950s. Initially they were nomadic people and moved within the forest areas from one part to another in search of water and fodder. Now they have settled in hamlets, some in the vicinity of existing villages and some deep inside the forests. There has been a great deal of damage to the forests because of the *Gowlies* and their buffaloes who roam within the forest throughout the year causing extensive damage to seedlings and

saplings. As the growth of grass is relatively less in these areas, the *Gowlies* intentionally set fire to the forest, hoping to get good growth of grass during the early monsoon showers. During the dry season, they resort to indiscriminate hacking of medri bamboos to provide fodder to the buffaloes. Most of the bamboo rhizomes that sprout in the monsoon season are also either eaten or damaged by the buffaloes. The *Gowlies* strip off barks of rosewood (*Dalbergia latifolia*) trees for flooring cattle sheds. They remove barks of dhaman (*Grewia tiliaefolia*) trees and use for making ropes. Dhaman is also heavily lopped for fodder. Teak trees in forest areas near the *Gowli* colonies (*Gowliwadas*) are afflicted with a disease locally known as '*Gandamale*' which is caused by a borer which thrives and proliferates in soil soaked in buffalo-dung and urine. The growth as well as the quality of the trees is severely affected due to this affliction.

16.10. In the northern *maidan* region of the state, grazing in forest areas is mainly by sheep and goats. After the little vegetation in the local forests is exhausted, the herdsmen take the animals in the south-west direction to the relatively better forests of the districts of Bellary, Davanagere, Chitradurga, etc, and sometimes even to the forests of Shimoga, Haveri and Dharwad districts. They virtually set up camps in the forests for four-five months and return just before the onset of the monsoon season. The same process is repeated year after year. Needless to say, repeated onslaughts by large numbers of sheep and goats have left deep scars in our dry deciduous forests.

16.11. A somewhat similar system of grazing was in vogue in the forests of Kollegal, where cattle herdsmen used to set up camps known as '*Doddis*' near water sources and maintain large herds of cattle including cows, sheep, goats, etc. They also looked after the cattle owned by other farmers on payment basis. During the British rule, rich farmers from adjoining areas of present Tamil Nadu used to send their cattle to these *Doddis* where the animals were looked after for about four five months by the owners of the *Doddis* on payment basis. The '*Doddi*' system has now been done away with thanks to persistent efforts by the field functionaries of the Forest department. This has also been possible as most of the forest areas of the region have been brought under the protected area network.

16.12. The intensity of grazing in the state is so severe that even the protected areas are not free from it. Most of the national parks and wildlife sanctuaries are under pressure from grazing by domestic animals from peripheral villages. The situation is further aggravated by the existence of a number of revenue enclosures and hamlets deep inside these protected areas. Bandipur national park, Ranebennur wildlife sanctuary, Shettihalli wildlife sanctuary, Bannerghatta national park,

Cauvery wildlife sanctuary, Male Mahadeshwara Hills wildlife sanctuary, etc. are more severely affected by the scourge of grazing. Although grazing is prohibited in national parks, it is difficult to implement this legal provision in the field for obvious reasons. Co-existence of wildlife and domestic animals is a serious threat from the point of availability of fodder, as it results in competition for food. Besides, the herbivores become highly susceptible to epidemics such as Foot-and-mouth disease, Rinderpest, etc. The Forest department, in collaboration with the Animal Husbandry department, carries out immunization campaigns for vaccinating the cattle living in the periphery as well as in the enclosures within the protected areas.

16.13. The ill effects of grazing on forest were perceptible even during the British rule when cattle population was limited, notified forest areas were richer and there were vast extents of grazing and other buffer lands. In order to discourage grazing in reserved forests, heavy fee was imposed on grazing by domestic animals. As a matter of fact, in certain forest areas, revenue collected from grazing fee was substantial as compared to revenue from forest produce. However, after independence the conditions of grazing in forest have been relaxed. Even where rules and restrictions are in place, the department has been lenient on grazing related violations in the same manner as in the cases of removal of firewood from forest for bonafide use. As a result, grazing takes place everywhere in the forest except in those areas which have been barricaded by fence or wall.

16.14. In view of a liberal approach taken towards grazing in forest and considering the operational difficulties of preventing complete entry of large numbers of cattle into forest through its porous boundaries, the working plans written for management of forests normally recommend 'rotational grazing' for natural forest and prescribe closure of grazing in plantations or regeneration areas for a number of years. While it is possible to keep plantations free from grazing because of artificial barriers such as fencing, implementation of 'rotational grazing' in natural forest is difficult. In 'rotational grazing', the forest block is divided into four or five equal parts and grazing is permitted in one part during the first year and in another part during the second year and so on. This way each part is subjected to grazing once in four/five years. This gives ample time to the grazed portion of forest to recoup itself. However, villagers are generally not amenable to such restrictions and in any case most of the cattle enter the forest on their own. As regards plantations or other closed areas, villagers are normally allowed to cut and carry the grass on head loads. In some forest areas, the VFCs take initiative and monitor sharing of grass and fodder among the villagers.

16.15. From what has been stated above, it is apparent that although the Forest department is very keen to bring down the incidence of grazing in forest to the minimum, its capability in doing so is limited in as much as the department has no control over the number of animals owned and let loose into the forests by the farmers/owners. On the other hand, a large number of cattle entering the forest are unproductive to the owners also. It is therefore necessary for the department to motivate the people to take up cattle improvement, stall feeding, fodder development, etc. so that their dependence on the nearby forests is minimized. The department should also impress upon the Animal Husbandry and Rural Development departments to take all necessary steps in this regard, as these activities primarily come under the purview and domain of these departments. As forest plays a much more critical and crucial role in protecting the overall environment than merely catering to the needs of the adjoining human and cattle population, it cannot be allowed to be degraded any further by unwise withdrawal of bio-resources to a level that the existence of the forest itself is at stake. . In pockets of Dakshina Kannada district, people have been able to reduce the number of unproductive cattle by taking up improved cattle breeding program. It is hoped that in the years to come, this practice will be replicated in all villages in Karnataka.

16.16. Of late damage caused to **forest by fire** has been receiving a lot of publicity and attention resulting in increased awareness among the people. Forest fire causes very visible damage to the forest. It has a deleterious impact on the deciduous and scrub forests of the state. Frequent fires destroy the bio-diversity of the forests by damaging and often killing the seedlings, coppice and natural regeneration. Forest fires in Karnataka are normally ground fires which burn grass, fallen leaves and dead wood. However, fires occurring in a forest with flowered and dried bamboo clumps may become very severe and give the impression of a crown fire. Forest fires are generally uncommon in the evergreen and semi-evergreen forests in the state. However, the *shola* forests and other forests abutting the grassy blanks in the Western Ghats are very vulnerable, as fire occurring in the grassy blanks, if unchecked, can cause wanton damage to these sensitive forest eco-systems.

16.17. Fire has a telling effect on the natural regeneration, as the seeds on the forest floor are completely charred and young seedlings get burnt. Saplings, poles and younger trees are damaged. Larger trees are also affected by fire with their increment getting reduced and quality of timber getting poorer. In case of severe fire, the bark and the cambium get scorched thereby killing the trees. Dead and fallen material lying on the ground gets burnt due to ground fire. Besides, leaf-litter, humus and other organic matter on the forest floor get completely burnt into ashes, to be

washed away by subsequent monsoon rains, leaving the area bare. Fire also affects wildlife and many micro-organisms living in forest. Destruction of micro-flora and micro-fauna in the layers of top soil and forest litter has adverse impact on organic decomposition and soil fertility. In a forest with a history of recurring forest fires, the species composition undergoes changes. Fire hardy species become predominant and the proportion of fire sensitive species comes down. Fires bring in coarse grasses and desirable ones are eliminated. Such growth besides being a perpetual fire hazard prevents other species from coming up. Fire coupled with heavy grazing results in retrogression of the forests to drier types. Recurring fire, year after year, can be devastating and is one of the chief causes of the general degradation of our forests.

16.18. Most of the fires are usually caused by human beings. Some fires are due to negligence and some are accidental. People set fire to the forests before the onset of rains in the hope of getting good growth of grass. Sometimes, non timber forest produce (NTFP) collectors set fire to the forest to facilitate collection. The head loaders destroy the vegetation to create new pathways in the forest to facilitate collection. Encroachers set fire to forests in order to clear the land for agriculture. People burn bushes and grasses around their houses and land without taking sufficient precaution to see that the fire does not spread to the nearby forests. Poachers set fire to clear the debris on the forest floor so that small games may be driven out and hunted with ease. Smugglers and anti-social elements set fire to plantations and forests to take revenge on departmental staff. Fire is also caused by negligence by persons camping in the forests during fire season and leaving their camp-fires burning, when they depart. Workers of the Public Works Department who carry out road repair works negligently do not extinguish the fire used for heating the tar after completion of their work. Forest fires are also caused due to negligence of forest employees, who do not take adequate precaution while carrying out fire tracing and controlled burning works as a result of which fire escapes to the adjoining forest.

16.19. Although forest fire is a recurring phenomenon in Karnataka, occurring year after year in some or the other part of the state, it is found to be more virulent during the years of drought. It is on expected lines, as during the drought years loss of moisture from the forest is very rapid and the forest floor becomes inflammable earlier than usual. The present increasing trend of forest fires is also linked by some to global warming. The cyclic activity of solar flares (Sun spot cycle of about eleven years) is also attributed to the recurring drought conditions.

16.20. Whatever may be the cause of forest fire, the first priority of a forest officer is to bring it under control immediately after it is noticed. While the cause of

fire should be thoroughly investigated and deterrent action taken, it should under no circumstances undermine or delay the process of fire protection. Since forest fire is a common phenomenon and is likely to occur during the fire season (February-May), timely preparations to face the challenges should be done sufficiently in advance and with meticulous planning. The Deputy Conservator of Forests, Assistant Conservators of Forests and Range Forest Officers of a forest division must discuss and prepare a comprehensive fire management plan for the division by the month of October, so that all possible aspects are taken care of.

16.21. The following preventive and remedial measures are suggested. The strategy includes identification of fire prone areas, preventive measures in the identified areas and monitoring of fire-accidents and control operations.

- Protection of forests from fire should be tackled regularly clearing the compartment, block, range and division boundaries to appropriate prescribed widths (3 meters to 10 meters). Only the undergrowth should be cut on these lines. These should be effectively used as demarcation lines (D-lines) along with fire lines. Maintenance of these lines should be an annual feature.
- In larger forest blocks where compartments have not been demarcated, internal lines running across the entire length and breadth, approximately dividing into sub blocks of 250 hectares, should be cleared to a width prescribed for compartment boundaries (at least 3 meters). These lines can also serve as inspection paths.
- The clearing and burning of fire lines must be carried out in the following manner:

  a) The fire lines will be thoroughly cleared of all grass and other growth and the cut material spread evenly along the cleared line.When the material is dried sufficiently burning must be started and completed by 31st January. On no account should any burning be allowed afterwards.

  b) Burning should always be supervised by the Deputy Range Forest Officer and Forest Guard. The officer in charge of burning must muster sufficient men during the burning operations which must always be done after 4.00 P.M.

c) Adequate fire patrol personnel should be engaged till the commencement of rainy season. Fire patrol personnel should be drawn from nearby villages and hamlets. Tribal people of the area should be necessarily engaged as they are used to life inside the forest. All the fire patrol personnel should be provided with fire resistant clothing and common fire fighting equipments like shovels, fire rakes, bill hooks, double bit axes, etc. They should be stationed in fire protection camps with facilities for taking rest. As the fire protection camps are temporary structures, separate arrangement for food for the fire patrol personnel has to be made. Pre-cooked food may be brought from outside or cooking may be done in nearby forest protection camps / anti poaching camps / forest rest house. Adequate drinking water should be available in the fire protection camps. The duties of the fire patrols are:

a) To clear the fire lines of rank growth.

b) To sweep the dry leaves and other dry material on the fire lines.

c) To patrol the forests both at day and night.

d) To give notice of fire to the nearest forest officer and help in putting it out.

- Watch towers should be constructed at strategic points so as to command a larger view of the forest area. These towers will act as fire finders/fire detection camps so that any incidence of fire is noticed early.

- Fire patrol personnel, Deputy Range Forest Officer, Forest guards should be provided with radio equipment like walkie-talkies. The wire less station at the range headquarters can monitor and co-ordinate the wire less communication system.

- During the fire season, arrangement should be made for vehicles or mini-trucks to be stationed near some of the strategic fire protection camps. In the absence of departmental vehicles, private vehicles should be hired. A group of at least ten people should be able to sit in these

vehicles so that large coverage of area can be done in shortest possible time.

- Annual estimates for fire protection works should be prepared for each range accompanied by a map on a scale of 1 cm=0.63 Km [1" = mile] showing the disposition of fire lines, internal lines to be cleared, location of the proposed watch tower, fire patrol personnel required, etc. Areas susceptible to fire should be marked on the map.

- All incidences of fire should be marked on the fire maps, chronologically indicating the extent of damage, nature of biomass loss and causes of fire. These maps should be prepared for successive years.

- At times fire is allowed to spread and get extinguished on its own due to the presence of natural barriers and the subordinates rarely take it seriously to muster men and extinguish before the fire engulfs large areas. Many petty incidences are not reported at all. This sort of negligence by the subordinates should be viewed seriously. The cause of fire should be thoroughly investigated.

- Areas burnt should be closed to grazing for a period of five years.

- Since the cause of a large number of forest fires is attributed to human failures, the participation of village communities in fire control assumes considerable importance. The co-operation of local population to prevent and control forest fire is to be enlisted by clearly specifying the future benefits that will accrue to the community as a result of their efforts at forest protection. Such partnerships between the local community and the Forest department could form the basis for effective protection. There should also be financial incentives to village forest committees (VFC) or local youth groups showing exemplary interest in fire protection. There should be adequate publicity and awareness raising campaigns to sensitize people regarding the harmful effects of fire on forest.

16.22. Success of fire protection works in a division depends upon the leadership, zeal and enthusiasm shown by the Deputy Conservator of Forests (DCF). He should constantly motivate the subordinate staff right from the month of October. He must make adequate advance planning in consultation with the ACFs and RFOs, who should be detailed about their specific responsibilities. No slackness should be tolerated in timely execution of the preparatory fire protection works. Sufficient resources are required for mobilizing men and material for carrying out fire protection works. Fire protection works are more important than raising plantations. Therefore, the DCF should leave no stone unturned in mobilizing adequate resources for fire protection works, utilize these liberally and at the same time ensure their proper utilization.

16.23. **Invasive species** such as *Lantana camara, Eupatorium, Parthenium,* etc. have engulfed many wildlife as well as other forest areas. The spread of *Lantana* in Bandipur, BRT and Nagarhole tiger reserves has threatened the habitat and many plant species palatable to elephants and other herbivores are slowly disappearing. Physical removal of invasive weeds is a gigantic task, as it regenerates very fast. More often than not, one weed is replaced by another weed. Several experiments have been carried out across the country to eradicate *Lantana*. Karnataka has also pioneered many such experiments, but no effective solution has been in sight. Although it is possible to control the menace of invasive species by intensive planting, it can be done only on a small scale. Such exercise cannot be carried out on a large scale; besides intensive planting is not recommended in wildlife areas to avoid biotic disturbance. It is however hoped that if the areas can be rigidly and continuously protected from fire, excessive grazing, illicit cutting, etc., the natural process of succession will restore the original vegetation in due course of time.

16.24. For effective forest management, **proper maintenance of the forest boundaries** is very essential. This also enables the field functionaries to know about the outer limits of the forests and then to detect and book forest offences. In this connection the provisions of para (ii), Chapter-VI of the Karnataka Forest Manual is reproduced for guidance. “Forest being a special kind of landed property the first requisite for its effective protection is to demarcate its boundaries in such manner that no body is left in any doubt as to its limit”.

16.25 . Many of the forest areas of the state have been demarcated by the working plan wing by fixing stone pillars and cairns. In addition to the outer forest boundaries, there are internal boundaries such as block and compartment boundaries. All these boundaries need to be maintained annually by the staff of territorial and wildlife

wings by clearance of rank growth to specific widths. Such demarcation lines, when maintained properly, also help in checking fire during the dry season. Works of maintenance of boundaries should be taken up regularly and the works should be frequently inspected by the superior officers. Boundary stones / cairns have to be maintained and painted every year. Missing boundary stones should be promptly replaced. However, due to various reasons including inadequate resources and shortage of manpower, it has not been possible to maintain all the demarcation boundaries.

16.26. In addition to taking up of new forest areas for survey and demarcation, the working plan wing is also required to carry out resurvey and demarcation of old forest areas once in ten years. However, due to paucity of resources and manpower, progress achieved in this regard is less and as a result, there are forest areas which have not been resurveyed for as many as 25-30 years. Such delay may result in the departmental staff loosing sight of the actual boundary position and this may increase the chances of non-detection of forest encroachment.

16.27. Many forest blocks of the state have not been delineated into compartments. Delineation of compartments facilitates better forest administration and management. It also helps in fire protection works. It is advisable to ensure that all forest blocks are delineated into compartments through a time-bound programme. The average size of the compartment may be kept in the range of about 150 to 200 ha. A forest block of size less than this average limit will itself become a compartment. After the forests are delineated into compartments, the history of each compartment should be maintained and updated regularly with details such as brief description of the compartment, map of the compartment, growing stock of different species, status of natural regeneration, fire occurrence, etc.

16.28. Rule 17 of the Karnataka Forest Rules, 1969 stipulates that immediately after the publication of the notification regarding constitution of reserved forest as per section 17 of the Karnataka Forest Act, 1963, the Deputy Commissioner shall get necessary entries made in the revenue records about lands included in the newly formed reserved forest and the District Survey Officer shall get necessary changes incorporated in the village map. However, this procedure was not followed in many cases of forest reservation in the past. As a result vast extents of our forest lands have not been entered as forest in revenue records. This often results in **wrongful grant of forest lands** as if these are revenue lands. It is therefore necessary to reconcile the forest records with revenue records. Whenever any discrepancy is noticed regarding non-entry or wrong-entry in revenue records, the same should be brought to the

notice of the Deputy Commissioner to effect necessary entry / corrections to be made in the revenue records as per the provisions of Rule 17, Karnataka Forest Rules, 1969.

16.29. In the chapter titled 'Funding in the forestry sector', it has been pointed out that **investment for general protection of forest areas** in the state is quite less as compared to the investment for raising plantations. In the Wildlife wing, investment for general protection of forests is somewhat better, as plantation activities are insignificant in wildlife areas. Investment made towards forest protection does not yield immediate result as in the case of a plantation. However, the long term impact of the protection measures on a forest is more impressive and it extends over much larger area. For example, if the peripheries of a forest block are well protected, the areas inside the block automatically get the benefits of such protection measures. The expenditure needed per unit area for general forest protection is much lower as compared to the expenditure required per unit area for raising a plantation. The overall productivity of a well-protected forest is much more than that of a plantation developed in a corner of the forest. Besides, the benefits of a well protected forest in terms of natural regeneration, bio-diversity conservation, soil and moisture conservation, etc. are immense. In view of this, there is urgent need to substantially increase the investment for protection of forests through various measures such as fire protection, control on grazing, setting up of forest protection camps and anti poaching camps, strengthening of field infrastructure, survey and demarcation of forest areas, etc.

16.30. In a previous chapter, the supreme sacrifice made by a number of forest officers/officials while performing their duties to protect forest has been remembered. Many of these officers/officials paid with their lives while confronting smugglers and poachers. Shri P. Srinivasa, IFS was killed in cold blood in November 1991 by forest brigand Veerappan. In a number of cases, officers while on patrolling or other duties were attacked and killed by wild elephants. There were a few instances where officers/officials died protecting forest from fire. Shri S. Manikandan, IFS was trampled to death by a lone tusker on 03-03-2018 in the Nagarahole national park while he was supervising fire protection works.

16.31. Death of a government servant on duty, whether because of smugglers or poachers, wild animals or fire, is an unfortunate happening and the Forest department must do whatever possible to prevent such incidents from recurring. The only way to counter dreaded smugglers or poachers is to confront them with full force and with sufficient men and material. There is no place for individual heroism in such cases. Whenever a serious situation involving organized smuggling or poaching arises,

adequate force needs to be mobilized, including seeking assistance from the Police department, to confront and tackle the situation. The department is also concentrating on deploying strike force in sensitive areas to prevent organized crime against forest property and assist the jurisdictional staff in crime control. The forest protection camps and anti poaching camps have been established for the same purpose so that the forest officers/officials can face the smugglers or poachers as a group rather than as an individual. It is also necessary for the forest staff to take all precautions against attack by wild animals, especially elephants and sloth bear. They must scrupulously follow the 'Dos and Don'ts' while perambulating in forest areas which are prone to attack by wild animals. Sometimes very basic thing like the footwear or the color of the attire put on by a person may make all the difference between life and death. As regards, fire protection works, caution is the only word. It is necessary for the forestry staff to be aware of the basic principles of forest fire prevention. Fire prevention requires advance planning and timely execution of planned works. Fire protection drills should be conducted regularly among the forestry staff during fire season. Arrangement for adequate fire-prevention equipment, fire resistant clothes, first-aid facilities, fast moving vehicles, etc. must be made sufficiently in advance to face the fire season. There must be arrangement for good drinking water, required in plenty during fire fighting operations, to control dehydration of the fire fighting personnel.

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FOREST CONSOLIDATION

One important area requiring attention of all interested in forest development is regarding consolidation of forests. Here the word 'consolidation' has been used in a broader context and is not limited only to the forests managed by the Forest department. The benefits accruing from forest and tree cover are much more than merely satisfying the immediate needs of the adjoining community. Multifarious long term benefits from forest and tree cover accruing to the society at large include generation of oxygen and absorption of carbon dioxide, soil and moisture conservation, regulation of stream flow, improvement of soil fertility and agricultural productivity, conservation of the plant and animal genetic resources, mitigation of the adverse effects of climate change, etc. In order to ensure that these long term and all-pervading benefits to the society flow seamlessly and perpetually, it is necessary to ensure that all forest and tree cover in the state, irrespective of whether these are with the Forest department or not, are maintained in a healthy and robust manner.

17.2. It may be recalled that immediately after Independence, large extents of forest lands were released in the country for increasing agricultural production under the 'Grow More Food' campaign. In addition, development projects consumed a lot of forest land. In Karnataka also, huge chunks of forest lands were released for augmentation of agricultural production under the 'Grow More Food' campaign. Large extents of forest lands were also cleared for the purpose of a number of hydro-electric and irrigation projects including Sharavathi, Kalinadi, Bhadra, Kabini, Harangi, Chakra, Varahi, etc. These projects involved clearance of forest area not only for construction of huge water storage dams and for evacuation of electricity and water through transmission lines and irrigation canals respectively, but also for the rehabilitation of the people displaced by the projects. Considerable extents of forest lands were also lost due to encroachments, as at that time there was practically no satisfactory rehabilitation package for the displaced people. In order to compensate for the loss of forest land, the benevolent state Government had, in the 1960s and 1970s, issued a number of orders transferring equivalent extents of thickly wooded revenue lands to the Forest department. However, for one reason or the other these lands were not handed over to the Forest department in many districts. During the late 1970s, the state Government had issued another order transferring a few lakh hectares of C&D class lands to the Forest department on 'as is where is' basis. However, before the Forest department could complete the process of taking possession and survey of these lands, the order was withdrawn. As a result, most of

these lands, other than the areas which by then had been brought under plantation by the Forest department or were notified under section 4 of the Karnataka Forest Act, 1963, had reverted to the Revenue department.

17.3. The department's persistent efforts at getting the thickly wooded lands transferred to its fold were generally thwarted by vested interest groups. Even the well intentioned move of one Deputy Commissioner to transfer such lands in Chickmagalur district to the Forest department as per the earlier government orders was scuttled. It was only after intervention of the Hon'ble Supreme Court of India, that certain portions of the thickly wooded lands, which till that time had not been encroached upon or granted under land grant rules, were decided to be transferred, and the Forest department could initiate action to survey the areas for proposing under section 4 of the Karnataka Forest Act, 1963.

17.4. There is also abnormal delay in completion of the settlement proceedings of areas notified under section 4 of the Karnataka Forest Act, 1963, and in notifying these as reserved forests under section 17 of the Act. Even in respect of many cases where reserved forests had been notified in the past, correspondng mutation entries were not made in revenue records and as a result, such lands were continued to be treated as revenue lands. As already mentioned, wrongful grants have been made in such lands presuming these to be revenue lands. During recent years, because of insistence of the Forest department mutation of forest lands in the revenue records has been carried out throughout the state and some improvement has taken place in this regard. However, this exercise needs to be continued and completed early to avoid any possibility of wrongful revenue grants in the future.

17.5. Proposals for notifying new areas under section 4 of the Karnataka Forest Act, 1963 also face hurdles before notification. There is general aversion to declaring any land as forest land or handing it over to the Forest department. There is a common perception that once a parcel of land becomes forest land, its status cannot be restored and it is permanently lost. This perception became stronger after the enactment of the Forest (Conservation) Act in 1980 which requires prior approval of the central government before diversion of any forest land for non-forest purpose.

17.6. The Forest department is an agency of the state government to implement government policies aimed at public welfare. However, there has always been a common perception about the department that its officers / officials work against the interest of the common man. It is true that the department's role of protecting forest entails it to take stern measures which more often than not are regarded as unpopular in as much as people are denied what they had been traditionally doing or enjoying.

At times the department has to act tough to protect forest from any form of abuse or vandalism. It must however be realized that the department's role is primarily of regulation or restriction on use of forest for a much larger common cause. Whatever the department does is only to implement the laws of the land formulated by the state and central legislatures as per the provisions of the Constitution. It is true that with the enactment of the Forest (Conservation) Act, 1980, the use of forest land for non-forest purpose which was quite liberal in the past has been restricted. However, the department is fully aware that sacrifice of forest land sometimes is inevitable for the cause of development and has always responded positively to such proposals while recommending to the government for diversion of forest land under the Act. However, the department is sensitive to any proposal of deforestation due to projects such as railways, roads, mini-hydel, wind-energy, etc. in the eco-sensitive forest areas, more particularly in the Western Ghats region, because such projects will have tremendous adverse impact on the highly sensitive eco-system. It therefore becomes incumbent upon the forest officers to examine such proposals critically and comprehensively analyzing their likely impacts on the environment. It is necessary that the technical opinion of the Forest department is given due consideration while sending proposals to the central government.

17.7. During the time of forest reservation, sufficient extents of wooded lands were kept out of the purview of reservation. This was primarily for two reasons: In Chickmagalur, Kodagu and Hassan districts where plantation crops, mainly coffee, were coming up, certain wooded lands were not reserved apparently for accommodating further expansion of such crops. It is necessary to bring such wooded lands to the fold of the Forest department so that these can be managed professionally by the department in a manner similar to that of the adjacent forest lands. Secondly, in the *malnad* region, considerable extents of wooded lands were kept for enjoyment of privileges by the local population. Some privileges were assigned for individual enjoyment through servicing of agricultural or plantation crops and some were assigned to the community as a whole. *Bane*, *Betta*, *Kumki* and *Kan* lands are examples of wooded areas which were burdended with such privileges. Although some of these lands have been managed well by some enlightened privilege holders, the lands have, over the years, undergone transformation in terms of crop composition, crop quality and tree density. Some areas have been subjected to over-use and abuse. Some areas have been fully degraded. Degradation is more palpable in the evergreen zone due to laterisation and the inherent inability of the evergreen species to re-establish in disturbed areas. The condition is somewhat better in the moist deciduous zone because of the resilience of the deciduous species to hold

on to the ground due to their coppicing vigour. In the recent decades, there have been some welcome developments regarding attempts at rejuvenation of these lands through voluntary as well as community efforts. These need to be strengthened and supported. Appropriate policy interventions are also required to finalise the sharing pattern of forest products from these lands, as privileges from some of these lands are individual-oriented and there is need for introduction of an element of equity in sharing of these products in the larger interest of the society.

17.8. In a significant order passed on 12-12-1996 on Writ petition (Civil) No. 202/1995 (T.N.Godavarman Thirumulkpad versus Union of India and others), the Hon'ble Supreme Court of India had ordered that the word 'forest' must be understood according to its dictionary meaning. The Hon'ble Court opined that forest covers all statutorily recognized forests, whether designated as reserved, protected or otherwise for the purpose of Section 2(1) of the Forest (Conservation) Act. The term 'forest land', occurring in Section 2 will not only include 'forests' as understood in the dictionary sense, but also any area recorded as forest in the Government record irrespective of the ownership. It was further clarified that the provisions of the Forest (Conservation) Act, 1980 must apply to all forests so understood irrespective of the ownership or classification thereof.

17.9. The intention behind the above order was to provide utmost protection to any forest irrespective of its ownership or classification. The Hon'ble Supreme Court of India has recognized the multifarious benefits that accrue from any forest eco-system and accordingly ordered that protection of such eco-system must be ensured at any cost by bringing it under the purview of the Forest (Conservation) Act, 1980. Following a directive from the Hon'ble Court, the Forest department has identified all the forest areas of the state which come under the definition of forest. The areas which are not under the custody of the Forest department are collectively termed as 'Deemed forests'. Final notification in respect of the 'Deemed forests' of the state is yet to be issued. Once these forests are officially recognized, the Forest department can take up comprehensive measures for their conservation and development.

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FARM FORESTRY THROUGH PUBLIC DISTRIBUTION OF SEEDLINGS

Forests of Karnataka, as in other parts of the country, are under various stages of degradation. The Karnataka Forest department has been relentlessly engaged in large-scale afforestation and reforestation in order to stop or slow down the process of forest degradation and to improve the quality of forest. However, various efforts at halting forest degradation and at improving forest quality have met with limited success in spite of various initiatives. The forests and plantations continue to be under tremendous stress due to external biotic factors. Even the plantations which are provided rigid protection by fencing are not safe from these external factors, as the fencing provides protection only for a few years. By and large, it has not been possible for the department to contain the external factors that are primarily responsible for forest degradation. It is apprehended that until and unless the primary causes of forest degradation are comprehensively addressed, any initiative at improvement of forest quality will not succeed. Such initiative is akin to giving health tonic to a sick person without curing his sickness.

18.2. One of the most important factors responsible for degradation of our forests is excessive withdrawal (mostly unrecorded) of biomass in the form of firewood and small timber. Another important factor is uncontrolled grazing by very large numbers of cattle. Other factors like fire, soil erosion, etc. are subsidiary to these two primary factors and will be under check once the primary factors are brought under control. The only way to reduce excessive removal of biomass from forest is to create abundant biomass resource outside the forest. This is possible only through very intensive and aggressive farm forestry. The notion that fuel wood should come from forest must go. Fuel wood required to cook food must also be grown along with food crops. Farm forestry not only reduces the pressure on forests but also helps in increasing the tree cover. Besides, it improves the income levels of the farmers. As regards stopping or regulating grazing in forest areas by large numbers of unproductive cattle, it is necessary to discourage rearing of unproductive cattle and to encourage cattle improvement, stall feeding and fodder improvement. Farmers owning cattle can achieve these objectives by adopting appropriate agro-forestry practices and integrating these with sound animal-husbandry practices.

18.3. Large-scale tree planting outside the natural forest areas is also necessary as the natural forests have a much larger national / global function of regulating stream flow and moderating climate. The overall impact of the forest eco-system on climate, hydrology, agriculture, etc. is so overwhelming that it is prudent to manage the natural forests in such a way that the national / global functions are not compromised or jeopardized.

18.4. The National Forest Policy, 1988 stipulates that one third of the total land area of the country should be under forest or tree cover. At present about 22% of Karnataka's geographical area is under forest or tree cover. In order to increase the state's forest or tree cover to 33%, an additional 11% of the state's geographical area has to be brought under tree plantations. The extent of land with the Forest department is limited and this extent is not likely to increase significantly in the future. Besides, most of the forest areas with the Forest department which are accessible and which are capable of growing trees have already been afforested. Although the Forest department will continue to afforest the remaining tree-less areas within the recorded forest area in order to increase the forest cover, it will not be possible to bridge the gap of 11% by the department alone. Bulk of the increment in forest or tree cover to make up for the deficit has to take place on non-forest land. The scope of taking up large-scale tree planting on non-forest government land is also very limited. Some such areas have already been taken under tree planting by the social forestry wing of the Forest department or other Government departments such as the Watershed development department. Besides, vast extents of non-forest government lands are either in much degraded condition or are under unauthorized cultivation. Therefore, the only way to achieve the national goal of 33% forest or tree cover is to encourage massive tree planting in private land under farm forestry program. Farm forestry has a number of advantages over community or public forestry: (a) the benefits from farm forestry entirely accrue to the individual farmers thereby improving their livelihood condition and economic status; (b) farm forestry does not have some of the inherent problems associated with community / public forestry such as, multiple stake holders / users, clash of interest, problems of protection, etc.; (c) the level of protection and management of a farm forest is far superior than that of a community or public forest due to undivided individual attention and interest from the owner of the land.

18.5. Even before the Forest department had started serious campaign for farm forestry through social forestry program in the 1980s, farmers had been taking up tree planting on their farm lands since ages. They were also protecting important trees that were coming up naturally in their farm lands. In addition to planting various fruit yielding trees such as tamarind, mango, jackfruit, nerale, coconut, areca-nut, etc., they were planting species such as bevu, honge, ficus, hebbevu, karijali, etc. in the farmlands for other benefits such as shade, mulching material, manure, timber, firewood, income, etc.

18.6. In order to encourage farmers to plant more trees in their farm lands, the Forest department had taken up public distribution of seedlings in a big way under the

externally aided Social Forestry Project (1983-1992). Under the project, about 50.75 crores seedlings were given free of cost to the farmers. This initiative had given an impetus to tree planting on private holdings and resulted in farmers taking up large-scale plantations of fuel wood species along with fruit and multiple-use species. The program became quite successful in districts like Bangalore Rural, Kolar, Tumkur, etc. This program has been continued in the state since then under a state sector scheme known as 'Raising of Seedlings for Public Distribution (RSPD)'. The Government of India had, through the NWDB / NAEB, launched a centrally sponsored scheme known as Decentralized Nursery / Kissan Nursery in order to give incentive to the farmers in raising seedlings so that these would be planted by the adjoining farmers in their farm lands.

18.7. Although the World Bank/ODA assisted externally aided Social Forestry Project had given impetus to planting on private holdings, there was no mechanism to ensure active participation of public. Since the cardinal principle of farm forestry is to ensure active participation of people, the department had in 1994-95 launched a new scheme entitled 'Support for planting on private holdings'. The aim of the scheme was to give financial incentive to individuals during the initial period of three years for successfully raising trees, based on the healthy seedlings surviving at the end of three years. The incentive under the scheme was limited to non-timber yielding usufruct plants like tamarind, honge, halasu, soapnut, etc., and was not extended to fast growing tree species like casuarina, eucalyptus, silver oak, etc. The scheme however continued only for a few years, as the JBIC assisted forestry project with a major farm forestry component was to be launched very soon.

18.8. Evaluation of the programs of public distribution of seedlings free of cost had brought out that while the farmers who were genuinely interested in tree planting had made good use of the seedlings, some others were indifferent and had not evinced much interest, and the seedlings were either not maintained well or were not planted at all. In view of this, the practice of distributing seedlings free of cost was given up and instead these were made available at nominal/subsidized rates. This was to ensure that only the farmers who were genuinely interested in tree planting would procure the seedlings from the department.

18.9. With the launching of the JBIC assisted forestry project, namely, the Eastern Plains Forestry and Environment Project (EPFEP) in 1996-97, farm forestry got added focus. This project had a very large farm forestry component. The project envisaged tree planting over 4,70,500 hectares, out of which 3,00,000 hectares of private farm lands were proposed to be treated under farm forestry through the

distribution of a variety of seedlings of fuel, fodder, green manure, small timber, non-timber forest products, medicinal plants and bamboo species required by the farmers and by extending advisory services in tree cropping and tree husbandry to the rural community. Under the EPFEP, seedlings were provided to the farmers at nominal/subsidized rates under the farm forestry component and 3.58 lakh hectares of farm land were brought under farm forestry as against the target of 3.0 lakh hectares.

18.10. Earlier, species chosen for public distribution were decided by the Forest department on the basis of what were considered suitable for planting in farm lands. However, in order to make the programme more participatory, the department started conducting demand-survey to make an assessment of the various species and their numbers required by the farmers during the next planting season. This enabled the department to raise seedlings as per the choice of the farmers and in adequate numbers.

18.11. During 2001-02, the Forest department launched a state sector programme called 'Vanasamvardhane Yojane' with the aim of encouraging public-private partnership in the area of afforestation. Many religious institutions and NGOs were involved in this programme and seedlings were provided to them free of cost for planting on farm lands. The target of the programme was to plant 500 lakh seedlings. The scheme was later transferred to the district sector and the planting target was achieved during 2007-08.

18.12. The program of public distribution of seedlings at nominal/subsidized rates was continued in the JICA assisted forestry project, namely, the Karnataka Sustainable Forest Management and Biodiversity Conservation Project (KSFMBC) which was launched during 2005-06 and was continued up to 31-03-2015. This project also had a fairly large farm forestry component. The project envisaged distribution of 7.60 crores seedlings to farmers at subsidized cost. The project also focused on the farmers themselves taking initiative in raising seedlings. With this objective in mind, the project provided for setting up of demonstration plots covering an extent of 2150 hectares in farmers' lands besides distribution of 500 tonnes of seeds among the farmers.

18.13. The Forest department had also been encouraging farm forestry under the MGNREGA. Large-scale farm forestry works are taken up in farmer's lands and seedlings were made available to them by the social forestry divisions. The beneficiaries were also paid wages for planting work.

18.14. To enlist the co-operation of farmers and general public in the noble task of increasing forest cover, the Forest department launched a programme titled 'Krishi Aranya Protsaha Yojane' from the year 2011-12. As per the guidelines of the programme, the farmers, public and NGOs may obtain the seedlings at subsidized rates from the nearest nurseries of the department. Seedlings so obtained are to be planted in their lands and nurtured and they are paid cash incentive from the department for each surviving seedling. The department provides Rs 10 as incentive for every surviving seedling at the end of the first year. A sum of Rs 15 and Rs 20 per seedling is provided for each surviving seedling after completion of second and third year respectively. The incentive is given to encourage the farmer not only to plant the seedling but also to nurture the seedling at least for three years. The total amount of money provided (Rs 45/- per seedling) more than compensates the cost incurred by the farmer in procuring and planting the seedling. The incentive is quite substantial when the farmer plants more number of seedlings. Needless to say that apart from getting the financial incentive, the farmers are entitled to get handsome returns from the grown up trees in various forms such as fruits, seeds, fodder, firewood, pole, timber, etc. The aim of 'Krishi Aranya Protsaha Yojane' was to encourage farmers to plant indigenous species in their farmlands rather than exotic or horticultural species. Therefore, species such as eucalyptus, acacia, silveroak (if planted in coffee estate), casuarina, seeme tangdi (*Cassia siamea*), gliricidia, sesbania, erythrina, rubber, subabul, coconut, betelnut, orange (including all species of citrus variety) and grafted mango were not covered under the incentive programme.

18.15. The farmers desirous of availing seedlings under the scheme have to register themselves with the department in advance giving various details such as particulars of land where tree planting is proposed, number of seedlings required, species, etc. These details are aggregated nursery-wise and range-wise and seedlings are raised accordingly. In order to facilitate the process of distribution of seedlings among the farmers, the department avails the services of NGOs, VFCs, etc. who are paid an amount of Rs 2/- per seedling as service charge.

18.16. By an order dated 19-06-2017, the state government has enhanced the package of incentive for the farmers under the 'Krishi Aranya Protsaha Yojane'. Under the revised incentive package, the Forest department will provide Rs 30/- as incentive for every surviving seedling at the end of the first year. A sum of Rs 30/- and Rs 40/- per seedling will be provided for each surviving seedling after completion of second and third year respectively. Thus an amount of Rs 100/- will be paid towards every successful plant as against Rs 45/- provided earlier.

18.17. The Annual Reports of the Karnataka Forest Department (KFD) for 2014-15, 2015-16 and 2016-17 reveal that the number of seedlings distributed by the department under the 'Krishi Aranya Protsaha Yojane' since its launch in 2011-12 is as follows: 2011-12 (49.11 lakhs), 2012-13 (76.94 lakhs), 2013-14 (99.03 lakhs), 2014-15 (66.73 lakhs), 2015-16 (60.67 lakhs) and 2016-17 (61.50 lakhs).

18.18. Out of the 49.11 lakh seedlings distributed during 2011-12, 18,67,136 seedlings were found to survive after the first year, 15,51,808 seedlings survived after the second year and 13,20,879 seedlings survived after the third year. This indicates that although the survival percentage after the first year was low (38.02%), further survival rate with respect to the number of seedlings that survived the previous year is encouraging: 83% after the second year and 85% after the third year. However, the number of seedlings that survived after the third year with reference to the originally distributed seedlings was 26.90%.

18.19. During 2012-13 rains, 76,93,796 seedlings were distributed to farmers under the scheme out of which 26,15,008 seedlings survived after one year, the survival rate being 34%. Out of the above, 19,16,032 seedlings survived after the second year with a survival rate of 73% with reference to the number of seedlings that survived the previous year, but only about 25% with reference to the number of seedlings distributed originally.

18.20. During 2013-14 rains, 99,03,132 seedlings were distributed to farmers under the scheme out of which 31,16,373 seedlings survived after one year, indicating a survival rate of 31% after the first year.

18.21. The Annual Report of KFD for 2015-16 indicates that the total number of seedlings survived (as on 2015-16) out of the ones distributed during the years 2011-12, 2012-13 and 2013-14 is 69,650,000. Since the total number of seedlings distributed during these three years was 225.08 lakhs, the overall survival rate is 30.94%. The Annual Report of KFD for 2016-17 indicates that the total number of seedlings survived (as on 2016-17) out of the ones distributed during the years 2012-13, 2013-14 and 2014-15 is 81,81,500. Since the total number of seedlings distributed during these three years was 242.70 lakhs, the overall survival rate is 33.71%.

18.22. From the above data, it appears that the average survival rate of the seedlings distributed under the 'Krishi Aranya Protsaha Yojane' is about 30%. It is also apparent that the highest casualty is noticed after completion of one year after which the mortalities are relatively less. This is along expected lines, as the seedlings

which have survived one dry season have a better probability of survival during the subsequent dry seasons.

18.23. Although the survival rate of seedlings under the scheme so far has been much below the average survival rate of a departmentally raised plantation, it is necessary for the Forest department not to get disheartened. The department should continue to bestow special attention to the innovative scheme, as the future of the natural forests to a considerable extent will depend upon the success of this scheme. As we have seen, for the scheme to succeed, the survival rate during the first year has to improve a lot. This will have to be ensured by a number of ways:

1. The quality of seedlings for supply has to be the best. Seedlings for the scheme should be raised separately and these should not be mixed with the seedlings raised for the purpose of departmental plantations. The general tendency of the field level functionaries to retain the best seedlings of the nursery for departmental plantations should be curbed.

2. The seedlings should be supplied to the applicants/farmers promptly as and when requests are made. Separate staff should be engaged to supervise distribution of seedlings so that distribution is not affected by other reasons such as non-completion of departmental plantation works, non-availability of staff to supervise distribution, etc.

3. The focus of extension should be on making farmers aware of various benefits of farm forestry and its impact on their economy, lifestyle and surrounding environment. The urge to plant trees in their farmlands should come voluntarily and naturally from the farmers. The department should not be seen as putting pressure on them to simply take away seedlings from the nursery. Similarly, the choice of species should be left to the farmers and no species should be forced on them just because seedlings are available in the nursery.

4. During the first year, the department should vigorously monitor the progress of planting through field-level staff, motivators, service providers, VFCs, etc. who should provide necessary technical input and assistance to the farmers in planting and nurturing the seedlings. The farmers should be encouraged and helped in all possible ways to attain the highest survival rates in their plantations.

5. Exemplary works by farmers should be given wide publicity and such farmers should also be awarded for their special achievements.

6. As regards, fast growing species such as *Acacia auriculiformis*, *Casuarina equisetifolia*, *Cassia siamea*, etc., it is necessary to encourage planting of these species in smaller woodlots; such woodlots will contribute in a very significant way towards production of fuel wood and small timber required by the farmers. As one of the principal aims of the farm forestry programme of the Forest department is to reduce biotic pressure on our natural forests, incentive to the farmers in planting these species will go a long way in achieving this aim. It is suggested that the upper limit of such incentive may be pegged at 1000 seedlings, which roughly correspond to one hectare of woodlot. Besides, a slightly reduced amount as financial incentive may be considered in respect of these species.

7. Farmers from Bangalore Rural, Ramnagar, Mandya and Mysuru divisions should be encouraged to grow hale trees (*Wrightia tinctoria*) in their farmlands. Wood from this species is very much in demand as it is eminently suited for turnery, carvings, etc.; superior quality toys are made from this wood at Channapatna near Ramnagar. Sufficient number of hale seedlings should be raised in the departmental nurseries of the divisions to supply to the farmers under the programme.

18.24. Overall, for 'Krishi Aranya Protsaha Yojane' to succeed there is need to evolve a comprehensive farm forestry policy based on our past experiences. The policy should address issues like assessment of demand for seedlings, raising quality planting material, network of high-tech nurseries, distribution mechanism for seedlings, timely technical advice, simplification of laws, incentives for planting, marketing support, etc. This assumes tremendous significance considering the vast potential of Farm Forestry in enhancing tree cover.

18.25. The'Krishi Aranya Protsaha Yojane' with the revised incentive is a very attractive programme and it is hoped that it will encourage more and more farmers to come forward to plant trees in their farmlands and thereby contribute to the national goal of enhancing the forest and tree cover to 33%. As the programme picks up, larger amounts will be required for disbursement among the farmers. Given the normal budgetary constraints and procedures regarding release of funds, this will naturally

cause delay in payments to the farmers. The momentum of the programme can be sustained only when payments to the farmers are made promptly, transparently and without undue delay. It is therefore necessary to provide adequate funds in advance to the disbursing officers. Alternatively, a separate and dedicated fund can be created out of certain portion of Forest Development Fee (FDF) collections and this fund should be kept at the disposal of the PCCF (HOFF) exclusively for the purpose of releasing to the disbursing officers for payments to farmers under the 'Krishi Aranya Protsaha Yojane'.

18.26. Karnataka needs a robust farm forestry programme not only for assisting the state in reaching the national goal of one third of its geographical area under forest or tree cover, it is also required for the long-term environmental sustainability of its agricultural ecosystem. As per the Report of Land use-Land cover classification of various districts of the state prepared in 2006 by the Karnataka State Remote Sensing Application Center (KSRSAC), the extent of land area brought under cereal crop in most of the districts of the state barring a few in the *malnad* region is as high as 75-85% of the geographical area of the districts. In some districts such as Gadag, Vijayapura, Kalaburagi and Yadgiri, it is almost 90%. Although the Forest Policy of 1952 had discarded the earlier held view that forestry has no intrinsic right to land, the same view was continued even after 1952 and expansion of agriculture by any means was encouraged. The general tendency in the agriculture sector has been to increase food production by expanding agricultural lands rather than by intensifying and modernizing agricultural operations. In the bid to expand agriculture, most of the lands which were considered fit for cultivation were cleared and brought under the plough. The pace of agricultural expansion has been so intense that private lands harboring tree growth around cultivated lands meant for the benefit of agriculture were also cleared; this was followed by unauthorized clearance of similar lands with the Revenue department. As a result, the forests in the state except in the *malnad* region have receded to the hilly and undulating tracts not considered fit for cultivation. Evidently, forest had to contend with the poorest of the available lands in adverse climatic conditions. Even these areas are not free from biotic pressures such as illicit removal, excessive grazing, recurring fires and, above all, encroachments by land hungry people. It is necessary to appreciate that having vast expanses of open agricultural land only under cereal crop without any tree growth or wood lot can be environmentally unsustainable and highly counter productive, especially in the rain deficient and drought prone areas of the state. The contribution of forest or tree cover to the sustainability of agriculture and food security has not been appreciated by vast majority of the people. On the contrary, forest lands are treated as an unnecessary appendage which is sought to be eliminated in order to expand croplands. It is necessary to dispel this misconception and make people aware of the positive role of

forestry in agricultural development. Maintenance of tree cover helps in restoring soil fertility leading to increased yield of agricultural crops. Trees improve soils through production and maintenance of organic matter, nitrogen fixation, nutrient recycling, reduction of desiccation, increase in soil moisture, etc. Forest or tree cover ensures protective environmental functions such as maintenance and restoration of soil fertility, erosion control, soil and moisture conservation and maintenance of bio-diversity. It also ensures productive economic functions such as production of food, fuel, fodder, agricultural implements and construction material, creation of rural employment and generation of income.

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JOINT FOREST PLANNING AND MANAGEMENT (JFPM)

Much of India's natural forests, which cover about 23% of the land area, have suffered rapid depletion and degradation over several decades due to increasing pressures of human and cattle populations for food, fuel and fodder. The crisis situation created by a vicious circle of progressive depletion of forest resources due to rising demand from an increasing population made it apparent that management of the very limited natural forests will not by itself fulfill the growing needs of the population and it will be necessary to develop forest resources outside the traditional forest areas. It was in this background that during the 1950s and 1960s, increasing emphasis was given to planting of trees on farm, village and community lands. These initiatives got further impetus in the recommendations of the National Commission on Agriculture (1976) which outlined the contours of Social Forestry in India. Since then, social and community forestry programs were given increasing prominence in order to bring forests closer to the people. The idea was to adequately cater to the forest based requirements of the people from lands outside the purview of the traditional forest areas, in a bid to reduce pressures on natural forests. The results of the social forestry programs were mixed. One positive development was the increased tempo of tree planting on private lands. However, it was criticized that much of such tree planting activities were initially taken up by big farmers, that the choice of species for planting was limited to a few fast growing species like eucalyptus, casuarina, poplar, etc., and that a substantial portion of the trees eventually catered to the pulp wood and paper industries. While the above criticism was partly true, it must be admitted that the supply of wood-based raw material to the industries had substantially reduced the pressure on the natural forests. Besides, sizeable quantities of the biomass generated in the plantations, in the form of leaves, twigs, branches, barks, etc. (estimated to be about 20%-30%) were available as fuel wood to the poor, many of whom also earned wages by working in these plantations. As regards social forestry plantations on non-forest community lands, it was generally argued that although these had marginally improved the availability of biomass, the approach adopted was merely an extension of the traditional forest management approach without much involvement of the adjoining communities. The overall criticism was that the social forestry was by and large a program driven by the Forest departments.

19.2. A review of the social forestry programs, with regard to their strengths and weaknesses, led to redefining the approach of forest management aiming at comprehensive and sustainable development of forest. In the new management approach, rehabilitation of degraded forests, primarily through natural regeneration,

was accorded very high priority. The concept of participatory forest management on usufructs sharing basis was also gaining ground as an effective means of regenerating India's degraded forests. The National Forest Policy of 1988 has recognized the interdependence between people and forests and envisages active community participation in the protection and development of forests. Enlisting people's involvement in the development of fuel wood, fodder, small timber and non-timber forest products (NTFP) for the rural and tribal population and creating a massive people's movement with the involvement of women are some of the basic objectives of the Forest Policy of 1988. It also stresses that rights and concessions from forests should primarily be for the bonafide use of the communities living in and around forest areas, specially the tribal people.

19.3. It was in the above context that the Government of India on 1st June, 1990 issued a circular highlighting the need and the procedure to be adopted for the involvement of village communities and voluntary agencies for regeneration of degraded forest lands. The circular emphasized on the need to motivate and organize village communities for protection, afforestation and development of degraded forest land, especially in the vicinity of habitations. In order to ensure community participation, the state governments were advised to enlist the services of committed voluntary agencies or non-government organizations (NGO) with proven track record and take full advantage of their expertise and experience for building up meaningful people's participation in protection and development of degraded forest lands. The voluntary agencies/NGOs were to be associated as interface between the state forest departments and the local village communities for revival, restoration and development of degraded forests. The circular constituted a significant departure from the then existing forest management practices, increasing the emphasis to be laid on obtaining the active participation of the people in forest conservation and development programs, by developing micro-plans, right from decision making to carrying out the decisions. Another significant point made in the circular was the benefit sharing arrangement which was intended to provide village communities a stake in the protection and development of the degraded forests.

19.4. In order to assist the state governments to take up participatory forest management, the Ministry of Environment and Forests had launched a number of centrally sponsored schemes during the 1990s. These included the schemes such as the Integrated Afforestation and Eco development Projects scheme (IAEPS) and Association of Scheduled Tribes and Rural Poor in Regeneration of Degraded Forests (ASTRP). During 2001-02, the National Afforestation and Eco-development Board (NAEB) of the Ministry of Environment and Forests launched a new centrally

sponsored scheme, namely, 'National Afforestation Programme (NAP)' in place of the earlier schemes. Through this flagship programme, the NAEB provided support for afforestation implemented through the Forest Development Agency (FDA), which is a registered society comprising of officials of the Forest department and members of the village forest committee (VFC). The focus of the program is consolidation and strengthening the process of joint forest management to empower grass root committees in planning, decision making and sustainable management of natural resources. The FDA was conceived and established as a federation of joint forest management committees at the forest division level to undertake holistic development in the forestry sector with people's participation.

19.5. In pursuance of the National Forest Policy of 1988 and the guidelines contained in the1st June, 1990 circular of the Ministry of Environment of Forests, the Karnataka Forest Department evolved a comprehensive forest management process called the Joint Forest Planning and Management (JFPM) in order to conserve and sustainably manage the forest resources with the involvement of the village communities living in the vicinity of forests. Joint forest planning and management is a consultative process by which the Forest department and the local people discuss the ecological and environmental impacts of management and decide the strategies after going through a process of micro-planning. Management decisions on a number of issues such as choice of species, protection, harvesting, sharing of benefits, etc. are taken after mutual consultation between the KFD and a committee of the villagers, namely, the village forest committee (VFC). With the objective of making JFPM an integral part of most of the forestry programs of the state, a Government Order No. AHFF 232 FAP 86, Bangalore, dated 12-04-1993 was issued. The order specifies the areas covered under JFPM, composition of the VFC, management aspects of the VFC, disposal of forest produce and sharing mechanism between the stake holders and the role of the Government and NGOs in JFPM activities. As per the Government Order, joint forest planning and management programme shall be introduced in the following categories of land: (a) Degraded forest land where the canopy cover is 0.25 and less; (b) Non-forest Government waste lands like 'C' and 'D' class lands, community lands, transferred for the purpose of joint forest planning and management; and (c) Roadsides, canal sides and foreshores of tanks.

19.6. The JFPM order of 1993 stipulated that annual accruals like grass, usufructs like fruits, nuts, lops and tops would be given to the beneficiaries free of charge. The proceeds from the sale of forest produce are to be shared between village forest committees and Government on an equal basis. Out of the 50% coming to the VFCs, 25% will be distributed to the beneficiaries and 25% would go into a special

fund called 'Village Forest Development Fund', to replant and sustain the program. The following processes were adopted in the state as a part of joint forest planning and management:

1. Participatory Rural Appraisal by involving non-government organizations (NGO).
2. Increased participation of women.
3. Training of VFC members and Forest Officers.
4. Exploring ways to build sustainable VFCs.
5. Preparation of demand oriented micro-plans based on requirement.
6. Study of various resource management options.
7. Site-specific planning.
8. Decentralization and bottom up approach.
9. Involvement of NGOs.
10. Integration of micro-plans into Working Plans

19.7. Field level initiation of the Karnataka Forest Department (KFD) into participatory forest management took place during 1992-93 with launching of the ODA (UK) aided Western Ghats Forestry and Environment Project (WGFEP). Launched initially in Uttara Kannada district and then extended to Shimoga and Chickmagalur districts, the project aimed at attaining sustainable development of the forests with active participation of the neighboring people. The project aimed at reorienting the conventional management approach of policing forest to that of conserving and developing forest in consultation, co-operation and participation of people. In other words, the project aimed at a process change in which the institutional capability of the Forest department is enhanced to develop JFPM strategies with local communities on the principle of joint sharing of benefits. The project provided for involvement of NGOs to motivate the people in joint forest planning and management and to liaise between the villagers and the KFD.

19.8. The Karnataka Forest Act, 1963 was amended in 1998 (Act No. 12 of 1998) by inclusion of a new section, namely, Section 31A - 'Constitution of Village Forest Committee for Joint Forest Planning and Management of Forest'. The purpose of this amendment was to give momentum to the movement of joint forest planning and management (JFPM) and to institutionalize the working of the village forest committees (VFC). This amendment has empowered the Government to make rules

regarding various aspects related to the constitution and functioning of VFCs, their duties and responsibilities, power and duties of forest officers, preparation of management plans, sharing mechanism, settlement of disputes, monitoring and evaluation, etc.

19.9. Before the Western Ghats Forestry and Environment Project came to an end in 1999, Karnataka Forest Department in 1997 launched another externally aided afforestation forestry project with JBIC assistance, namely, the Eastern Plains Forestry and Environment Project. This project covered the *maidan* areas of the state and had a large component of participatory forest management, besides farm forestry. During the implementation of this project spanning over eight years (1997-2005), about 3000 VFCs were formed and about 1.6 lakh hectares of land comprising of degraded forest lands, government waste lands, village common lands and tank foreshore areas were afforestated with the involvement of the VFCs.

19.10. On the basis of experience gained during the course of implementation of JFPM activities and in order to intensify the activities of JFPM for better protection, development and management of degraded forests and other Government waste lands and also to overcome some operational problems encountered in the field, the Government of Karnataka issued a comprehensive Government Order No.FEE 50 FAP 2000, Bangalore, dated 19-06-2002. The revised Government order provides for revised modalities for sharing of forest produce between the VFCs and the Government as follows:

1. The total proceeds derived from the sale of non timber forest products (NTFP) shall be shared between the VFCs and the Government in the ratio 90%:10%. +
2. The total proceeds derived from the sale of other forest produce obtained from the assets created with the help of VFC, the sharing pattern between the VFC and the Government will be 75%:25%.
3. The total proceeds derived from the sale of other forest produce obtained from the assets created prior to formation of VFC (including older fuel wood, fodder and small timber plantations but excluding Teak plantations), the sharing pattern between the VFC and the Government will be 50%:50%.
4. The total proceeds obtained from the natural growth prior to formation of VFC (excluding valuable species viz., Sandalwood, Rosewood, Teak, Honne, Matthi and Nandi) subject to the provision of Working Plan prescriptions, the sharing pattern between the VFC and the Government will be 50%: 50%.

19.11. The Government Order of 19-06-2002 also stipulates that out of the share of the VFC as indicated above, a minimum of 50% shall go to the Village Forest Development Fund (VFDF) and the balance will be shared by the members of the VFC as dividends or will go to the Village Development Fund (VDF) as decided by the VFC.

19.12. After the Eastern Plains Forestry and Environment Project came to an end in 2004-05, Karnataka Forest department in 2005-06 initiated another forestry project namely, the Karnataka Sustainable Forest Management and Biodiversity Conservation Project (KSFMBC) with the financial assistance of Japan International Cooperation Agency (JICA). The objective of the project which covered the entire state was to bring about ecological restoration and to facilitate livelihood improvement of the inhabitants of the project villages by afforestation through joint forest planning and management (JFPM). In addition to afforestation, farm forestry and other associated works, this project had a component of conservation of biodiversity and improvement of protected areas including one national park and four wildlife sanctuaries. Keeping this in view, the project envisaged formation of eco development committees (EDC) to assist in the protection of the protected areas. During the implementation of this project spanning over ten years (2005-2015), about 1,222 village forest committees (VFC), 73 eco development committees (EDC) and 6,066 self help groups (SHG) had been constituted / identified under the project and about 1,87,085 hectares of land were afforested.

19.13. In addition to the above externally aided forestry projects, each of which had a significant component of afforestation with people's participation through JFPM, the Forest department since 2001-02 was also implementing the NAEB-sponsored National Afforeststion Programme (NAP) through Forest Development Agencies (FDA). The department in 2009-10 had also launched an afforestation program, namely, the Samruddha Hasiru Grama Yojane, under which it was envisaged to increase tree cover and develop the available natural resources of a village to achieve self sustainability in terms of various forest products such as small timber, fodder, green leaves, medicinal plants, etc. to cater to the needs of the villagers, and also to supply bamboo and other raw materials to the artisans of the village. Besides, it was proposed to set up biogas plants for energy generation and to take up afforeststion and soil conservation works so as to improve ground water table. The programme of comprehensive village development was initiated by taking one village per forest division.

19.14. With the closure of the externally aided forestry projects, some of the VFCs which were formed under the projects were found to have become inactive due to non availability of funds. Some of the VFCs were covered under the NAP-FDA

programme. In order to reactivate the dormant VFCs, the State Government in 2013-14 initiated a scheme called Village Forest Committees with activities such as skill up-gradation, training and facilitation works, maintenance of plantations, setting up of biogas plants, providing of LPG connections, etc.

19.15. An important outcome of JFPM initiatives in the state is that these have brought the people closer to the forests and the Forest department. There is increased interaction between the Forest department and local communities which resulted in mutual understanding between the two. It also led to better appreciation of the concept of people's participation in forest management amongst the field level functionaries of the department. Constant dialogue and interaction between the department and the facilitator NGOs helped in better appreciation of each other's point of view. Overall, it provided a platform for positive consultations among the department, local people and the NGOs.

19.16. One positive result of the JFPM programme in the state is the formation of a large number of village forest committees (VFC). Some of these VFCs have been able to generate resources through the JFPM process and remained active without any external support. A number of eco-development committees which were established around some wildlife areas and other eco-tourism spots, have been able to function effectively and sustainably. Formation of a number of self help groups (SHG) under the JFPM is also an important contribution, as it has empowered and emboldened the women, even from among the marginalized sections of the society, to take up various income-generating activities.

19.17. Another positive impact of the JFPM programme has been on poverty alleviation through a number of benefits. There is more efficient utilization of forest resources. Expenditure as well as time in procuring fuel wood and fodder has reduced considerably. Various income generating activities supported under the JFPM, including strengthening of the SHGs, have opened up diversified means of livelihood such as farming, livestock rearing, dairy, horticulture and home enterprises. These have paved the way for improved living standards in respect of food, clothing, shelter, education of children, reduced burden on women engaged in collecting firewood and feed, etc. These have also had a beneficial impact on women and tribal people. All these developments have indirectly reduced dependence on the forest.

19.18. However, one notable drawback of the JFPM programme so far is that it has by and large remained as a scheme of the Forest department requiring constant funding and hand holding to remain active. In other words, it has not been internalized as a means of forest management. Ideally, JFPM ought to have become a

tool for forest management so that it fits into any activity of the Forest department which aims at protection and development of degraded forest. There have been many examples of VFCs doing exceedingly well in forest protection and development during the currency of the supporting project or scheme. But most of these VFCs become dormant or inactive with the withdrawal of support or funding, and it becomes necessary to infuse more support and funding to activate them. JFPM can be said to have become successful only when it attains self sustainability.

19.19. The decision making capability of the VFCs is generally poor and as a result, most of the decisions in the VFCs are taken by the Forest department officials. For JFPM to be successful in its true sense, the VFCs need to emerge as autonomous village level institutions so that they can take independent decisions regarding forest management under the guidance of the Forest department. The significance of JFPM lies in empowering people to manage forest in a democratic and decentralized manner. There is further need for raising awareness of the people about the significance of JFPM so that the urge to manage the forests comes from the community as a spontaneous need of the society rather than a program thrust upon them.

19.20. When joint forest management (JFM) was introduced in India in the 1970s, it was thought by some that the new policy initiative would eventually replace the system of forest management practiced by the Forest department. The traditional approach of the department of policing the forest is regarded by many as a legacy of the British administration. They argue that before the British took over forest administration and initiated the process of reservation, forests were managed very efficiently by the community and that degradation and depletion of forests started only after their nationalization. The votaries of this argument also assert that once the control of the Forest department is withdrawn, the community will be able to effectively manage the forests as they had done in the past. When the government came out with the policy of enlisting people's participation in regeneration of degraded forests with less than 25% crown density, they had expressed resentment that high forests had been kept out of the purview of the JFM process.

19.21. There is, however, very little evidence to indicate that forests were well managed before scientific management of forests was started by the British during the middle of the nineteenth century. As a matter of fact, rational codification of rights, privileges and concessions to be enjoyed by the public was initiated during the British period only. The British Indian Government had not embarked upon this exercise immediately upon taking over the reins of administration. They had initially continued with the way forests were earlier managed by the erstwhile rulers who had

allowed the forests to be subjected to heavy and indiscriminate exploitation: Private dealers were allowed to cut and carry marketable timber on payment of royalty. In some areas a system of issue of licenses/permits to exploit timber was in vogue. There was practically no restriction on removal of firewood. People used to graze their cattle freely and they used to cut the tree growth for agricultural implements and for dwelling. Officials responsible for collection of land revenue also used to collect royalty or fees for forest produce. The British Indian Government continued with similar approach to forest management for many years until the middle of the nineteenth century when it was realized that if the over-exploited forests are to be protected and developed, much more needs to be done by stopping their abuse and controlling / regulating their use. Under the guidance of Dr. Dietrich Brandis, Inspector General of Forests, a professional German forester, the British Indian Government initiated the process of reservation of forests so as to protect these areas from indiscriminate felling and manage them for sustainable production as per silvicultural principles.

19.22. The process of reservation of forests brought in certain restrictions to the manner in which people were enjoying the benefits accruing from the forests. Until then, forests were almost regarded as 'open access resources', often for everybody's use. This apparent free access to the forests and the forest products by the common man has often been interpreted to mean that forests are common property resources. Common use of the forest resources by the community has often been interpreted as common management of the resources by the community. Such an interpretation is unrealistic and unreasonable, because abundance of forest resources, over large areas, for the benefit of a relatively small population, had given a wrong impression of forests being an inexhaustible resource and, consequently, the urgency and need to manage forests on a rational basis was not felt.

19.23. Prior to the advent of the British, there must have been examples of forests which were protected well by the communities across the length and breadth of the country. In the *malnad* region of Karnataka, one does come across patches of forest with high bio-diversity which are the results of sustained efforts at preservation by the adjoining communities. However, these are at best excellent examples of forest protection and not of sustainable forest management: while certain patches of forests were given utmost protection, other portions of the forests were used and abused heavily for obtaining the biomass requirements of the people. There does not appear to have been conscious attempt at sustainably managing forest through the community as an institutional mechanism prior to the advent of the British. Attempts at community management of forests, made in Madras Presidency in the 1920s, did

not yield desired success. It must also be added that while reserving forests, the British administration had excluded considerable extents of tree-covered lands from the purview of reservation for the use of the people. Most of these forests have vanished in due course, as the lands have been encroached upon and later regularized or have been granted under land grant rules. As a matter of fact, in Karnataka, except for some patches of thickly wooded Revenue lands in inaccessible areas, it is only the reserved forests which have so far remained fairly in tact despite pressures from various fronts.

19.24. In the above context, the government's initiative to permit only some of the forests to be managed by the community as a partner with the Forest department through joint forest planning and management (JFPM) was a step in the right direction. It was realized that appropriating the entire forest to the community for management would not be feasible, as in a situation of growing demand and dwindling supply, sustainable management of forest will certainly require some degree of centralized authority. However, as rigid centralized control over natural resources often leads to distorted priorities, much to the detriment of common and local needs, this authority must have a lot of flexibility. Besides, it was also appreciated that the 'common property resources' psychology of people, built over years of free, unrestricted and unlimited use, never allowed the authority to forcefully and effectively enforce whatever laws were enacted to protect the forests. It was therefore essential to decentralize control over natural resources to a desirable extent. To make it possible for the people to collectively exercise this control, it is important that conditions are created for effective management of forests, with people's participation and involvement by creating appropriate local bodies and institutional structure. While government organizations will necessarily have to play a nodal role in facilitating this development process, co-operation and assistance of dedicated non-government organizations (NGO) must also be fully enlisted at all stages of planning, implementation and utilization. In short, a desirable institutional alternative has to lie somewhere between the state controlled forest management model and the 'free-for-all' model. The joint forest planning and management programme of Karnataka was precisely modeled in this fashion.

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FOREST COVER AND TREE COVER SCENARIO

The Forest Survey of India (FSI), Dehradun had since 1983 initiated the work of assessment of the forest cover of the country on a two-year cycle using satellite data. The first cycle assessment of the forest cover was based on satellite data pertaining to the period 1981-83. The results of the first cycle assessment were published as the State of Forest Report (SFR) 1987. Since then, fourteen assessments of the country's forest cover have been made and the results have been published in the State of Forest Reports 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, 2005, 2009, 2011, 2013, 2015 and 2017. For the purpose of monitoring of change in forest cover, initially three types of forest were considered: (1) Dense forest with crown density above 40%, (2) Open forest with crown density between 10% and 40% and (3) Mangroves. In the State of Forest Report 2001 and subsequent reports, Mangrove forests have not been shown as a separate category. These have been classified into dense and open mangroves and merged with regular forest cover. However, a chapter on the mangrove forests has been incorporated in each State of Forest Report. In the State of Forest Report 2003 and subsequent reports, 'Dense forest' (with crown density above 40%) has been sub-divided into two categories: (1) Very dense forest (VDF) with crown density above 70% and (2) Moderately dense forest (MDF) with crown density between 40% and 70%.

20.2. In the initial years of assessment of forest cover, interpretation of satellite data was done visually. The mode of visual interpretation was gradually replaced by the technique of digital image processing (DIP). For State of Forest Reports 1995 and 1997, digital data was used for two states. For State of Forest Report 1999, digital data was used for fourteen states. For State of Forest Report 2001 and subsequent reports, digital data has been used for the entire country. There was also a significant change in the methodology adopted in the mapping of forest cover pertaining to the period 2006-2007 which was reported in State of Forest Report 2009: vector approach was followed in place of rastar approach. The new approach focuses on each polygon where change in forest cover has occurred either due to improvement or degradation. Due to this change in the methodology, the subjectivity in the interpretation has been greatly reduced. In order to make the forest cover pertaining to 2006-07 which was mapped with the help of the new methodology comparable with the forest cover pertaining to the preceding period, i.e. 2004-05, the satellite data for 2004-05 was reinterpreted with the new methodology. This resulted in revision of the figures published in State of Forest Report 2005.

20.3.The forest-cover scenario of Karnataka as depicted in the SFRs is indicated below:

TABLE-II

Forest Cover of Karnataka as depicted in the State of Forest Reports (SFR) Published by the Forest Survey of India (FSI), Dehradun

(Area in square kilometers)

State of Forest Report: Year of Report (Year of assessment)	Dense forest (Crown density above 40%)		Open forest (Crown density between 10% and 40%)	Mangrove	Total	Change
1987 (1981-83)	16,394		15,870	0	32,264	
1989 (1985-87)	24,749		7,351	0	32,100	-164
1991 (1987-89)	24,856		7,343	0	32,199	+99
1993 (1989-91)	24,852		7,491	0	32,343	+144
1995 (1991-93)	24,859		7,521	2	32,382	+39
1997 (1993-95)	24,854		7,546	3	32,403	+21
1999 (1996-98)	24,832		7,632	3	32,467	+64
2001 (2000)	26,156		10,835	-	36,991	+4,524
State of Forest Report: Year of Report (Year of assessment)	**VDF (Crown density above 70%)**	**MDF (Crown density between 40% & 70%)**	**Open forest (Crown density between 10% and 40%)**		**Total**	**Change**
2003 (2002)	431	22,030	13,988		36,449	-542
2005 (2004-05)	464	21634	13,153		35,251	(-1,198)
2005 (2004-05)(Revised)	1,772	20,196	14,232		36,200	-249
2009 (2006-07)	1,777	20,181	14,232		36,190	-10
2011 (2008-09)	1,777	20,179	14,238		36,194	+4
2013 (2010-12)	1,777	20,179	14,176		36,132	-62
2015 (2013-14)	1,781	20,063	14,577		36,421	+289
2015 (2013-14) updated	1,783	20,177	14,489		36,449	+317
2017 (2015-16)	4,502	20,444	12,604		37,550	+1,101

20.4. It may be noted from the above table that the change in forest cover in a few instances is quite significant. The forest cover increased by whopping 4,524 square kilometers between the State of Forest Reports 1999 and 2001. The net difference in forest cover assessments shown in SFR 1999 and SFR 2001 is mainly attributed to change in technique of interpretation from visual mode to digital mode and partly due to real change in the forest cover during the intervening period between the two assessments. The change in forest cover depicted between SFR 2001 and SFR 2003 (–542 square kilometers) is partly attributed to interpretational corrections as a result of progressive ground truthing. Change in the methodology followed in the mapping of forest cover from rastar method to vector method also had a bearing on the interpreted results. Between SFR 2003 and SFR 2005, there was earlier a difference of – 1,198 square kilometers; this figure subsequently changed to -249 square kilometers, as the satellite data pertaining to SFR 2005 was reinterpreted as per the new methodology in order to make the forest cover figures comparable to those of SFR 2009. All these changes in technology have made the interpretation more and more objective and the accuracy levels have improved. As a result, the

figures of forest cover provided in the State of Forest Reports have become progressively more realistic. The figures given in SFR 2009 and subsequent Reports are based on interpretation of satellite data with similar advanced technology. Hence, these figures can be taken to represent fairly realistic assessments. However, comparison of the forest cover figures between two assessments on a long time-scale (such as, between SFR 1987 and SFR 2015) is not realistic because of the corrections/improvements in technologies made during the intervening period. It must however be conceded that on a short time-scale of consecutive assessments (when methodology of interpretation remained the same), Karnataka's forest cover had shown increase on more occasions.

20.5. It may also be noted that phenomenal increase (+2,719 sq. km.) in the extent of very dense forest (VDF) has taken place between 2013-14 and 2015-16 assessments as published in the SFR 2017. A similar phenomenal jump in the VDF category had also taken place between the 2005 assessment and 2005 (Revised) assessment when the forest cover pertaining to this category jumped from 464 square kilometers to 1,772 square kilometers.The jump between 2005 and 2005(Revised) assessments was mainly attributed to improvement in the technology of interpretation. As regards the jump between the 2013-14 and 2015-16 assessments, no specific reason has been indicated; however, the overall increase by 1,101 square kilometers in Karnataka's forest cover has been 'attributed to plantation and conservation activities both within and outside the Recorded Forest areas as well as improvement in interpretation due to better radiometric resolution of the recent satellite data from Resourcesat-2'. It will be interesting to know as to how much of the increase in Karnataka's VDF by 2,719 sq. km. recorded in SFR 2017 is due to 'plantation and conservation activities' and how much is due to 'better radiometric resolution of the recent satellite data'. As a matter of fact, to any forester who has served in the Western Ghats region of Karnataka, the previous FSI assessments of VDF appeared to be gross under-estimates. This is primarily because, about 60% of the country's Western Ghats region is located in Karnataka and some of the best forests of the region occur in a number of districts such as Belagavi, Uttara Kannada, Shivamogga, Chickmagalur, Udupi, Dakshina Kannada, Kodagu and Hassan. Most of these pristine and dense forests (mostly evergreen and semi-evergreen) have virtually remained untouched except for limited clearances for hydro-electric projects and ply-wood working in some parts prior to the 1980s. In this context, it may be mentioned here that as per the Land use-Land cover assessment (2006) carried out by the Karnataka State Remote Sensing Application Centre (KSRSAC) based on interpretation of satellite imageries pertaining to the period 1999-2000, the district-wise natural forest area in the density class above 70% was as indicated in the following table:

TABLE-III
Forest Cover of Karnataka (above 70% Crown Density)
as per KSRSAC Report (2006)

District	Type of forest			Total
	Evergreen	Semi-evergreen	Moist deciduous	
Belagavi	22,895.01	-	-	22,895.01
Uttara Kannada	1,98,516.10	5,665.92	0.12	2,04,182.14
Shivamogga	29,179.39	18,579.06	-	47,758.45
Udupi	14,490.44	7,925.69	195.19	22,611.32
Chikkamagalur	8,447.40	365.08	1,221.66	10,034.14
Hassan	2,698.40	180.24	4.14	2,882.78
Dakshina Kannada	9,247.88	1,098.98	-	10,346.86
Kodagu	30,843.65	-	119.44	30,963.09
Mysore	-	-	0.13	0.13
Chamarajanagar	-	-	-	-
Total	**3,16,318.27**	**33,814.97**	**1,540.68**	**3,51,673.92**

20.6. The figure of 3,516 square kilometers derived from the KSRSAC (2006) assessment comprises of only natural forests and does not include the forest plantations, coffee plantations and palm plantations some of which are also likely to belong to the category of VDF. Keeping this in view, and considering that the imageries used for the KSRSAC assessment pertained to 1999-2000, the figure of 4,502 square kilometers published in the SFR 2017 appears realistic.

20.7. The State of Forest Reports have also provided details regarding changes in district-wise forest cover. Various reasons for change of forest cover are indicated. These include afforestation, rotational felling, submersion, etc. The Forest department can access from the Forest Survey of India information such as co-ordinates of the places where the changes have been noticed during assessment. It is necessary for the department to obtain such information and verify the changes through field inspections. This helps the department to monitor and review the forestry activities carried out at the field level. It is also necessary for the department to share the findings of the field inspections with the FSI in case there are differences between the FSI assessment and actual ground situation. This enables the FSI to further fine-tune its technique of assessment.

20.8. It may be pointed out that the 'forest cover' interpreted by the FSI and reported in the State of Forest Reports includes not only the tree growth inside recorded forest area (RFA) but also the tree growth outside recorded forest area. However, the 'forest cover' pertaining to outside the RFA includes only the tree patches larger than one hectare. Tree patches located outside the recorded forest and which are smaller than one hectare are not included in 'forest cover', as these small patches cannot be captured by the remote sensing satellites and sensor. If digital

boundaries of recorded forest area (RFA) are available, it is possible to compute the forest cover pertaining to the recorded forest area. As digital boundaries of the recorded forest area in respect of all the states are not available, the Forest Survey of India has made an assessment regarding how much of the 'forest cover' pertains to the recorded forest area by making use of the green wash areas of the Survey of India (SOI) toposheets and published in the State of Forest Report 2015. According to this report, the total forest cover inside the green wash area for the entire country is 527,640 square kilometers and outside the green wash area is 174,033 square kilometers. This indicates that at the country level, about 25% of the forest cover is contributed by tree growth outside the green wash area. Besides, it should also be noted that this component of forest cover does not include tree patches less than one hectare.

20.9. As per SFR 2015, the forest cover within green wash area in Karnataka has been computed as 27,322 square kilometers and the forest cover outside green wash area is 9,099 square kilometers. However, as digital boundaries of recorded forest area (RFA) in respect of Karnataka are available, the FSI has also computed the forest cover within RFA as 22,854 square kilometers and the forest cover outside recorded forest area has been assessed as 13,567 square kilometers. The difference between these two computed figures, i.e. computed on the basis of green wash areas and as per digital data of forest boundaries of RFA (27,322 - 22,854) or 4,468 square kilometers primarily accounts for wooded areas in the state under the control of the Revenue department which are not notified forests but are included as green wash areas in the SOI toposheets. These areas include various categories of land such as *paisary* and *bane* lands of Kodagu district, *kan* and *kumki* lands of Dakshina Kannada and Udupi districts, *betta* lands of Uttara Kannada district, thickly wooded revenue lands in Chickmagaluru and other districts, etc.

20.10. In the SFR 2017, the forest cover of Karnataka for the period 2013-14 as published earlier in SFR 2015 has been updated: the updated forest cover is 36,449 square kilometers out of which 22,025 square kilometers constituted forest cover within RFA and 14,424 square kilometers constituted forest cover outside RFA. The corresponding figures for the 2015-16 assessment (SFR 2017) are 22,384 square kilometers and 15,166 square kilometers. This indicates that between these two consecutive assessments there was increase in forest cover both inside and outside the RFA by 1.63% and 5.14% respectively. It has also been indicated in SFR 2017 that forest cover within the RFA has been computed from 31,037 square kilometers of forest areas for which digitized boundary data are available. It can therefore be inferred that out of these 31,037 square kilometers of recorded forest area, an extent of 8,653 (31,037-22,384) square kilometers has tree growth with less than 10% crown density. This gives an impression that large extents of recorded forest area of

the state are available for afforestation. However, in reality it is not so. Considerable portions of such recorded forest comprise of areas which are not available for plantation. These include grassy blanks surrounding the *shola* forest patches atop some of the Ghat areas, inaccessible, steep, hilly and rocky areas without any or with little tree growth within the high forest areas, open grasslands within the protected areas required for grazing by herbivores, water bodies within the recorded forest areas, highly degraded and barren areas in the *maidan* region of the state having no potential for tree growth, areas under encroachment, etc. As most of the accessible areas out of the recorded forest area of the state which have potential for tree growth have been covered under afforeststion, the extent of such lands which are available for planting is limited. It is also true that large extents of our scrub forests, especially in the semi-*malnad* and *maidan* areas, which have been brought under tree planting since many years have not been able to get registered in the category of forest with more than 10% crown density. Such poor response is partly because of the relentless biotic pressures on whatever grows on these lands and partly because of the intrinsic inability of the lands to respond to treatment due to impoverished soil and deficient moisture conditions.

20.11. One important feature of the State of Forest Report 2001 was the introduction of the term 'Tree Cover'. All perennial woody vegetation including bamboos, palms, coconut, apple, mango, neem, peepul, etc. have been treated as tree in this report. It excludes non-perennial non-woody species and tall shrubs or climbers. Substantial tree wealth exists in the country in the form of linear plantations along roads, canals, etc., scattered trees on farmlands, homesteads and urban areas and blocks of plantations and woodlots smaller than one hectare. These areas were assessed by the Forest Survey of India on the basis of field inventory, as these cannot be captured by the remote sensing satellites and sensor whose data have been used by the Forest Survey of India for estimating forest cover. All such trees and plantations constitute 'tree cover'. Only trees having diameter of 10 cm or more at breast height have been included in the tree cover. Tree cover is comprised of tree patches and isolated trees situated outside the recorded forest and covering less than one hectare. The Forest Survey of India, Dehradun uses the terminology 'Trees outside forest' (TOF) which refers to all trees growing outside the recorded forest areas irrespective of size of patch. Thus, trees included in the 'tree cover' constitute only a part of the TOF. Tree Cover is a sub-set of TOF. As the tree patches larger than one hectare and located outside the recorded forest are already included in the forest cover, 'tree cover' as defined above assumes significance. For estimating the 'forest and tree cover', only the extent of 'tree cover' has to be added to the forest cover. The status of forest cover and tree cover in Karnataka as indicated in the State of Forest Reports is as follows:

TABLE-IV
Forest Cover and Tree Cover of Karnataka
(Area in square kilometers)

State of Forest Report	Forest Cover		Tree Cover		Forest and Tree Cover	
	Forest Cover	Forest Cover as % of G.A	Tree Cover	Tree Cover as % of G.A	Total Forest and Tree Cover	Total Forest and Tree Cover as % of G.A
2001	36,991	19.30	7,446	3.88	44,437	23.20
2003	36,449	19.00	5,371	2.80	41,820	21.80
2005	35,251	18.38	5,467	2.85	40,718	21.23
2005 (Rev.)	36,200	18.87	5,467	2.85	41667	21.72
2009	36,190	18.87	5,683	2.96	41873	21.83
2011	36,194	18.87	5,733	2.99	41927	21.86
2013	36,132	18.84	5,920	3.09	42,052	21.93
2015	36,421	18.99	5,552	2.89	41,973	21.88
2017	37,550	19.58	5,713	2.98	43,263	22.56

(G.A. represents the Geographical area of Karnataka: 191,791 square kilometers.)

20.12. We have already seen that as per SFR 2017, out of the forest cover of 37,550 square kilometers, 22,384 square kilometers pertain to forest cover within the recorded forest area (RFA) and 15,166 square kilometers pertain to forest cover outside the RFA. Therefore, the total extent of tree growth outside the recorded forest areas (TOF-Trees Outside Forest) in Karnataka works out to 20,879 (15,166 + 5,713) square kilometers. This implies that out of 43,263 square kilometers of 'Forest and Tree Cover' of the state, RFA contributes 22,384 square kilometers and the balance area of 20,879 square kilometers pertains to 'Trees Outside Forest (TOF)' i.e. tree growth outside the RFA. In terms of percentage, the tree growth within the RFA contributes to 51.74% of the 'Forest and Tree Cover' and TOF contributes the remaining 48.26%. This indicates that TOF contributes significantly to the state's forest and tree cover. There is further scope to increase the TOF, and KFD is focusing on this through intensive farm forestry initiatives.

20.13. As per the first four State of Forest Reports, there was no mangrove forest in Karnataka. Subsequent reports up to SFR 2015 have mentioned about the presence of mangrove forests whose extent has remained almost static at 3 square kilometers or 300 ha. In SFR 2017, the extent of mangrove forest in Karnataka has been reported as 10 square kilometers (Uttara Kannada district 8 sq.km. and Udupi district 2 sq. km):

TABLE-V
Mangrove Forest in Karnataka

State of Forest Report	Extent of Mangrove forest in sq. km.
1987	0
1989	0
1991	0
1993	0
1995	2
1997	3
1999	3
2001	2
2003	3
2005	3
2009	3
2011	3
2013	3
2015	3
2017	10

20.14. The Mangrove patches of Karnataka are located along the confluences of the west flowing rivers as they join the Arabian Sea in the west coast in the districts of Uttara Kannada, Udupi and Dakshina Kannada. The Forest department has been developing mangrove plantations in the estuarine areas for the last 15-20 years and these have grown into full fledged forests. Considering the efforts and success of the department in developing the mangrove forests, the assessments made by the Forest Survey of India as reflected in the earlier State of Forest Reports appear to be underestimates. It is likely that some of the mangrove patches have been assessed as regular forest, as all the three districts have regular forest patches adjoining the mangroves. It is learnt that the Energy and Wetlands Research Group, Centre of Ecological Sciences, Indian Institute of Science has mapped the mangroves of Uttara Kannada district with the use of remote sensing imagery in December 2016 and a total of 1119.73 hectares of mangrove area and 1786.75 hectares potential area were registered. The recently published SFR 2017 has confirmed the ground situation.

20.15. One criticism that the Forest department is often faced with is that in spite of raising thousands of hectares of plantations every year and for so many years, there

has been no perceptible increase in the forest cover of the state. It is true that the Forest department has been raising on the average about 60,000 - 70,000 hectares (600-700 square kilometers) of plantations every year. However, the following points need to be appreciated in the context of the state not registering phenomenal growth in its forest cover:

1. The 'forest and tree cover' indicated by the Forest Survey of India, Dehradun in the State of Forest Report includes all areas having canopy density above 10%. The Forest department (including the social forestry wing) raises plantations on lands both within recorded forest area (RFA) and outside RFA. However, in either case, the plantations which are raised on land with canopy density above 10% do not add to the 'forest cover', as these areas are already included in the 'forest cover' as assessed by the FSI.

2. Plantations raised in areas after clear felling of older plantations do not add to the forest cover, as the older plantations were already included in the forest cover, being above 10% canopy density.

3. In view if the above, only plantations raised by the department on lands with canopy density less than 10% are likely to add to the figure of forest cover after a few years of their development when these are captured in satellite imageries. However, it must be realized that these plantations, both inside and outside RFA, are under tremendous pressure due to biotic interference. As a result, many of these plantations become victims of social felling and do not contribute significantly to the forest cover. Nevertheless, by providing bio-mass to the adjoining villages for a number of years, these plantations act as a temporary buffer and prevent degradation of some natural forest or another plantation.

4. On account of rotational as well as social felling, many areas were planted and replanted. Such areas did not add to the total area of planting.

20.16. The forests of the state, especially the ones nearer to habitations, are under tremendous biotic pressure and they suffer a lot because of unauthorized withdrawal of biomass almost on a daily basis. The plantations developed by the Forest department, whether inside or outside the recorded forest area (RFA), have been catering to the biomass needs of the rural population and also a section of the urban population. Most of these plantations - although these are very successful in the beginning - gradually thin out over a period of eight to ten years because of continuous unauthorized withdrawals. Although these plantations have not been adding significantly to the forest cover of the state, they have indirectly helped in

retaining the present 'forest and tree cover' from further shrinking. But for these plantations, there would have been drastic fall in the 'forest and tree cover' of the state over the years. The very fact that the forest cover of the state has not fallen and has rather been showing marginal increase is indicative of the fact that the pressure on the forests on account of withdrawal of biomass has somewhat been contained by the initiatives taken by the Forest department. However, the department cannot be complacent over the marginal increase in forest cover. It is necessary to continue with the tempo of planting by covering more and more areas and by improving the quality and productivity of the plantations. Joint forest planning and management must be encouraged in the degraded forest areas adjoining the villages so that these forests are conserved and developed sustainably. The forests which are managed solely by the Forest department must be given more protection so as to further improve their canopy density. There must be additional thrust on farm forestry and social forestry in order to ensure that most of the biomass needs of the population including firewood, fodder, small timber and NTFPs are met from outside the regular forests. The incentive programme of 'Krishi Aranya Protsaha Yojane' initiated by the Forest department is an important step in this direction. People should also be encouraged to use alternative sources of energy such as LPG, bio-gas, solar energy, etc. so as to bring down the consumption of firewood from forest to the minimum. Combined effect of these initiatives will be beneficial to our plantations and forests and they will be able to register continuous growth. This will in the long run add to the forest and tree cover of the state.

20.17. We have seen that due to change in technology of interpretation and mapping during the past three decades, it has not been possible to quantify the realistic change in forest and tree cover over a long time-scale, say, during the period from 1991 to 2015. Comparable figures for the years 1991 and 2015 can be generated only if satellite imageries for these two periods are subjected to the same technology of interpretation and mapping. It is suggested that the satellite imageries covering Karnataka for the years 1991, 2001, 2011 and 2015 are subjected to the latest technology of interpretation and mapping being adopted by the FSI and the forest covers corresponding to these years are assessed. This will enable the department to realistically assess the change in forest and tree cover in the state during the last three decades. Similar exercise can also be carried out in respect of the forest areas which were brought under JFPM since the early 1990s in order to assess the changes that have taken place in the JFPM areas.

20.18. It has been pointed out in a preceding paragraph that as per the State of Forest Report 2017, within the recorded forest area of Karnataka an extent of 22,384 square kilometers has canopy density above 10%. It has also been pointed out that considerable portions of such recorded forest area with canopy density below 10% comprise of areas which are not available for plantation for various reasons. In addition, large extents of the accessible areas out of the recorded forest area of the state with potential for tree growth have already been brought under plantation. It will however be advisable for the Forest department to identify all such areas on division/range basis (including wildlife areas) in consultation with the Forest Survey of India, Dehradun as well as Karnataka State Remote Sensing Application Centre (KSRSAC), Bangalore. This will enable the department to plan its strategy for future plantations. Department's focus should be on taking up afforestation on areas coming under such identified parcels of land (excluding wildlife areas) and having the potential of supporting forest cover so that its canopy density can be raised to a level beyond 10%.

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FORESTRY TRAINING

Training plays a very important role in any organization that aims at progress or development. Training refers to the process of acquiring knowledge for doing a certain job and, at the same time, learning and upgrading the essential skills required for doing the job well. There is also need for training the employees for their career development. When an organization has a wider public interface, such as a government department, there is also a need for training the employees in behavioral or attitudinal aspects. Training is as much beneficial to an individual as it is to the organization he works for. It helps in improving workers' performance; it enriches the employees with knowledge, information and new technology. Training helps in identifying the weaknesses and strengths in employees and assists in eliminating their weaknesses and in strengthening their skills. Training provides consistency in performance of duties and ensures worker satisfaction leading to improved quality of services and products and increased productivity. Because of confidence, consistency in performance, efficiency and increase in productivity, there is reduction in degree and levels of supervision and reduction in cost and time.

21.2. As far as the Forest department is concerned, training is an integral part of every forestry personnel. Every person joining the forest service has to mandatorily undergo induction training program at the beginning of his or her career. The induction training courses for Indian Forest Service (IFS) and State Forest Service (SFS) officers are of two years duration and that for Range Forest Officers (RFO) is for eighteen months duration. In respect of these three cadres, the course contents/syllabi are decided by the Directorate of Forest Education (DFE), Dehradun under the Ministry of Environment, Forests and Climate Change. The IFS officers are trained in Indira Gandhi National Forest Academy, Dehradun. In respect of SFS officers, the training is conducted in institutes under the administrative control of the DFE. Earlier, the induction course of RFOs was also exclusively conducted in institutes under the administrative control of the DFE. State governments willing to conduct induction training course for RFOs are now permitted to do so with prior approval of the DFE. However, the course contents/syllabi and duration of the course are prescribed by the Directorate of Forest Education.

21.3. In the initial years of colonial rule, forests in India were administered by men drawn from civil service and the army. Dr. Dietrich Brandis, who was the first Inspector General of Forests, Government of India (1864-1883), recognized the need for fully qualified and scientifically trained officers to help in the administration and

conservation of the forests in the country. Having recognized the need to have a premier forest service to manage the varied natural resources of the vast country and to organize the affairs of the Imperial Forest Department, Imperial Forest Service was constituted in 1867. From 1867 to 1884, the officers appointed to the Imperial Forest Service were sent for training to France (Nancy) and Germany (Hanover). Subsequently, from 1885 to 1905 the training of the officers was conducted in the United Kingdom at Coopers' Hill, London, which was a very prestigious professional college of forestry at that time. From 1905 to 1926, the officers were trained in the Universities of Oxford, Cambridge and Edinburgh. The training of the Imperial Forest Service officers in India started in 1926 at Indian Forest College, Dehradun but it was discontinued in 1932 because of lack of demand of officers.

21.4. The British India Government had also recognized the importance of a multi-tier forest administration for effective management of forest resources in the federal and provincial governments. This resulted in the constitution of Provincial Forest Service and Executive and Subordinate Services. It was in this direction that the Imperial Forest School was founded in 1878 at Dehradun for training range forest officers. The training course was of two years' duration. The proposal to constitute a provincial service was mooted in 1891 to meet the increased demand for trained officers. The service was to form a link between the Imperial Forest Service and the Executive and Subordinate Forest Services. In 1906, when the Imperial Forest Research Institute was established, the status of the school was raised to that of a college, called Imperial Forest College and, in the same year, a special third-year course was introduced for training selected rangers for admission to the provincial service. Training of the gazetted officers remained suspended during 1933-38. By that time the subject of Forest had been transferred to the provinces and the princely states, and the recruitment to the Imperial Forest Service had been discontinued. In view of the increase in demand of forest officers in the states and provinces, Superior Forest Service was started and the Indian Forest College was established at Dehradun in 1938 to train officers recruited to the Superior Forest Service. In 1966 the Indian Forest Service was reconstituted. The first batch of IFS probationers was trained in 1968-70 along with the SFS trainees at Indian Forest College. Combined courses for both IFS and SFS were conducted in Indian Forest College, Dehradun up to 1975. Since 1976, IFS and SFS officers are trained in separate institutes. Indian Forest College continued to train IFS officers. The institute was renamed as Indira Gandhi National Forest Academy in 1987. For training SFS officers, three State Forest Service Colleges were established at Burnihat, Assam (1976), Coimbatore, Tamil

Nadu (1980) and Dehradun (1981). The name of the SFS colleges has since been changed to Central Academy for State Forest Service.

21.5. As regards training of range forest officers, the Imperial Forest College in Dehradun is the oldest institution in India. Madras Forest College, Coimbatore is the second oldest forestry training institution in the country after Dehradun. It was established in 1912. Later these two colleges were renamed as Northern Forest Rangers College and Southern Forest Rangers College. In Mysore kingdom, the Mysore Forest Rangers School was established in 1918-19 with a first batch of 26 students. However, the school was closed in the aftermath of the First World War which had affected the activities of the Forest department leading to substantial retrenchment of the forest establishment. The Mysore Forest School was restarted in 1940 in the Forest Research Laboratory, Bangalore for training of Forest Rangers. About 15 batches of students had passed through the school.

21.6. Subsequently, more colleges for training Rangers were established by the Government of India because of demand. These were Forest Rangers College, Balaghat (Madhya Pradesh), Eastern Forest Rangers College, Kurseong (West Bengal) and Central Forest Rangers College, Chandrapur (Maharashtra). These institutes were managed centrally up to 1978. With the Government of India deciding to de-centralize training of RFOs in a phased manner, a number of Range Forest Officers Colleges have been established in various states including one in Karnataka. However, allotment of seats to all these institutes is authorized by the Directorate of Forest Education (DFE), Dehradun, and RFO trainees from other states are also allotted training slots in these institutes. Earlier, most of the RFO trainees from Karnataka had received their training in Southern Forest Rangers College, Coimbatore. Subsequently, some of the trainees had been trained in other training colleges in Chandrapur, Burnihat, Haldwani, Rajpipla, etc. as per the allotment made by the DFE. With the starting of a RFO training center in Gungargatti, Dharwar in 2016, a sizeable number of trainees from Karnataka will be trained in this institute in the future. In this context, it may be noted that one center for training Range Forest Officers had been established in Dharwar in the early 1950s and two batches of RFOs had passed out from that institute. However the center was short-lived and not much information is available about it. Another training center was established in 1980-81 at Tavaragatti in Khanapur taluk of Belgaum district for the specific purpose of imparting training to a batch of surveyors who had been promoted as RFOs.

21.7. While the onus of training of forestry personnel of Indian Forest Service officers, State Forest Service Officers and Range Forest Officers is within the ambit of the Central Government, the training of other forestry personnel such as Foresters, Forest Guards and Forest Watchers has been the mandate of the concerned State or Union Territory Governments. Therefore, the induction and in-service training of the frontline staff of the forest departments are being imparted by the concerned state governments in their respective forest training centers.

21.8. The training wing of the Karnataka Forest Department is under the overall supervision of an officer of the rank of Additional Principal Chief Conservator of Forests. There are at present six training institutes/centers: (1) Forest Training Institute, Gungargatti, Dharwad (2) Forest Technical and Administrative Training Institute, Kadugodi, Bangalore, (3) Forest Guards Training Center, Ilwala, Mysuru, (4) Forest Training Centre, Tattihalla, Haliyal taluk, Uttara Kannada, (5) Forest Guards Training Center, Kushalanagar, Kodagu and (6) Forest Guards Training Center, Naubad, Bidar. The training institutes at Bidar, Ilwala, Kushalanagar and Tattihalla are headed by Assistant Conservators of Forests (ACF). There are two DCFs with headquarters at Kadugodi and Gungargatti. DCF, Kadugodi is administrative head of Kadugodi, Ilwala and Kushalanagar training institutes. DCF, Gungargatti is administrative head of Gungargatti, Tattihalla and Bidar training institutes.

21.9. Among the six training institutes/centers mentioned above, the centers at Kushalanagar and Bidar are very old and were started during 1960. The training center at Kushalanagar (campus area-1.64 ha) is situated on the Kushalanagar-Madikeri Road on the bank of the Cauvery River. The Bidar training center (10 ha) is situated at Naubad in the outskirts of Bidar town by the side of Bidar-Bhalki State Highway. Both these centers were meant for induction training of forest guards. There was one more training center at Kirawatti in Yellapur forest division which was started during 1972 for training newly recruited forest guards. There was also a training center for newly recruited forester-cum-surveyors in Dandeli in Haliyal division which was established in 1972 and continued till mid 1980s. After these two training centers were closed, a new forest training center was started at Tattihalla in Haliyal taluk of Uttara Kannada district by renovating a colony of buildings taken over by the Forest department from the Karnataka Power Corporation. This training center with an area of 13.50 ha was established in 1987. It is situated in the midst of forest with beautiful sylvan surroundings in Bhagawathi range of Haliyal forest division. Since 1987 this center has been imparting induction training to foresters

[re-designated as deputy range forest officers (DRFO)] and forest guards. Another training center for induction training of forest guards was started during 2007 in Ilwala near Mysore on the left side of Mysuru-Hunsur Road with a sprawling campus of about 100 ha. This center has been imparting induction training mainly to forest guards except on one occasion when a batch of foresters was also trained.

21.10. Thus at present there are four training centers primarily dedicated to induction training courses for newly recruited forestry personnel. At present the induction course for DRFO is of one-year duration and that for the Forest Guards is for nine months. Newly recruited Forest Watchers are trained for a period of three months. In addition to the induction training courses, a number of refresher courses for in-service personnel including ministerial staff are conducted in all the four training centers. Besides, short term training courses for VFC members, farmers, etc. are also organized in these centers.

21.11. The Forest Technical and Administrative Training Institute (FTATI), Kadugodi, Bangalore was originally established in 1985-86 and named as "Social Forestry Training Center" under the World Bank aided social forestry project. The institute is located in eastern Bangalore on Whitefield Main Road opposite to International Technology Park (ITPL), Bangalore. The campus of the institute is about 16.70 ha in extent and most of the area is under good vegetation of indigenous and planted species. The objective of the training center was to train the in-service officers / officials in Social Forestry programme. To start with, the training classes were conducted under Paragola and the trainees were lodged in tents. The basic infrastructure of the training center was revamped in 1992 by constructing the old administrative block (commonly known as IWST block) containing office-cum-lecture hall and dormitories for trainees. The institute was renamed as "Forest Technical and Administrative Training Institute" in 1995. The infrastructure of the institute was further improved during 2005-06 and 2006-07 with the construction of the new administrative block and the new hostel block funded under the JBIC project.

21.12. The Forest Training Institute (FTI), Gungargatti, Dharwad was established during 1996 primarily to provide in-service training to officers of Karnataka Forest Department. The institute is located at a distance of 12 kms from Dharwad city on way to Belagavi and is just 2 kms away from Bangalore-Pune National Highway NH No. 4. The institute is spread over an area of about 42 ha. The need for establishing this institute was felt due to changing role of forest officers in a

changed scenario where new concepts like social forestry and people's participation were making ways in traditional forestry practices as envisaged in the 1988 National Forest Policy. The main objective of the institute was to address the needs of the frontline staff to enable them to effectively communicate with the public and carry out extension activities as envisaged in new forest policies, strategies and projects along with those of traditional forestry. The construction of the infrastructure of the institute started in 1992 under the World Bank aided social forestry project. Later the construction was completed under the Western Ghats project. At present induction training courses for DRFOs are conducted in the institute. Induction training for RFO trainees from Karnataka has been started during 2016-17 with the approval of the Directorate of Forest Education, Dehradun. In addition, a number of refresher courses for various levels of forest officers/officials and ministerial staff are conducted in the institute.

21.13. As mentioned above, the institutes at Gungargatti and Kadugodi were primarily meant for in-service training of the personnel of the Forest department. These were also meant for imparting training in various subjects like social forestry, joint forestry planning and management (JFPM), extension forestry, etc. involving, apart from departmental staff, other stake holders such as members of the village forest committees (VFC), members of self-help groups (SHG), non government organizations (NGO), motivators, etc. However, the Forest department, which had tremendous shortage of staff, especially at the field level, because of general economy ban on recruitment during the period 1985-2000, was specially permitted by the Government to recruit forest guards, foresters and forest watchers since 2002-03. This has resulted in recruitment of a fairly large number of forestry personnel during the last decade and a half. As the capacity of the training institutes at Tattihalla, Kushalanagar, Ilwala and Bidar is limited, the Department had no other alternative but to make use of the institutes at Gungargatti and Kadugodi also for the purpose of induction training of the newly recruited foresters, forest guards and forest watchers. Although training on refresher and other courses has continued in these institutes, needless to say that the degree and scale of these courses had to be curtailed for reasons of space, time and resources.

21.14. The Forest Training Institute, Gungargatti, Dharwad has recently been upgraded to a Forest Academy for imparting induction training to range forest officers. This institute will provide training not only to RFOs recruited by the Karnataka Forest department but also to RFOs recruited by other State Governments and as allotted by the Director of Forest Education (DFE), Ministry of Environment,

Forests and Climate Change, Government of India. The syllabus for induction training course for RFOs is approved by the DFE. The number of trainees allotted to the Academy is 50. Considering that the induction training for RFO is for a period of eighteen months, the institute will have to train 100 trainees at any given point of time.

21.15. The Government of India has formulated a National Training Policy in 2012 in order to develop the human resources of the various sectors of the Government. The Policy prescribes that training should be made available to all civil servants from the lowest level functionaries to the highest levels. Such training should be imparted not only at the time of their entry into service but also at appropriate intervals in their career. In keeping with the National Training Policy, the State Government of Karnataka has formulated a State Training Policy for improved service delivery and better governance. The policy provides for high quality training to employees at regular intervals during their career. The policy advocates training for all with special attention paid to the employees at the cutting edge level, who interact with the public at large and whose performance to a large extent determines the perception of the common man about the functioning of the government. It suggests adoption of need based training and learning. It advocates building competencies and skills at each level of government. The policy envisages compulsory training at induction level. Every officer / official must undergo minimum of three training programs (Induction, Functional and Managerial) in his or her career. It advocates that training should be mandatory at every stage of promotion. In view of these policy directives, it has become incumbent upon the State Forest department to review its ongoing training programs and incorporate appropriate modifications and additions. There is need not only for augmentation of the present training facilities and infrastructure of the department but there is also urgent need for the expansion of the scope and content of the training programs.

21.16. Here it will be pertinent to mention that the process of recruitment of DRFOs, Forest Guards and Forest Watchers in the state has not been very regular. There was practically no recruitment of forestry personnel during the period 1985-2000 because of economy ban. Recruitment for the posts of RFOs, DRFOs, Forest Guards and Forest Watchers picked up from 2002 onwards. Details of recruitment that have taken place during the period from 2002-03 to 2016-17 are indicated in the following table:

TABLE-VI
Number of RFOs, Dy. RFOs, Forest Guards and Forest Watchers recruited during the last fifteen years (2002-03 to 2016-17)

Sl. No.	Year of recruitment	RFO	Dy. RFO	Forest Guard	Forest Watcher	Total
1	2002-03	-	75	100	-	**175**
2	2003-04	20	75	110		**205**
3	2004-05	-	-	-	195	**195**
4	2005-06	20	-	-	-	**20**
5	2006-07	-	-	-	-	**-**
6	2007-08	40	91	149	100	**380**
7	2008-09	-	-	-	-	**-**
8	2009-10	-	133	241	-	**374**
9	2010-11	-	201	789	-	**990**
10	2011-12	63	-	-	-	**63**
11	2012-13	-	-	593	262	**855**
12	2013-14	-	-	-	-	**-**
13	2014-15	61	-	-	-	**61**
14	2015-16	97	127	348	11	**583**
15	2016-17	72	479	555	248	**1,354**
	Total	**373**	**1,181**	**2,885**	**816**	**5,255**

21.17. It is evident from the above table that although the momentum of recruitment has picked up, its frequency and regularity has not been satisfactory. This has resulted in recruitment of more number of persons at a time than the number of persons who can be trained in the training institutes. On a few occasions, for want of sufficient number of slots in the training institutes some of the newly recruited staff had to be sent for field duty instead of sending them for induction training. They were subsequently sent for induction training only after slots became available. In view of this, it is necessary to streamline the process of recruitment so that recruitment of each cadre takes place every year with mechanical regularity. This way the training institutes can be utilized to their optimum potential. This will also ensure that some of the training programs envisaged under the new policy guidelines can be accommodated in the existing institutions.

21.18. In order to increase the capacity to conduct additional training programs, the Forest department has also taken action to develop the following institutions:

21.19. 'Aloka'- a heritage building is located within the campus of the Ilwala training center near Mysore. This magnificent building of unique design is said to have been built in the beginning of the 19th century by an Irish resident, modeled on a mansion in Ireland. This massive building was used by the Chamaraja Academy of

Visual Arts (CAVA) for some time. It is at present in the custody of the Forest department. The building is in need of considerable repairs before being put to use. Given the heritage nature of the building, such repairs will need to be carried out under the guidance and supervision of experts. There was earlier a proposal to renovate the building and then set up a forest and wildlife museum. However the project has not taken off. Considering that the Forest department has to take up induction and other training programs for a large number of DRFOs, Forest Guards, Forest watchers and ministerial staff in the near future and also considering that some facilities for such training are already available in the vicinity (i.e. Ilwala training center), the department has initiated steps to take up repairs to the 'Aloka' building in a phased manner so that training of forestry personnel can be started from this building. Facilities for both class rooms and residential accommodation for the trainees can be developed in this building which is spread over a large area. Gradually the building can be utilized for multiple purposes such as wildlife research center, forest and wildlife museum besides forestry training center. A little distance away from the above heritage building is also another building apparently constructed during of the same period and which was perhaps a Guest House attached to the 'Aloka'. This building also can be put to use after some repairs as a guest house for the guest faculty of the training center.

21.20. The Forest department is in the process of developing one more training center in Chakra colony of Sagar division in Shimoga circle. Chakra colony is situated in Malali village of Hosanagara taluk over an area of about 50 ha. The colony is about 24 kms from Hosanagar and about 5 kms from Nagara. It is situated about 2 kms away from the Hosanagar-Kundapur road. Hosangadi, a town in Udupi district, is at a distance of 32 kms from the colony. The Karnataka Power Corporation (KPC) had constructed two dams across the river Varahi near Saavehaklu and Chakra under the Sharavathi tail race project. The colony area was leased out by KFD to the Karnataka Power Corporation (KPC) in the late seventies. On that land, the KPC had constructed dwelling units and other basic facilities for its staff and the laborers who were engaged for the construction of Chakra dam and other related activities. After completion of the project work and other associated activities, the KPC handed over the area back to the KFD on 'as is where is' basis. The area was taken back under control of Forest department in 2001. At the time of taking over the area many of the buildings were in very bad shape and these were dismantled. The structures which were in relatively better condition are being renovated by the Department by entrusting the work to the Karnataka Rural Infrastructure Development Limited, Shimoga. With the already available infrastructure such as road, sufficiently big buildings for conducting training classes, residential facilities, water supply and electricity connectivity and open space for conducting physical training and games, Chakra colony has a potential to be developed into an ideal training center similar to the training center at Tattihalla. The department has already renovated some of the

structures such as old guest house, old hospital building and a few other buildings of Chakra colony. Some more old structures are also being renovated. The Research wing has already established a nursery of evergreen tree species. Adjoining to the nursery, there is a large old building which after renovation can be used for indoor sports and yoga. Overall, with the available infrastructure and other facilities already developed and being developed by the department, Chakra colony can become an excellent forest training center. It is also an ideal place for imparting training on evergreen and semi-evergreen eco-systems, bio-diversity conservation, medicinal plants, etc. The center can also be fruitfully used for training on forest eco-tourism and associated subjects.

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FOREST ECO-TOURISM

In the recent two-three decades there has been considerable increase in the number of visitors to some of Karnataka's national parks, wildlife sanctuaries and other places of interest located in forest areas. An increased inflow of tourists into our protected areas or other forest areas has evoked mixed response from wildlife admirers, conservationists and tourism developers. Heavy and continuous traffic to these natural areas contributes to destruction of the environment including loss and deterioration of habitat, pollution from litter, contamination of natural water bodies, loss of tranquility, disruption of wildlife migrations, loss of biodiversity, etc. On the other hand, tourism itself can become an effective tool for sustainable conservation of the natural resources: it can facilitate promotion of awareness, interest and concern for biodiversity conservation among the general public; it can also generate much needed resources for further developing the natural areas; it also provides employment and income to the local population.

22.2. It has been increasingly realized that the negative impacts on the environment which are generally attributed to tourism can be negated or reduced to the minimum by effective planning and devising appropriate strategies for action. It is in this context that the concept of eco-tourism gains relevance. Eco-tourism basically refers to a regulated form of tourism wherein the volume of traffic into natural areas is limited to their carrying capacity and all tourism related activities are planned and executed in such ways as to contribute to conservation and development of the natural areas. Evidently, eco-tourism is a natural resource-based and nature-oriented travel and any activity associated with it needs to be subservient to and in harmony with the principles of ecological conservation of the natural resources.

22.3. The following principles need to be adhered to in respect of eco-tourism programme for protected and other forest areas:

1. Eco-tourism should not adversely affect the environment;
2. Revenue generated from eco-tourism should be ploughed back for conservation and development of the natural resources;
3. Eco-tourism should maximize local benefits;
4. Eco-tourism must raise sensitivity and awareness to environmental conservation.

22.4. In view of the likely harmful impacts of tourism on the environment, the carrying capacity of each protected area or forest area needs to be carefully assessed.

Necessary steps should also be taken in order to raise the carrying capacity to its full potential. Tourist traffic and facilities for their comfort should never exceed their carrying capacity. Each protected or forest area which is important from the point of tourism should have its own tourism plan providing detailed guidelines for area managers, tour operators as well as tourists. All tourist movements should be thoroughly planned and should be restricted to clearly identified tourism zone marked clearly on map and on ground. No tourism should be allowed in any area outside the designated tourism zone. The conveyance used should be less polluting vehicles (preferably battery operated), boats, riding elephants, etc. There should be ceiling on the number of vehicles/tourists allowed to enter the protected area at any given point of time. Tourists should be invariably accompanied by trained guides to ensure their safety and minimize disturbances to the environment. All accommodations for tourists, including infrastructure such as cafeteria, shops, etc. should be preferably located outside the limits of the protected areas/forests or, if that is not possible, in a corner of the buffer zone. All structures, including buildings, in the protected areas/forests should be simple and architecturally compatible with the natural surroundings. Maximum use of solar, wind and other forms of non-conventional sources of energy should be done for lighting, heating, cooking and other purposes.

22.5. For eco-tourism to be sustainable it is important to ensure that the protected area or other forest area – the basic capital on which eco-tourism thrives – is not only conserved but also developed further. This requires additional investment by way of strengthening of protective measures, development of forests, eco-development activities, human resources development, etc. Additional investment is also required for increasing the carrying capacity of the protected areas to their optimum potential. It is therefore necessary to ensure that income from eco-tourism is re-invested into the protected areas/forests only. Private enterprises and tourism developers operating near the protected areas/forests should contribute to the development of the protected areas/forests through payment of appropriate cess.

22.6. Creation of national parks, wildlife sanctuaries, tiger reserves, reserved forests, etc. have resulted in forfeiture or curtailment of rights, concessions and privileges enjoyed by the local inhabitants. It is therefore necessary to ensure that the ecotourism plan for any protected or forest area incorporates provisions which can, to some extent, compensate the poor for the sacrifices being made by them for conservation of forest and wildlife. The local people should be actively associated and given preference for the manpower and infrastructure requirements in respect of eco-tourism related activities. Some of the local educated youths, on proper training,

can become excellent guides to accompany the tourists inside the protected areas/forests.

22.7. Prior to the 1980s, infrastructure and other facilities with the Karnataka Forest Department to support tourism were very limited. As a result, the number of tourists visiting Karnataka's wildlife and other forest areas was modest. The visitors were accommodated in the forest guest houses of the department and they were taken into the forest for safari or wildlife viewing in departmental vehicles. Bandipur, Nagarahole and Bhadra (Muthodi and Lakkavalli) were three well-known wildlife destinations during those days. With the establishment of the Jungle Lodges and Resorts (JLR) in the 1980s, there has been gradual increase in the number of visitors to the wildlife areas of the state. The JLR is a state government unit under the Tourism department and since the early 1990s it has been managed by officers on deputation from the Forest department. It is a responsible wildlife and eco tourism company strongly committed to using tourism as a tool for environmental conservation, especially wildlife conservation. During the last 30 years, the JLR has expanded and set up about twenty resorts and camps in various parts of the state, mostly near wildlife habitats or natural locations with scenic beauty. All of JLR's resorts and camps are located in some of Karnataka's ecologically sensitive yet amazing natural destinations. Visit to any of the resorts and camps of the JLR is also highly educative, as the guests get an opportunity of experiencing wildlife and fragile habitats firsthand under the guidance of a batch of dedicated and expert naturalists.

22.8. While the facilities provided by the JLR have been effectively catering to a relatively affluent section of the society, the Forest department has been developing infrastructure and providing other facilities for the general public, including students, at fairly affordable rates. Such infrastructure and facilities are now available in most of the popular wildlife destinations. These include the camp areas of Bandipur and Nagarahole tiger reserves, nature camps at Kulgi, Anshi, Bhagawathi valley (Kudremukh national park), Anejari (Mookambika wildlife sanctuary), Gangajala (Ranebennur wildlife sanctuary), Muppane (Sharavathi Valley wildlife sanctuary), Gopinatham (Cauvery wildlife sanctuary), etc. The department has also established a few nature parks in forest areas outside the protected area network. These include Nisargadhama at Kushalanagar, Jog, Seethanadi, etc. Basic facilities such as lodges, dormitories, kitchen, etc. have been provided in the nature camps for comfortable stay of the tourists. In order to promote awareness, interest and concern for biodiversity conservation among the people, each nature camp is also provided with an interpretation center adequately equipped with maps, literature, guides, books, exhibits and audio-visual aids to impart nature

education and park interpretation and proper orientation to visitors. This has been done in order to kindle interest and concern of the visitors to the importance of wildlife and forest conservation and to enable them to develop the right attitudes before they enter the protected area or forest.

22.9 Children are the future of the nation. Realising the importance of nature education for the youth of the country and for survival of the planet Earth, the Forest department has launched a programme called Chinnara Vana Darshana. Every year, 10,000 children studying in the 9th standard in Government schools on the fringes of the forests are taken to the forest areas for a tour of two days. During their stay in the forest, the children are exposed to the beauty of nature and the various operations and activities of the Forest department. The entire cost of the programme is borne by the department. It is also heartening to note that the JLR has set up a separate vertical called 'Jungle Camps and Trails', especially to cater to the needs of the youth and the middle-income families. This is on the realization that the children and the youth, who have a pivotal responsibility in nation-building, have a right to visit the natural areas to enjoy, appreciate and understand the flora and fauna, but do not have sufficient disposable income. Jungle Camps and Trails provide basic facilities in the forest without any frills; clean accommodation is provided in tented camps or dormitories, basic but good quality food is available and no jeep safari is offered. The total emphasis is on creating awareness and developing love towards nature among the youth and the middle classes. Trained nature guides accompany the guests for guided nature trails. They are also exposed to adventure activities in the forests. All these facilities are provided at very reasonable prices.

22.10. Among Karnataka's protected areas, Bandipur and Nagarahole tiger reserves have been attracting fairly large number of tourists during the recent years. Due to high density of tigers in the landscape, probability of sighting the animal is quite high in these parks. This naturally attracts more visitors. The areas fall in the popular tourist circuit comprising of Mysore, Ooty and Kerela. Tourists travelling in this circuit normally do not stay overnight but arrive at the parks for enjoying a safari in the afternoon. During tourist season they come in large groups. There are also many private resorts and home-stays in the vicinity of these two parks. Visitors to these resorts and home-stays constitute a large segment of tourists who visit the parks for wildlife viewing in the mornings and afternoons. Tourist inflow to the other tiger reserves of the state, namely, Bhadra, BRT and Dandeli-Anshi, is moderate; however, this number is also increasing day by day due to people's awareness and interest in wildlife. Besides, many private resorts and home-stays have come up in the nearby areas providing a steady flow of tourists for wildlife viewing.

Nisargadhama in Kushalanagar and elephant camps at Dubare (Kodagu district) and Sacrebylu (Shimoga district) are other popular tourist locations. However, most of these tourists are day travelers. Tourist inflow into the remaining protected areas and forests of the state is quite nominal and is not a matter of immediate concern from the point of over-exposure.

22.11. The Forest department is however quite sensitive to the likely impact on our wilderness areas due to increased tourist flow in the years to come. Keeping this in mind, the department is encouraging setting up of Urban Tree parks in various parts of the state. Development of Safari parks and Zoos on the lines of Bannerghatta Zoological Park is also being encouraged. These parks and safaris not only serve the purpose of recreation, creating awareness amongst the urban people, but also keep the pressures low on our natural areas, as casual visitors are encouraged to visit these parks rather than Bandipur and Nagarahole national parks.

22.12. As wildlife tourism was gaining importance in the state as reflected by the growing enthusiasm shown by people to visit wildlife areas in increasing numbers, it became necessary to formulate a policy to encourage, guide, direct and regulate this form of tourism so that it develops in a desirable manner. Due to the ecologically sensitive nature of the protected areas and other forests, the Forest department has been adopting a guarded, cautious and conservative approach towards tourism so that least disturbance is caused in these areas, and their tranquility and serenity are preserved. During August 2004, the Forest department announced its eco-tourism policy, namely, 'the Wilderness tourism policy in national parks, sanctuaries, reserved forests and other forests of Karnataka', which gave guidelines regarding conduct of tourism within the protected areas and other forest areas. The objectives of this policy were to further the cause of conservation of forest and wildlife. The Forest department wanted to permit wilderness tourism in specific areas of national parks, sanctuaries and forests, and use it as a tool of conservation. The policy outlined the activities permissible for the wilderness tourists such as safari, trekking, nature walk, camping, boating, bird-watching, etc. It also highlighted the need to develop facilities associated with wilderness tourism, namely, interpretation centers, guide facilities, nature camps and forest guest houses. The policy prescribed that the entry of the number of tourists should be within the permissible limits. Private resorts or tour operators are not allowed to operate within the national parks, sanctuaries or their enclosures. The policy stipulated that wilderness tourism may be operated through the Jungle Lodges and Resorts Limited or Adventure groups like Youth Hostels Association of India or by the Forest department where such facilities exist. The policy laid emphasis on benefitting the local community, especially the tribal

people and the department should work out ways and means by which such benefits are accrued.

22.13. During October, 2012, the National Tiger Conservation Authority (NTCA) had issued a set of comprehensive guidelines for tiger conservation and tourism under section 38O (1) (c) of the Wild Life (Protection) Act, 1972 for implementation in and around the tiger reserves in the country. Part-A of the guidelines pertains to tiger conservation and related matters; Part-B pertains to tourism in and around tiger reserves. The tourism related guidelines have laid emphasis on a distinct shift of approach from wildlife tourism to ecotourism which is defined as 'responsible travel to natural areas that conserves the environment and improves the well-being of local people'. The guidelines have recommended a form of tourism that is community based and community driven. It has been advocated that tourism should be low-impact, educational and it should conserve the ecology and environment, while directly benefiting the economic well-being of local communities. The guidelines have stipulated that each state government shall develop a 'State-level Tourism and Ecotourism Strategy for Tiger Reserves'. The state governments have also been directed to develop a state-level policy to favor eco-tourism in place of wildlife tourism as a comprehensive plan to ensure that the primary objective of tiger conservation is not compromised. The plan should focus on maintenance of integrity and connectivity of tiger reserves and on development of appropriate land use and water management planning and regulation for maintaining the ecological integrity of landscape in and around tiger reserves. The plan should also include various issues such as, (a) local community rights, participation and benefit sharing, (b) sound environmental design and sustainable use of indigenous materials, (c) conservation education and training, (d) capacity building of local communities in planning, providing and managing ecotourism facilities, (e) adequate machinery for monitoring and evaluation of the impact of ecotourism activities on wildlife conservation and local communities, etc. The NTCA has also cautioned that no new infrastructure shall be set up within the core or critical tiger habitat of tiger reserves.

22.14. Guidelines for the tiger reserve management in the context of tourism include development of a mechanism to monitor the ecologically sensitive areas, assessment of carrying capacity and regulation on the number of visitors/vehicles, identification and demarcation of tourism zone, development of a participatory community-based tourism strategy, monitoring the impact of tourism on wildlife and its habitat, setting up lists of Do's and Don'ts for visitors, providing for subsidized visits of students while fostering educational extension activities, etc. Detailed

guidelines regarding the tourist facilities and the conduct of tour operators have been provided. These include environment-friendly infrastructure, use of non-conventional energy sources, training of guides and drivers, maintenance of absolute tranquility within the tourism areas so as not to cause any disturbance to wildlife and to allow them free passage, regular review of the tourist facilities by the management, etc. With regard to pilgrim sites located inside tiger reserves, the NTCA guidelines provide for limited movement of people during nominated days, strict implementation of the rules relating to tourism facilities such as noise, building design, use of alternate energy and free passage of wildlife, revenue sharing with local communities, etc.

22.15. While issuing the above guidelines, which are applicable to the tiger reserves, the National Tiger Conservation Authority (NTCA) has also suggested that the state governments should lay down guidelines on similar lines for tourism in other protected areas.

22.16. In March 2012, the Government of Karnataka set up the Karnataka Ecotourism Development Board (KEDB) under the Chairmanship of the Hon'ble Forest Minister of Karnataka to monitor and develop ecotourism in and around the forests of the state. The objectives of KEDB are:

- To create awareness regarding the conservation of forests and wildlife amongst the people in general and children and youth, in particular;
- to encourage and promote ecotourism activities;
- to encourage local community involvement in ecotourism providing for greater employment opportunities and economic benefits;
- to assist in formulation of policies, laws and guidelines for organized development of ecotourism;
- to conduct research and impact studies in ecotourism areas;
- to promote ecotourism as a front line non consumptive activity of the Forest department;
- to develop good practices to be followed by ecotourism operators;
- to standardize and operate certification of ecotourism;
- to train and certify nature guides;
- to produce literature and electronic media material required for nature education and ecotourism promotion;
- to facilitate linkages between public and private operators in the cause of conservation of wildlife;

- to coordinate and liaise with national/international bodies, experts and funding agencies and receive contribution and funds from Government of India, State Government, National and International funding agencies, etc.;
- to maintain and facilitate ecotourism activities inside the parks and forest areas;
- to develop trekking trails and operate wildlife safaris in the 'Protected Areas';
- to encourage public-private partnerships (PPP) in the area of ecotourism, wherever the law permits; and
- to carry out any other activities in furtherance of the above objectives.

22.17. Since its inception, KEDB has been organizing a number of workshops and seminars to discuss various aspects of ecotourism in order to formulate a comprehensive policy on ecotourism in protected and other forest areas of the state. Under the guidance of the Board, the Forest department has been conducting regular courses of Volunteer Training Programme to train individuals as eco-volunteers to assist the department in various activities such as animal census, etc. Under the driving force and initiative of the KEDB, the Forest department, in association with the Jungle Lodges and Resorts Limited, has initiated a unique programme called 'Karnataka Ecotrails' offering a great trekking experience in the forests. This programme provides an opportunity for regulated trekking in different landscapes of Karnataka including the protected areas and tiger reserves. The eco friendly trekking and adventure activities are specially planned for the adventurists and the wildlife lovers under the guidance of certified nature guides. The Board is also instrumental in training certified nature guides to ensure a formal naturalist component in Ecotrails experience. The Karnataka Ecotourism Development Board has been entrusted with the task of formulating the 'State-level Tourism and Ecotourism Strategy for Tiger Reserves' for Karnataka as per the guidelines of the NTCA.

22.18. Karnataka Forest department has been following the guidelines of the state's wilderness tourism policy of 2004 while creating infrastructure and other facilities near the protected areas and also in regulating the number of tourists within the permitted tourism zone. The extent of tourism zone within each tiger reserve has been kept below 20 per cent of the area of the reserve, within the upper limit fixed by the National Tiger Conservation Authority (NTCA). Number of vehicles permitted to enter the tourism zone for wildlife viewing (safari) is strictly monitored and kept within the carrying capacity of the reserve as prescribed by the NTCA. Private vehicles or vehicles owned by private resorts are not allowed to ply within the

reserves. Tourists are ferried into the reserves for safari either in vehicles of the park authorities or in vehicles owned by M/s Jungle Lodges and Resorts Ltd. In order to ensure free movement of wildlife within the protected areas, movement of vehicles along highways or public roads passing through protected areas is regulated by establishing checking gates at entry and exit points. Speed breakers or rumble strips have been provided at frequent intervals along these roads to slow down the speed of vehicles to avoid injury or death of animals while crossing the roads. Night traffic along the highways passing through some of the important protected areas is strictly regulated.

22.19. As is evident from above, the ongoing eco-tourism policy of Karnataka is more or less in sync with the guidelines of the NTCA. With the finalization and adoption of the 'State-level Tourism and Ecotourism Strategy for Tiger Reserves' by the state government, the Forest department will be able to further fine-tune the ongoing eco-tourism policy under the guidance of the Karnataka Ecotourism Development Board.

22.20. A matter of concern regarding tourism in wildlife areas is the overzealousness among tourists to view animals, especially the tiger. While this is quite understandable, it is necessary for the park managers to be conscious and careful about the grave dangers from over-exposure of any animal including the tiger. In their enthusiasm to attract more visitors to the park, the park staff may be tempted to walk the extra mile to show the animal by any means. This phenomenon has become quite common in many of our wildlife parks across the country, as is evident from so many video clips circulating in the facebook and other social media. This tendency of over exposing our wildlife needs to be curbed at any cost. Viewing of an animal in the wild should always happen naturally, i.e. by chance and not by design. The attempt of the park manager should be to showcase the forest as a whole so that the visitor has a feel of the forest eco-system in its entirety with all its diversity, splendor and magnificence. The naturalist or the guide accompanying the tourists should be adequately trained and equipped with knowledge and information not only about wildlife but about the entire forest eco-system so that the tour continues to become interesting and educative even if no wild animal is sighted during the safari. It is also necessary to give boost to the concept of forest or nature eco-tourism to reduce pressure on some of our forests on account of wildlife tourism. The effort of the department ought to be to increase awareness among the people, especially children and youth, about the benefit and pleasure of simply walking in the forest and enjoying the various facets presented by its diverse flora and fauna in the backdrop of an enchanting landscape of hills, dales, springs, streams, waterfalls, ponds, lakes and

rivers. In this context, the initiative taken by the Forest department and the Karnataka Ecotourism Development Board to launch the innovative programme of Ecotrails to explore the hidden beauty of the forests appears to be a step in the right direction.

22.21. Many protected areas across the country provide flexibility to private tour operators and wildlife resort owners to carry visitors in their own vehicles to the tourism zone for wildlife viewing. As we have seen, in Karnataka this facility is not provided and all visitors are required to board vehicles of the Forest department or M/s Jungle Lodges and Resorts Limited. This has been done to maintain tranquility of the forest and also to ensure that ingress into the park is kept within its carrying capacity. It is necessary to ensure that this policy is scrupulously followed for all times to come and any attempt to dilute it in the name of making wildlife viewing more people-friendly should be resisted by any means. Wherever there is more demand, Forest department should make arrangement for adequate number of vehicles but regulate the flow of traffic within the park's carrying capacity.

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MINING IN FOREST AREAS

There are more than one hundred mining leases in the forests of Karnataka. Most of these mines are in Bellary district, some are in Chitradurga and Tumkur districts; a few mines in Gadag and Bagalkot districts are currently not in operation. These mines, located in dry deciduous and deciduous scrub forests, are mostly iron ore mines and a few are manganese mines. Although mining is revenue earning activity with tremendous implications for industrial development, its effect on forests is very devastating. Open-cast mining practiced in these mines is an intensive activity requiring deployment of a large number of heavy machines and vehicles which create a lot of disturbance to the forest eco-system. In addition to disfigurement of the mined area and loss of forest due to overhead dumping of waste material, the adjoining forest areas of a mine also get damaged because of mining and related activities. Besides, the forest on either side of the road along which the ore is transported by trucks gets severely affected due to continuous pollution by dust and mine particles. By altering the landscape, mining leads to change in direction of water flow resulting in hydrological catastrophe. Mining causes a lot of damage to the environment because of erosion, formation of sinkholes, loss of biodiversity, siltation of watercourses and water bodies, contamination of soil, groundwater and surface water, etc.

23.2. Organized mining in the forests of Karnataka started with the discovery of manganese ore in Kumsi forest in Shimoga district in 1899. The ore was discovered by Mr. H.K. Slater of the Mysore Geological Department. He had also mapped the area during his survey of Shimoga district during the period 1902-1913. Extraction of manganese ore was started in the early 1900s in Kumsi, Harnahalli, Shankaragudda (present Shankar state forest) and nearby forest areas such as Shirigere and Tuppur. The Kumsi mining block, also known as Holme's Block, was the largest mining block in the region. The ores were recovered by open cast mining from various mining pits which bore interesting names such as Vinayaka, Gange-Gowri, Bisonmatti, Old Segematti, New Segematti, Python, Kalbetta and Laxmi. The mining pits in Shankaragudda-Harnahalli block were known as Shankara, Raghavendra, Triveni, Krishna, etc. Evacuation of the ore was done through a dedicated two-foot tramway which connected the mining belt to Shimoga. The tramway was later dismantled, perhaps after the Shimoga-Talguppa railway line was laid during the late 1930s. The extracted ore was shipped to the Workington Iron and Steel Company Limited in the United Kingdom for production of Bessemer steel. Extraction of manganese in the forests of Sandur in the present Bellary district was started as early as 1907 by the

General Sandur Mining Company, an enterprise from Belgium, for the purpose of export. With the establishment of the Mysore Iron and Steel Works (MISW) at Bhadravathi in 1923, large quantities of iron ore and limestone were in demand locally. The supplies were made mainly from Kemmenagundi iron ore mine and Bhadigunda limestone mine respectively. Both these mines were in forest areas of present Bhadravathi forest division. Manganese ore required by MISW was supplied from the Kumsi mines. With the establishment of a number of ferro-alloy companies in the country including at Dandeli, Vyasankere (near Hospet), Bhadravathi, etc. internal demand of manganese ore grew. This resulted in considerable mining of manganese ore in the forests of the Western Ghats region of Karnataka, especially in Shimoga and Uttara Kannada districts. The mining areas were Kumsi, Harnahalli, Shankaregudda, Yogimalali, Hosahalli, Shiddarahalli and Gangoor areas of Shimoga and Bhadravathi forest divisions and Nagri, Veerampalli, Sanmaga, Ushoda, Supa, Castlerock, Londa, Hudsa, Chipoli areas of Uttara Kannada and Belagavi districts. Extraction of manganese ore was started from 1961 in Bisgod mines in Yellapur forest division of Uttara Kannada district. Extraction of manganese ore was also taking place in the forest areas of Chitradurga and Bellary districts.

23.3. Prior to the enactment of the Forest (Conservation) Act, 1980, control of the Forest department on mining activities in forest areas was limited. The lease was allotted and administered by the Mines and Geology department. Forest department's responsibility was mainly to clear tree growth for mining as and when there was a request from the mining lease holder. Even the system of issuing of transit pass for mineral was not in vogue although the practice of authorizing the mining lease holder to issue Form 31 under Rule 149(1) of the Karnataka Forest Rules, 1969 was introduced later. However, as these mining activities grew in volume, the department's concern about safeguarding the forests from the evil effects of mining increased, especially in respect of the forest areas of the Western Ghats region. Damages to the forest were far more severe in this region which is highly eco-sensitive and is very rich in biodiversity. In addition to the normal damages associated with any open cast mining, these forests suffered heavily on account of the labour colonies that were invariably set up within the forest areas resulting in frequent fires, pilferages, etc. Because of heavy rainfall, considerable extents of exposed forest areas turned lateritic. With the enactment of the Forest (Conservation) Act, 1980 followed by a number of clarifications issued by the Government of India and the judgment dated 12th December, 1996 of the Hon'ble Supreme Court of India in the famous case of Godavarman Thirumulkpad versus the Government of India and others, the Forest department was in a better position to exercise control over

mining activities in forest areas. As the lease periods of most of the mining leases were nearing expiry, the department took a conscious stand of not recommending the mining leases situated in the Western Ghats region for renewal and extension. By the mid-1990s most of the mining leases in this region had expired and these were not renewed further. As most of these mining leases were located in highly eco-sensitive wildlife areas, namely, Anshi national park, Bhadra, Shettyhalli and Dandeli wildlife sanctuaries, the Forest department's decision not to extend permission for mining was accepted without much resistance. As a result, most of the mining activities in the Western Ghats region of Karnataka had come to a close in the beginning of 2000 AD. The only exception was iron ore mining in Kudremukh in Chickmagalur district by the Kudremukh Iron Ore Company Limited (KIOCL), a Government of India undertaking. This export-oriented company was extracting iron ore (magnetite) since the 1980s with a production capacity of 7.5 million metric tonnes (MMT) per annum. Because of intensive mining for more than twenty years, there had been immense ecological damage to the entire eco-system surrounding the mining lease area, which is located inside Kudremukh national park – a very spectacular and biologically diverse landscape harboring tropical rainforest. Opencast mining in such a sensitive area had created a lot of soil erosion in the hilly areas resulting in siltation of Bhadra River and its downstream reservoir. As the iron ore was of low grade (30% Fe), the waste material content (tailings) from the mine was of high volume and it caused large-scale siltation of the water-bodies including the Lakya dam. The matter was taken up by the Hon'ble Supreme Court of India through a public interest litigation (PIL) petition filed by Wildlife First, a Bangalore based NGO. The Hon'ble Court had on 31st December, 2005 directed for immediate stoppage of all mining operations in Kudremukh. With the closure of Kudremukh mine, Western Ghats region in Karnataka has been virtually freed from mining activities. With the closure of the mines in the Western Ghats region, the demand of ore (iron and manganese) is primarily met from the mines of Bellary district.

23.4. Karnataka's Western Ghats region had a few Bauxite mines located in Khanapur taluk of Belgaum district and Baindoor taluk of Udupi district. These mines were not given renewal after the expiry of their earlier leases. During January, 2004, the State Government of Karnataka had issued certain guidelines imposing restrictions on mining and quarrying in the Western Ghats area in order to save the pristine eco-system and bio-diversity of the region. Since then, mining activities in the Western Ghats region of the state have virtually come to an end.

23.5. As regards iron ore, most of the mining leases in Karnataka are situated in Bellary, Chitradurga and Tumkur districts. Mining in these districts had started during the 1940s and onwards. Part of the extracted iron ore was utilized in MISW, Bhadravathi which was subsequently renamed as Visvesvaraya Iron and Steel Limited (VISL). The remaining iron ore was exported. With the setting up of a number of steel plants within Karnataka and in the neighboring states, demand for iron ore kept on increasing. This resulted in increased mining activities, especially in the Sandur- Bellary-Hospet sector, known for high grade iron (haematite) ore. There is very high concentration of mines in the forest areas of Sandur taluk and the adjoining forest areas of Hospet and Bellary taluks.

23.6. Ballari (new name of Bellary) district is rich in mineral wealth, especially in iron ore and manganese deposits. With the stoppage of all mining activities in the Western Ghats region of the state, pressure for mining of both these minerals on the Bellary region increased. Most of the mines are situated in forest land. The principal mineral bearing forests are in Sandur North, Sandur South, Hospet and Ballari forest ranges. Most of the mining leases are of smaller extents. However, there are major players in M/s National Mineral Development Corporation Limited (NMDC), a Government of India enterprise, the State owned M/s Mysore Minerals Limited (MML), and M/s Sandur Manganese and Iron Ore Limited (SMIORE) in the private sector. Formerly the leases were governed by the Department of Mines and Geology which collected the major revenue. A nominal fee @ Rs.50-00 per acre was collected by the Forest department as damage and disfigurement charges. The scenario has changed completely with the enactment of Forest (Conservation) Act, 1980. According to the Act, mining in forest land irrespective of classification and ownership is a non-forestry activity and the leases have to be approved by the Government of India. The Forest department now exercises control on transit of the iron ore by issuing forest permit for each consignment [Form-27 as per Rule 145(2) of the Karnataka Forest Rules, 1969].

23.7. Mining of major minerals like iron ore and manganese in the Ballari district has led to forest and land degradations. Though the need for development of mining industry is an accepted factor in the evolution of the region's economy, its impact on environment can not be ignored. Mining affects the environment in diverse ways. The surface mining technology used for mining selective minerals like iron and manganese by adopting conventional practices like drilling, blasting and preliminary crushing invariably causes pollution. The significant impact of mining is mainly on land, forest, terrestrial and aquatic ecology, water resources and ambient air. Some of the impacts on the landscape and human environment can effectively be

permanent. Health problems of miners and nearby community arising out of pollution due to dust, noise, gases, mine waste discharge, etc. are significant. The key problems are land degradation, degradation of forest and decrease in bio-diversity, air pollution, water pollution and noise pollution.

23.8. From 2004 onwards, large quantities of iron ore were extracted from the mines of Ballari, Chitradurga and Tumkur districts as a result of a sharp increase in the international demand. The Indian Bureau of Mines (IBM) had given its approval for an upward revision of the quantities of ore that could be removed annually by a number of mines. Such large-scale permission coupled with very high market prices fuelled by very high demand resulted in rampant and unscientific mining leading to environmental degradation in the district. The Hon'ble Supreme Court of India while hearing Special Leave to Appeal petition Nos. 7366-7367/2010 with regard to such severe environmental degradation on account of over-exploitation had, after obtaining a comprehensive report from the Central Empowered Committee (CEC), ordered on 29-07-2011 to suspend mining operations in Ballari district. The Hon'ble Court in an order dated 05-08-2011 ordered the Indian Council of Forestry Research and Education (ICFRE) to carry out a macro level EIA study of Ballari district in collaboration with the Forest Survey of India (FSI) and Wildlife Institute of India (WII) and incorporating other domain specialists as needed in consultation with the Ministry of Environment and Forests (MoEF). The Hon'ble Court by another order dated 26-08-2011 suspended mining operations in Chitradurga and Tumkur districts and extended the macro level EIA study to be carried out by the ICFRE in respect of these two districts also.

23.9. The report submitted by the ICFRE in respect of mining in Ballari district has revealed that both large and small mines affect the environment in different ways. If scientific mining is carried out and due safeguards are in place then large mines cause comparatively less pollution and damage to the environment as compared with smaller mines. The report has pointed out that severe and significant damage has been caused to the environment by small lease holders, and the damage has been compounded by blatant illegal/unscientific mining operations. A large number of mines have not only violated the approval conditions of Environmental Conservation (EC), Forest Conservation (FC) and Indian Bureau of Mines (IBM), but also encroached upon the adjacent lands illegally and in the process damaged the environment. Environmental safeguards and stipulated conditions have been flouted in the greed to mine greater areas and earn more profits. The report of the ICFRE has summarized that rampant, unauthorized and unregulated mining has had a negative impact on the floral and faunal biodiversity, agriculture and ambient air, along with

adverse impacts on human health and well-being. It has therefore recommended for planning, implementation and institutionalization of a range of mechanisms and processes which will enable the country to meet the industrial and economic imperatives on the one hand but also safeguard the environment, biodiversity and human well-being considerations on the other. These twin goals have to be addressed concurrently if inter-generational equity considerations as highlighted by the Hon'ble Supreme Court of India are to be effectively addressed. The ICFRE has reported similar violations in respect of the mining operations of Chitradurga and Tumkur districts also.

23.10. Keeping in view the requirement of iron ore by the steel industry, the Hon'ble Supreme Court had ordered on 02-09-2011 for e-auction of the already extracted iron ore lying in various mine-heads and stockyards (about 25 million metric tonnes) through a three-member Monitoring Committee constituted for this purpose. Subsequently, the Hon'ble Court had also ordered for reopening of A-category mines under specific conditions. The Hon'ble Court vide another order dated 18-04-2013 permitted resumption of mining by B-category mines subject to fulfillment of certain conditions. All the C-category mining leases were ordered for cancellation in the order dated 18-04-2013. The A-category mines are those where there have been few or no illegalities committed during mining, while the C-category mines are the ones where legal processes were flouted the most. The B-Category mines are the ones where the illegalities were within certain limits. The orders of the Hon'ble Court permitting resumption of mining in respect of the A and B category mines were subject to their complying with stringent Reclamation and Rehabilitation (R&R) norms laid down by the Hon'ble Court. The permitted mining leases were to be allowed to start mining operations subject to their obtaining of all statutory approvals and satisfactory implementation/completion of the R&R Plan. The Monitoring Committee was entrusted with the responsibility to monitor implementation of R&R works and to accord permission for resumption of mines subject to satisfactory implementation of R&R works and other conditions imposed by the Hon'ble Court. The Monitoring Committee was also directed to conduct e-auction of fresh ore extracted from the permitted mines. The Hon'ble Supreme Court had also put a cap on production of iron ore from A and B category mines in Karnataka at 30 MMT per year out of which 25 MMT was to be extracted from Ballari district and the balance 5 MMT was to be extracted from Chitradurga and Tumkur districts. The Hon'ble Court had further ordered that only end-users such as steel-plants, sponge-iron plants, etc. are eligible to participate in e-auction and that the ore can not be exported. In an order dated 14-12-2017, the Hon'ble Supreme

Court has raised the annual cap of production of iron ore from A and B category mines to 35 MMT (28 MMT from Ballari district and 7 MMT from Chitradurga and Tumkur districts).

23.11. With regard to the C-category mines, the Hon'ble Supreme Court on 30-07-2015 directed the state government to commence the process of auction of fifteen (15) mines out of a total of forty-nine (49) mines. Only end-users (including PSUs) engaged in production of sponge iron, pig iron, steel and pellets would be eligible to participate in such auction. The process of e-auction of the C-category mines is in progress.

23.12. As regards preparation of the Reclamation and Rehabilitation Plan, the state government had entrusted the task of preparation of the Plans to the Indian Council of Forestry Research and Education (ICFRE), Dehradun. These are site-specific plans and are required to be prepared for individual mining leases keeping in view the degree of damages and measures required to address these damages. The R&R plans have to be approved by the Central Empowered Committee before these are implemented in the lease areas by the mining lease holders.

23.13. For the purpose of preparing the Reclamation and Rehabilitation plan for each individual mine, the ICFRE started with study of the baseline status of the lease area in terms of various local and regional parameters such as climate, physiography, topography, geology, land use pattern, soil, air, water, flora, fauna, social environment, etc. It was followed by study of environmental impacts of mining on landscape, ecology, air quality, noise and vibration, water quality, soil quality, aquatic life, society, etc. Various activities prescribed for implementation have been grouped in the following categories:

1. **Reclamation and Rehabilitation of the area under encroachment:** Measures recommended under this category include planting (in mining pit, overburden dumps and other areas) and stabilization of dump by erection of various structures like retaining wall, catch water drains, silt trap, check dams, gully plugs, etc. in the encroached portion of the mining lease area.

2. **Stabilization of dump:** This refers to various measures prescribed to stabilize the dumps within the lease area. The works include erection of toe walls, various types of check dams, garland drains or catch water drains, silt traps or silt settling tanks, planting (in case of inactive dumps), etc.

3. **Surface Water Management:** This refers to works prescribed for erosion control by various means such as diversion drains/catch water drains, silt retaining and grade stabilization structures such as gabion check dams, earthen check dams, stone masonry check dams, silt settling tanks, rain water harvesting pit (RWHP), etc.

4. **Biological Measures:** These include planting and sowing of native species including grasses and legumes, planting of avenue trees, planting in safety zone or green belt, afforestation, etc.

5. **Biodiversity Conservation Plan:** Considering the importance of the forest ecosystem in terms of its environmental services, certain portion of the mining lease area rich in plant diversity is recommended for further enrichment by planting and sowing of more indigenous species.

6. **Management of flora and fauna:** Here suggestions are given for overall management of floral and faunal components in and around the lease area. Prescriptions regarding fire protection, raising public awareness, etc. are also given.

23.14. As the responsibility of taking up reclamation and rehabilitation works within the mining lease areas has been entrusted to the mining lease holders, they are carrying out various works as per the prescriptions of the approved R&R plan. The responsibility of the Forest Department and the Mines and Geology Department is to ensure that the works are carried out as per the plan prescriptions. The mining lease holders also approach the concerned Departments as and when they are in need of any assistance in carrying out the prescribed works. The R&R works are also being supervised by the Monitoring Committee.

23.15. The impact of damage caused by mining is not only restricted to the forest areas leased for mining. The forest areas immediately surrounding the mining lease also bear the brunt of mining works. These areas require to be rehabilitated mostly through enrichment planting, soil and moisture conservation works and intensive protection. Establishment of vegetation in areas affected by mining and attendant activities is rather difficult. Appropriate soil and water conservation measures need to be carried out while preparing the area for afforestation. Since the areas are devoid of fertile top soil and other organic matter it is preferable to start planting from lower strata of plants initially. Colonizing grasses, herbs and shrubs are planted first. Once the area becomes partially stabilized planting of other tree species is taken up. Vegetation thus established functions as sink of air pollutants and also as natural dust

filters. Developing a stable forest eco-system in mine affected areas with varied soil conditions and micro-climate is a daunting task. Therefore, choice of species is of utmost importance. Species which have attributes of a pioneer species are given preference. The Forest department has been presently carrying out afforestation and protection works in these areas with the department's internal resources. The Hon'ble Supreme Court has ordered constitution of a Special Purpose Vehicle (SPV) for the purpose of ameliorative and mitigative measures as per the "Comprehensive Environment Plans for the Mining Impact Zone" (CPEMIZ) around mining leases in Bellary, Chitradurga and Tumkur districts. Once the SPV is fully operational, sufficient funds will be available to the department for carrying out rehabilitation, restoration and protection works in the forest areas affected by mining.

23.16. Among the forest areas presently leased out for mining in Karnataka, the forests of Sandur are unique. These represent some of the best dry deciduous forests of the state. These are also very rich in biodiversity including varieties of medicinal plants. The total extent of the Sandur forests is about 32,000 hectares out of which about 8,000 hectares have been affected by mining, although the actual area broken up and cleared for mining is much less (about 2,000 hectares). With the regulation imposed by the Hon'ble Supreme Court of India on mining and other related activities, there has been considerable improvement in the overall environment of the mining areas during the last five-six years. The quality of Reclamation and Rehabilitation (R&R) works turned out by the mining lease holders is by and large of high standard. The scale and intensity of mining has come down considerably due to the ceiling on production fixed by the Hon'ble Supreme Court. Half of the annual production of iron ore is done by two government undertakings, namely, M/s NMDC Limited and M/s MML. Transportation of ore from the mine-heads has been streamlined. About 40% of the iron ore is transported through railway wagons. Once the SPV becomes operational, considerable improvement will take place in the transportation infrastructure such as conveyor belt, railway network, railway siding, etc. This will further ease the pressure on the road network.

23.17. Considering the importance of iron ore as an industrial raw material and its predominant occurrence in the forests of Sandur-Ballari-Hospet sector, it will not be possible to completely halt mining in these areas. However, in view of the richness of biodiversity of the forests, mining should not be proposed / permitted in any new forest area; it should be restricted within the forest areas which have already been leased for this purpose. Proper implementation of R&R works by the mining lease holders within the lease area will contain the damages caused by mining to the minimum. The field officers of the Forest department should continuously monitor

implementation of the R&R works by the lessees. Effective implementation of R&R works within the mining lease areas will also reduce the damages caused to the peripheral forest areas. The department should also make the mining lease holders responsible for fire protection of the forests immediately abutting their mining leases. The department should concentrate on enrichment planting wherever required but the thrust should be on intensive fire protection during the summer months. As the areas are rain-deficient, extensive soil and moisture conservation (SMC) works will help in rejuvenation of the forests. Most of the mining leases are along the ridges; the quality of the forest is fairly good in the valleys and in other areas away from the mining leases. The most important treatment necessary for these areas is effective fire protection. The areas adjoining habitations will have to be protected from fire and encroachment. Degraded open patches will need afforestation.

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THE WAY AHEAD

The greatest gift that a forester receives in his life time is the unique opportunity to walk in the forest, to be in the lap of Mother Nature. And, on top of it, he is paid for it! Walking has been one of the basic duties of a forester for ages. Every forester has to prove his ability to walk for a considerably long distance before being considered worthy of any forest service. In the earlier days, walking was the only mode of traversing a forest. With the advent of vehicles of various types, life of a forester has become relatively easier. However, the four-wheeler, motorbike or bicycle takes him or her only up to a point, beyond which there are miles and miles to cover on foot. Even for conducting thorough inspection of a plantation of 25-50 hectares, a forest officer has to walk at least 4-5 kilometers within the plantation. The field level functionaries such as forest guards and forest watchers spend most of their time walking through the forest, while attending to their regular duties such as perambulation, patrolling, detecting forest offences, raising nurseries and plantations, inspecting forest boundaries, supervising forestry works including cultural operations, fire tracing, etc. The mere presence of a forester or a forest guard in the field makes a lot of difference in terms of forest protection, as smugglers and poachers will avoid such areas for committing an offence. The supervisory level field officers such as Deputy RFOs (Foresters) and RFOs have to spend considerable time in the forest besides attending to their office works. The inspecting and controlling officers such as ACFs and DCFs are expected to devote as much time as possible in the forest to inspect works.

24.2. In the recent years, due to multifarious reasons, forest officers at the district and taluk levels such as DCFs, ACFs and RFOs have to spend a lot of time in attending to office works and in attending meetings convened by superior officers, district and taluk administrations, etc. RFOs/DRFOs have to visit the taluk courts very frequently in view of increasing number of forest offence cases. The need for timely submission of a large number of reports to superior offices keeps the RFO engaged in his office much longer than desirable. The DCFs also get bogged down to their headquarters because of office works and meetings. Now and again, they are summoned to the state headquarters for meetings and other purposes. In spite of the advancements in the information and communications technology, officers get tied down to office works and do not get adequate time to visit forest to take stock of various works being carried out in the field.

24.3. While the field level functionaries must be constantly in the field for executing and supervising forestry works, the inspecting and controlling officers must also be able to organize their time schedule in such a way that they can devote a long time in the field. Frequent inspections by the DCF have tremendous impact on the morale of the subordinate staff. They become more vigilant in their work and put in extra effort to turn out better results. Inspection of works during execution is more important than inspection after the execution, as the inspecting officer can guide in improving the quality of works. Frequent inspection of works enables the DCF to have a grip over various activities going on in his division. He can interact with the field staff more informally and can get firsthand information about the difficulties they face in the field in carrying out their day-to-day works. A good feedback about what is happening in the division helps the DCF to take prompt and correct decision. Overall, an officer who moves around in his jurisdiction can take decisions with full confidence. His efficiency in office work also improves due to his knowledge and information about the ground situation. It is also necessary that all the field level officers and officials reside in their designated headquarters with their families so that they can concentrate on their work in their respective jurisdictions with undivided attention.

24.4. In Karnataka, the forest service is a uniformed service for officers up to the level of RFO. Although there is no specific dress code for officers of the rank of ACF and above, it was quite common in the past for even senior officers to wear khaki while touring in forest areas. This tradition is perhaps an expression of solidarity with the junior brothers of the department. Besides, from a practical point of view, khaki dress is well-suited in forest areas where one has to travel or walk a lot along dusty forest roads. Khaki color gels well with the forest background. A person wearing khaki is least likely to provoke or disturb wildlife. It is advisable that any one venturing into the forest wears khaki or similarly coloured attire.

24.5. For quite sometime, one of the crying needs of the Forest department has been to reorganize the beat-level and section-level administrative units of the department by reorganizing the beat and section boundaries. Many of these units are large and unwieldy and it is not possible to manage these efficiently and effectively, especially in the context of increasing pressure on forest areas and forest resources. For a very long time - from mid 1980s to early 2000s - direct recruitment of most of the categories of staff of the Forest department including the frontline staff had been stopped on account of economy ban. This resulted in chronic shortage of staff at the level of section foresters and beat forest guards. As the older staff members kept on retiring, the number of vacancies in these categories of posts kept on mounting.

Filling up of the existing vacancies of guards and foresters became the most important priority for the department rather than reorganizing the sections and beats. From 2002-03 onwards, with the restarting of the process of direct recruitment of frontline staff of forest watchers, forest guards, deputy RFOs and RFOs (about 5200 persons have been recruited so far), things have gradually looked up and the vacancy position has eased to some extent. However, the need to reorganize the sections and beats was always in the back of the mind of the state government. It was in this background that the government had constituted a committee in 2003 to look into all aspects of re-organization of beats, sections, ranges, sub-divisions and divisions in Karnataka Forest department. The committee, after examining the matter in detail and in consultation with the field officers, had prepared a report and submitted to the Government in 2004. The report has comprehensively analyzed the problems of the existing beats and sections and recommended for their reorganization. The report has recommended that each beat can normally be assigned an extent of forest area ranging from 800 ha to 1000 ha. In forest areas that are very sensitive from the point of smuggling, fire, pilferage of non timber forest produce, etc., it has recommended for beats of smaller size up to 500 ha. The report has recommended beat size up to 2000 ha only in case of absolutely undisturbed continuous forest areas. In wildlife areas, it has recommended a size of 500 ha to 800 ha. In *maidan* areas, it has recommended beat size up to 1000 ha. The report has also recommended that depending upon the sensitivity of the area, with reference to parameters like smuggling, poaching, forest fires, etc. two or three beats can be placed under a forester (now called Deputy RFO) in a section. In order to provide support for protection duties in the beat, the report has recommended that every beat guard may be provided with the assistance of at least one forest watcher. It has also been recommended that the number of forest watchers in a beat would depend on sensitivity of the area to theft, smuggling, encroachment, fire, etc.

24.6. During the year 2015, the Government had constituted one more committee to comprehensively review the cadre structure of the various categories of posts of the Karnataka Forest department and to submit a report containing recommendations regarding restructuring of the cadre by abolition of redundant posts, continuation of the essential posts and creation of new posts in keeping with the emerging needs and challenges of the department. The terms of reference of the committee were to review the cadre strength and structure of various categories of posts of the Karnataka Forest department and to submit recommendations regarding restructuring the cadre. The committee conducted detailed discussions with the department and, after examining the cadre structure of the department in the context

of the emerging challenges, has submitted a report to the Government in June 2015 making a number of recommendations. In particular, the committee has recommended for reorganization of the beats and sections by reducing their present area and redefining the boundaries for effective protection and management. As a general rule, an average area of 1000 ha for a beat and 3000 ha for a section has been suggested. Acceptance of these recommendations by the government will strengthen the protection machinery of the department which will go a long way in overall protection and conservation of the forests of the state. It is heartening to note that the state Government on 23-12-2017 has sanctioned creation of 3,085 posts of front-line staff including 751 posts of forest watchers, 1,500 posts of forest guards and 751 posts of Deputy RFOs.

24.7. Another area requiring improvement in the Forest department is in respect of cadre management through a transparent placement policy. Although it is generally argued that all posts in a cadre are equally responsible with equal remuneration, people have their own perceptions about these posts. There are two types of posts in every executive cadre of the department: territorial posts and special duty posts. Special duty posts pertain to the wings of the department such as Social Forestry, Working Plan, Research, Training, Vigilance, etc. and the posts on deputation to other departments, corporations and authorities. Earlier, posts in the Wildlife wing were also treated as special duty posts. But with the transfer of areas to the Wildlife wing, these posts are now treated as territorial posts. Territorial posts are by and large more sought after because these are considered to be more challenging. The nature of work in the territorial posts is more diverse. These posts carry a lot of administrative responsibility. The special duty posts are more technical in nature and the duties attached to these posts focus on one particular aspect of forestry or forest management. Territorial posts generally carry more financial responsibility also.

24.8. In the absence of any transparent policy of placement, posting of officers to various posts becomes arbitrary. The process may get vitiated by favoritism, partiality, one-upmanship, etc. If equal opportunities are not provided to all, officers/officials who have once shown good performance keep on getting postings of their choice and the others have to be content with whatever remaining posts are offered to them. Such situation creates disappointment, disgruntlement, bickering and disillusionment among the not-so-lucky officers/officials. They do not deliver the best. This is harmful to the organization also, as it is deprived of the full potential of all the officers/officials. The basic principle should be that everybody ought to be given opportunity to excel; in the process some do well, some may not do very well. Those who do well should be rewarded with more challenging job and those who do

not do well should be encouraged to improve or better his or her performance. This way every officer/official will ultimately be able to assess his or her own strengths and weaknesses and will ungrudgingly accept the posts offered to them and will do justice to the posts offered.

24.9. The number of territorial posts as compared to special duty posts in each executive cadre of the Forest department is low except in the case of Forest Guards. Therefore, managing the cadre of the Forest Guards to the satisfaction of the personnel has not been a problem. In general, every Forest Guard gets a number of opportunities to serve in territorial posts (beats). However, in respect of the other cadres such as DRFO, RFO and ACF, the number of territorial posts is less than the number of special duty posts. Therefore, it is necessary to ensure that unholy clamor or competition for territorial positing is resisted. Earlier, there was a practice that an officer after completion of his induction training would have to serve in the Development wing for a fixed tenure (five years) before being considered for a territorial post. It is advisable to revive this practice and follow it rigidly so that cadre management of field level officers is made transparent and fair. In addition, after an officer completes one term in a territorial post he should next be given a special duty post, followed by a territorial post, and so on. This arrangement will ensure that every officer gets equal opportunity to serve in territorial posts. Another principle that may be adopted is that when an officer is promoted, he or she is necessarily posted to a special duty post. Besides, in order to avoid cornering of coveted posts by a few, it is advisable to introduce a system of counselling for transfer of officials up to the level of Assistant Conservator of Forests (ACF).

24.10. As regards officers of the Indian Forest Service (IFS), there has been perceptible improvement in their placement in the recent years. Most of the young direct recruit officers have been provided responsible posts of territorial or wildlife divisions immediately after their promotion as deputy conservator of forests (DCF). However, the level of recruitment to the IFS has been low. As a result, there are not many young officers to man all the divisions of the state. The process of promotion from the state forest service (SFS) to the IFS has also been delayed for one reason or the other. This naturally brings disappointment to some of the SFS officers who miss out because of age restriction.

24.11. At the middle level of the IFS, a number of officers have been working outside the department for considerably long time. They have been recognized for their administrative, managerial and IT skills and they are providing excellent services to other departments and corporations of the state government. In the

process, the Forest department has been deprived of their valuable services. More importantly, they have been denied the opportunity to work in the forests and thereby gain valuable experience which is required at a later stage when they come back to the department to man senior level positions. Lack of sufficient experience of working in the forest becomes a handicap to them and may affect their career development in the department.

24.12. The Forest department has a social forestry wing represented in every district by a DCF who is assisted by an ACF, a few RFOs, DRFOs and forest guards. The social forestry divisions are working under the Zilla Panchayats. However, due to insufficient funds these divisions do not carry out much afforestation works. Ideally the social forestry wing should take full responsibility for the activities such as extension forestry, farm forestry, etc. However, as the social forestry divisions are short staffed, most of these activities are carried out by the territorial divisions. Needless to say, this diverts the attention of the territorial staff from their basic duty of forest protection. It is therefore necessary to strengthen the social forestry divisions to enable them to effectively carry out the task of implementing social forestry activities including farm forestry.

24.13. In the preceding chapters, a number of references have been made regarding inadequate funding in the forestry sector. The level of funding has improved in the recent years because of Karnataka Forest Development Fund (KFDF), CAMPA and a number of state sector plan and non-plan schemes besides a few centrally sponsored schemes. However, the distribution of the funds across the forest areas of the state has not been uniform. The position is slightly better in the wildlife areas (about 10,000,00 hectares) where funds are utilized more or less uniformly across the entire landscape for various works such as forest protection, fire protection, habitat improvement, etc. In the forest areas (other than the wildlife areas) which comprise of about 30,00,000 hectares, the focus is more on the plantation areas (recently developed in three-four years) which constitute at the most 2,00, 000 hectares. There is urgent need to increase focus and attention to the remaining forest areas (about 28,000,00 hectares). These forest areas do not require intensive management. The emphasis should be more on general protection through setting up of forest protection camps (FPC), frequent and regular patrolling and very intensive fire protection measures. Habitat improvement works such as soil and moisture conservation (SMC) and sowing seeds of native species should be carried out wherever necessary. The SMC works should be of low intensity and should be carried out with local manpower and with locally available material.

24.14. In the chapter on joint forest planning and management (JFPM), we have seen that during the last thirty-five years Karnataka has made considerable progress in bringing the people closer to the forests. There are some good examples of village forest committees (VFC) doing exceedingly well in forest protection and development. However, JFPM is yet to emerge as a self sustaining movement in the state. The institutional framework of JFPM needs to be further strengthened so that VFCs emerge as autonomous village level institutions capable of taking independent decisions regarding forest management under the guidance of the Forest department. There is need for further raising people's awareness about JFPM so that they on their own volition come forward to manage forests. The Forest department should continue to support the programme for the management and development of the degraded forest areas.

24.15. It has also been indicated in the preceding chapters that the goal of reaching 33% forest or tree cover can be achieved only when large-scale tree planting is taken up in the non-forest areas, especially in farmlands and other private lands. Such efforts will also reduce the pressure on our natural forests. With this objective in view, the Forest department's ongoing programme of 'Krishi Aranya Protsaha Yojane' must be pursued relentlessly and vigorously with very liberal funding and other technical support. This programme not only aims at ameliorating the environment but also helps in overall development of the rural economy.

24.16. The Forest department at present does not have an organized and structured publicity and public relations wing. The department's performance in implementing various people oriented programmes such as 'Krishi Aranya Protsaha Yojane' can be considerably improved if the vision and mission of the department are meaningfully conveyed to the people. A strong publicity and public relations wing is very much essential for developing a healthy interface between the department and the general public and people's representatives.

24.17. The overall strategy for forest development in Karnataka will thus need a three-dimensional approach. Forestry activities in the core forest areas will have to be steered by the Forest department, the main thrust being on conservation and protection. The degraded forest areas, which also happen to be the forests near habitations, should be conserved and developed by the adjoining communities with the guidance of the Forest department under the JFPM model. Forest and tree cover outside the traditional forest area should be expanded through aggressive farm forestry and development of plantations on all available non-forest lands.

24.18. In earlier chapters, we have mentioned about the Land use-Land cover classification (2006) done by the Karnataka State Remote Sensing Application Center (KSRSAC), Bengaluru for each district of Karnataka. This excercise was part of an assignment that the Government of Karnataka had given in 2003-04 to KSRSAC to develop and generate comprehensive database using Geographic Information Systems (GIS) and Remote Sensing (RS) to be used for planning and management by the Karnataka Forest Department. This was in continuation of the Forest department's earlier initiatives begun under the Western Ghats Forestry and Environment Project (WGFEP) to develop a GIS-RS based database for forest management. The project was steered by two very competent and energetic forest officers with engineering and ICT background, namely, Mr. Vipin Singh and Mr. Bishwajit Mishra. An important aspect of the project was that it was finalized after very detailed ground truthing and field validation with full involvement of the field-level officers of the Forest department. As already mentioned, the Land use-Land cover statistics are very detailed. The extent of each forest type in each density class has been indicated. In case of forest plantations, the extent of each type of plantation such as teak, eucalyptus, acacia, bamboo, casuarina, cashew, etc. has been given. Similar information has been provided for croplands and other plantations like coffee, tea, areca nut, cashew, rubber, agricultural plantations (mixed horticultural plantations), etc. District-wise details of scrub forests, forest blanks, grasslands, scrub lands, rocky/stony areas, waterlogged areas, etc. have been given.

24.19. For the purpose of comprehensive assessment of various types of land use in the state, the above district level details have been aggregated. For convenience of understanding, the state has been divided into three broad regions on the basis of average rainfall received as high, medium and low and the districts have been placed in these three regions as follows: (a) *Malnad* Region receiving high rainfall [Belagavi, Uttara Kannada, Shivamogga, Chickmagaluru, Udupi, Hassan, Dakshina Kannada, Kodagu, Mysuru and Chamarajanagar], (b) Semi-*malnad* Region receiving medium rainfall [Dharwad, Gadag, Haveri, Dhavangere, Chitradurga, Tumkur, Bengaluru (Urban), Bengaluru (Rural), Ramanagara and Mandya] and (c) *Maidan* Region receiving low rainfall [Bagalkot, Vijayapura, Bidar, Gulbarga, Yadgiri, Raichur, Koppal, Ballari, Kolar and Chikkaballapur]. The aggregated land-cover land-use details for the state and the three regions are indicated in the following table:

TABLE-VII
Land use-Land cover classification of Karnataka as per KSRSAC (2006) Assessment as per satellite imageries of 1999-2000 (Area in hectares)

Type of land use	*Maidan* Region	Semi-*malnad* Region	*Malnad* Region	Total for State
Geographical Area	69,43,000	51,66,600	70,72,300	191,81,900
Recorded Forest Area	5,57,493	6,30,961	31,47,193	43,35,647
Evergreen forest (crown density > 10%)	-	-	5,67,948.20	5,67,948.20
Semi-evergreen forest (CD > 10%)	-	-	2,41,486.51	2,41,486.51
Moist deciduous forest (CD > 10%)	-	81.96	7,49,929.61	7,50,011.57
Dry deciduous forest (CD > 10%)	36,794.19	1,12,403.92	3,93,467.21	5,42,665.32
Evergreen forest (CD <10%)	-	-	12,860.45	12,860.45
Semi-evergreen forest (CD < 10%)	-	-	5,221.84	5,221.84
Moist deciduous forest (CD < 10%)	-	-	88,482.18	88,482.18
Dry deciduous forest (CD < 10%)	7,221.70	9,891.88	7,645.12	24,758.70
Scrub forest	3,28,249.18	2,34,374.10	2,02,949.40	7,65,571.68
Forest blank	27,587.84	29,852.78	1,03,140.67	1,60,581.29
Grass land	-	6,623.89	82,805.40	89,429.29
Teak plantation	-	487.53	82,308.15	82,795.68
Eucalyptus plantation	54,378.38	1,15,397.9	42,182.56	2,11,958.84
Acacia auriculiformis plantation	1,966.62	3,240.91	49,708.16	54,915.69
Casuarina plantation	-	-	4,125.33	4,125.33
Bamboo plantation	-	504.64	897.15	1,401.79
Cashew plantation	-	-	27,849.55	27,849.55
Mixed plantation	39,069.67	53,180.13	39,939.12	1,32,188.92
Forest plantation	3,340.06	681.47	6,141.39	10,162.92
Crop land (cereal crop)	56,19,627.51	38,01,373.06	30,88,778.36	125,09,778.93
Coffee plantation	-	-	2,84,282.38	2,84,282.38
Tea plantation	-	-	3,526.85	3,526.85
Areca nut plantation	-	-	73,291.01	73,291.01
Rubber plantation	-	-	15,301.99	15,301.99
Mixed Horticultural plantation	54,583.99	2,37,816.54	2,51,796.61	5,44,197.14
Scrub land	2,35,547.25	1,42,516.31	1,65,660.91	5,43,724.47
Barren rocky/stony land	1,79,501.84	67,168.59	28,158.25	2,74,828.68
Waterlogged area	26,851.16	5,321.73	2,170.38	34,343.27

24.20. Perusal of the above table prepared on the basis of the district-wise Land use-Land cover data reveals that while the forests in the Western Ghats (*malnad*) region are in fairly good condition, the same is not true in respect of the forests in the semi-*malnad* and *maidan* regions. In these two regions natural forests have shrunk considerably. In the *maidan* districts, natural forests have been virtually decimated except in Ballari and Kalaburagi districts which together account for about 34,000 hectares out of 36,794.19 hectares for all the ten districts. Bagalkot, Vijayapura, Koppal and Kolar districts have not registered any natural forests (above 10% crown density). In the semi-*malnad* region, a few patches of natural forest occur mostly in Dharwad, Haveri, Davanagere, Ramanagar and Mandya districts accounting for about 1,08,000 hectares out of about 1,12,500 hectares for the entire region. The

remaining five districts of the region, namely, Gadag, Chitradurga, Tumkur, Bangalore Rural and Bangalore Urban have practically no natural forest above 10% crown density. It has therefore become absolutely necessary to protect by any means the remaining few pockets of natural forest from decimation. Although planting of eucalyptus in forest areas had been discontinued many years ago, it continues to dominate the landscape with its residual growth at the cost of natural vegetation. Although the Forest department has been carrying out large-scale plantations of about 50,000-70,000 hectares every year, increase in plantation area as assessed by interpretation of satellite imageries is quite insignificant compared to the actual extent of plantations raised. Scrub forests are quite extensive throughout the state, implying that these forests have retained the same status despite repeated planting initiatives. It has also been found that in the semi-*malnad* and *maidan* districts, land under cereal crop is 75-80% (90% in a few cases) of the geographical area of the districts and therefore, the national goal of one third forest or tree cover can never be achieved unless vast extents of the areas presently under cereal crop are brought under farm forestry through 'Krishi Aranya Protsaha Yojane' or similar programs. Besides, such massive expansion of cultivation of cereal crop in areas with limited and uncertain rainfall may not be environmentally sustainable.

24.21. From the KSRSAC assessment, it is apparent that our forests are under tremendous pressure, more so in the *maidan* and semi-*malnad* regions. The forests of the *malnad* region appear to be in satisfactory condition. However, the focus of the department should shift from planting to overall protection of the forests in all the three regions. The strategy for future action may incorporate the following activities:

24.22. In the **semi-*malnad* and *maidan* regions**, principal focus should be on overall protection and conservation of the existing forest blocks through eco-restoration providing for rigid protection, soil and moisture conservation and fire protection. This model should be implemented in the forest blocks year after year. Annual dibbling of seeds of native species just before the commencement of the rainy season should be an integral part of the eco-restoration model. In these regions, the ongoing plantation programme of the department should be very limited and restricted to selected areas where soil conditions are good. Number of seedlings should not be more than 200 per hectare. Focus should be on the quality of the seedlings rather than on their numbers. There should also be concerted efforts at converting the old eucalyptus plantations into natural forest by introducing indigenous species. Some of these plantations in the semi-*malnad* area have better soil profile even now. All out efforts, including uprooting of old eucalyptus stumps, should be made to restore these areas to their original state.

24.23. As condition of the natural forests in the semi-*malnad* and *maidan* regions is very poor and is fast deteriorating, it is necessary to include the remaining relatively better natural forests into the protected area (PA) network. The objective is primarily to protect the remaining bio-diversity of flora and fauna existing in these forests. This will automatically help in conservation and development of the natural forests within the protected areas. This process has already begun with the notification of a number of protected areas such as Jogimatti wildlife sanctuary (Chitradurga district), Gudekote sloth bear sanctuary (Ballari district), Rangayyanadurga four horned antelope wildlife sanctuary (Davanagere district), Ramadevara Betta vulture sanctuary (Ramanagar district), Yadahalli chinkara wildlife sanctuary (Bagalkote district), Chincholi wildlife sanctuary (Kalaburagi district), Thimlapura wildlife sanctuary (Tumkur district), Kappathgudda conservation reserve (Gadag district), Thimlapura conservation reserve (Tumkur district), etc. In addition, a number of dry deciduous forests of Bangalore (Rural), Ramanagara and Mandya districts have been added to the existing protected areas such as Bannerghatta national park and Cauvery wildlife sanctuary. It is necessary to continue this process and include more and more natural forests into the protected area (PA) network. Priority should be given to those districts from which natural forests have practically vanished. The existing remnant natural forests such as Kammasandra and Royalpadu forests of Kolar district, Narasimhadevarabetta and Ittikaldurga Blocks (NDB and IDB) of Chikkaballapura district, forest blocks of Manvi and Deodurga ranges in Raichur district, Agoli-Benakal forest blocks of Koppal district, Changler and Shahabad forests of Bidar district, Devarayanadurga and Siddarabetta forests of Tumkur district, etc. are examples of such forests. The forests of Sandur in Ballari district, which have been adversely affected by large-scale iron ore mining during recent years, also need to be given utmost protection. Sandur forests stand out as an important example of how a forest eco-system can retain its unique bio-diversity inspite of harsh climatic and soil conditions. The erstwhile rulers of Sandur state were successful in managing these forests ensuring the least biotic interference.

24.24. As the recorded forest area in the semi-*malnad* and *maidan* regions is very low, the national goal of raising the forest or tree cover to one third of the geographical area cannot be reached in these regions merely by planting in forest areas. The only possible way to come closer to the national goal in these regions is to increase the tree cover through farm forestry. Farm forestry is necessary both for increasing the tree cover and for making the ongoing agricultural activities environmentally and economically sustainable. Agricultural activities together with

farm forestry activities can provide better security to the farmers, especially in situations of deficient rainfall or drought. 'Krishi Aranya Protsaha Yojane' should be the flagship programme of the Forest department in the regions both in terms of attention and investment.

24.25. In the ***malnad* region**, the focus should shift from planting to overall protection. The present practice of under planting in the moist deciduous forests should be done away with. However, the ongoing practice of overall protection coupled with cultural operations and diffused soil and moisture conservation works should be continued. Planting, if at all required, should be restricted to only open areas with suitable species in limited numbers (say, 50 seedlings / ha).

24.26. The dry deciduous forests of the *malnad* region should be treated in the same manner as suggested for the dry deciduous forests of the semi-*malnad* and *maidan* regions. In other words, eco-restoration providing for dibbling of seeds, rigid protection, soil and moisture conservation and fire protection should be the principal focus. However, in limited areas with better soil, planting of indigenous species may be done with lesser number of seedlings (say 200 per ha). Teak, medri bamboo and sandal should be encouraged in these areas. There are large extents of *Acacia auriculiformis* plantations in the *malnad* region. As and when these plantations are harvested, first priority should be to consider indigenous species for replanting. The possibility of thinning these plantations and progressively introducing indigenous species such as saldhupa, mango, cane, etc. should also be explored.

24.27. In the days and years to come, the most important resources to be managed for the welfare of mankind are going to be forest and water. There is an inseparable and intrinsic relationship of mutual inter-dependence between these two natural assets. Significantly, the 'world forestry day' and the 'world water day', which symbolize the importance of these two resources across nations, are observed on two consecutive days, namely, 21st and 22nd of March. Among all natural eco-systems, forest is the most efficient in harnessing water (precipitation) and releasing it gradually through regulated stream flow. Healthy forests play a very important role in protecting and sustaining water resources. This role is all the more pronounced in peninsular India where rainwater is the basic source of water. The entire river system of Karnataka is dependent upon the forests of the Western Ghats which arrest, regulate and release rainwater throughout the year. Forests absorb rainfall, refill groundwater aquifers, retard, filter and cleanse surface water runoff, mitigate erosion, reduce flooding and maintain stability and vitality of watersheds.

24.28. In Karnataka, all evergreen and semi-evergreen forests and considerable portions of moist deciduous forests are included either in the 'protected area (PA) network' or in 'protection / biodiversity conservation' working circles of the forest working plans. These areas are managed as per the prescriptions of the management plans or working plans. This ensures that maximum protection is afforded to these forests with minimum intervention or interference. As we have seen, the approach to forest management with regard to the remaining forest areas has also been very conservative: there is a ban on felling of naturally growing trees, extraction of forest produce including dead and fallen material is very limited, there is increasing focus on habitat improvement including soil and moisture conservation works, etc. The Forest department also exercises utmost caution while regulating felling of trees in private lands in the eco-sensitive areas of the state. For similar reasons, mining has been done away with in the Western Ghats region.

24.29. While the forests of the Western Ghats primarily provide for protection and sustenance of the state's river system, there is need to expand and protect forest and tree cover throughout the state in view of the critical role played by forest and tree cover in conserving rainwater. Although the tree canopy traps rainwater and lets it down to the forest floor, efficient and effective absorption of the precipitation into the ground is possible only when the forest floor is rich with humus, leaf-litter and varieties of ground flora including weeds, grasses, ferns, seedlings, saplings, etc. Fire and excessive grazing are the main factors which damage the forest floor. A forest which has been rigidly protected from fire and grazing by domestic cattle is bound to have an ideal forest floor facilitating maximum absorption of rainwater into the ground and thereby enriching the groundwater resources.

24.30. In the above background, Forest department's approach to forest management has become more and more conservation oriented. During the last few decades, population has increased manifold and forest has shrunk considerably. This has increased pressures on forests tremendously. Given the present scenario of increasing population and limited forest resources, the existing natural forests cannot be any longer expected to provide for all the biomass needs of the population as in the past. Keeping the natural forests under continued stress will be suicidal, as their efficacy and efficiency in harnessing water resources will be seriously jeopardized. The signs of increasing stress on our forests are too obvious to be missed: depleting ground water level, recurring drought, repeated forest fires – these are all portents or manifestations of the ground reality that the existing forest or tree cover is not capable enough to sustainably harness the rainwater. Therefore, there is an urgent need to increase the forest and tree cover both in quality and in extent. This is possible

only when additional forest resources are created and developed outside the natural forests. Such forest resources, besides relieving the pressure on the natural forests, will also provide people with their biomass needs, help in improving rural economy and usher in all-round ecological development. Once the natural forests are relieved from the biotic pressures, they will show signs of rejuvenation and progress towards what is called a normal or ideal forest. Such a normal or ideal forest ecosystem is the only guarantee for protection and development of our water resources.

24.31. In the context of overall forest conservation for general well-being of the nation, and more particularly for conservation of our water resources, the concept of eco-sensitive zones (ESZs) or ecologically fragile areas (EFAs) has become increasingly more relevant. The ESZs were originally mooted by the Ministry of Environment and Forests (MoEF) during the early 2000s in order to regulate and manage the activities in certain areas in the outer periphery of protected areas (PAs) such as national parks and wildlife sanctuaries. The idea behind regulation and controlled management of activities in the peripheral areas (up to a distance of 10 km from the boundaries of national parks and sanctuaries) was to provide a buffer or shock-absorber to the protected areas so as to facilitate unhindered conservation and propagation of wildlife in the PA proper. The MoEF has given detailed guidelines to the states regarding constitution and notification of ESZs around the PAs. However, the process of constitution and notification of ESZs around the protected areas in the country, including Karnataka, has been highly delayed for various reasons.

24.32. The benefit of regulated activities in the ESZs however is not restricted to wildlife conservation alone. It results in ecological recovery and conservation of the entire landscape, as activities harmful to the ecosystem are discouraged and environmentally beneficial activities are encouraged. It has been increasingly realized that the protection of all landscapes, especially the ones which are inhabited by human beings, is of utmost importance in view of increasing population pressure and the resultant developmental activities. Considering the eco-sensitive nature of the Western Ghats region, the Ministry of Environment and Forests (MoEF), Government of India in 2010 had set up an expert panel, namely, the Western Ghats Ecology Expert Panel, also known as the Gadgil Commission after its chairman Mr. Madhav Gadgil to comprehensively examine various issues relating to the Western Ghats region and to submit a report with recommendations for conservation and sustainable development of the region. The panel had submitted its report during 2011. Important recommendations of the panel include constitution of a national-level authority, the Western Ghats Ecology Authority (WGEA) and keeping about 64% of the geographical area of the region under the Ecologically Sensitive Area

(ESA) zones. As this report had evoked mixed response and a lot of opposition from the local inhabitants as anti-development, the MoEF in 2012 constituted one high level working group (HLWG) under the chairmanship of Mr. K. Kasturirangan. The Kasturirangan committee report submitted during 2013 has sought to balance the two concerns of development and environment protection by bringing down the environmental regulation regime proposed by the earlier report. The Kasturirangan report seeks to bring 37% of the Western Ghats under the ESA zone. The report is yet to be accepted by the Ministry of Environment, Forests and Climate Change. Implementation of the recommendations of the report will have far reaching implications on the forest of Karnataka, as considerable portion of the Western Ghats region is located in Karnataka.

24.33. Constitution of ecologically sensitive zone - whether for the protected areas or for the Western Ghats - is considered by vast majority of the population as curtailment of their right to pursue activities of their choice. Their general opposition to the formation of ESZ also finds political support. It should however be realized that the concept of ESZ is not for curtailment of activities but for ensuring environment-friendly activities for the long term benefit to one and all. The disastrous effects of unplanned activities in all types of landscapes, including urban-rural and *malnad-maidan* areas of the state, are now too ominous to be ignored. As a matter of fact, time has come when we must think of environment-friendly activities in all landscapes and not merely in the Western Ghats region or around the protected areas. It is time to utilize all types of land wisely and ensuring the least damage to the environment. It is time to cover as much area with forest or tree cover as possible. This is the need of the day not only for conservation and wise utilization of water resources but also for mitigating the adverse effects of climate change looming large before all of us. And, the sooner, the better.

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Appendix-I

KARNATAKA FOREST DEPARTMENT, BANGALORE
Names of Forest Martyrs (1966-67 to 2017-18)

Sl. No.	Name of Officer / Official.	Designation.	Division.	Date of Death.
1	Shankar Moodalagi	Forest Guard	Belgaum	13-08-1966
2	Madanaika	Forest Guard	Chamarajanagar	29-12-1966
3	Jogegowda	Forester	-do-	29-12-1966
4	Abdul Ahamaad	Forester	Kollegal	19-01-1971
5	Ahmahad Khan	Forester	-do-	30-01-1971
6	HuchaShetty	Forest Guard	Chamarajanagar	09-11-1976
7	K.N.Rangarajeurs	Range Forest Officer	Hassan	05-07-1978
8	G.I.Hampaiah	Forest Guard	Belgaum	30-08-1982
9	N.A.Basarikatti	Forest Guard	-do-	25-03-1983
10	K.M.Pruthukumar	Forest Watcher	Research Madikeri	27-08-1983
11	H.A.Hanumanthappa	Range Forest Officer	Chickmagalur	26-01-1985
12	B.D.Khanapuri	Forester	Belgaum	08-11-1986
13	Aravind D.Hegde	Range Forest Officer	Sirsi	19-04-1988
14	B.C.Mohanaiah	Forest Guard	Kollegal	04-08-1989
15	H.Basavanne	Forest Guard	Sagara	06-11-1989
16	P.Srinivasa, IFS	Deputy Conservator of Forests	Chamarajanagar	10-11-1991
17	B.Nagaraju	„D" Group	Bhadra Tiger Reserve	23-06-1994
18	M.R.Poojari	Forest Guard	Dharwad	14-06-1995
19	G.K.Annaiah	Elephant Kawadi	Chamarajanagar	17-10-1996
20	K.S.Vittal	Forest Guard	Virajpet	14-05-1997
21	L.Lokesh	Forest Guard	Sagara	12-10-1997
22	S.T.Ganesh	Daily Wage Employee	-do-	12-10-1997
23	Y.Hanumanthappa	Forester	-do-	28-11-1997
24	P.A.Ponnappa	Forest Guard	Nagarahole Tiger Reserve.	23-12-1997
25	G.K.Rama	Forest Watcher	-do-	30-07-1998
26	M.V.Ranganagowdar	Range Forest Officer	Belgaum	20-03-1999
27	Sreenivasaiah	Forest Watcher	Tumkur	24-07-1999
28	Veerabhadrappa	Forest Watcher	Shimoga WL	26-10-1999
29	Annappa Mallappa Mugala-khoda	Forest Guard	Haliyal.	26-07-2002
30	Kalegowda	Forest Guard	Chickmagalur	21-08-2002
31	M.D.Shirahatti	Forest Guard	Gadag	23-01-2005
32	Rajashekharappa	Forest Guard	Tumkur	14-03-2006
33	H.C.Narayana	Forest Watcher	Shimoga	07-04-2007
34	Dr. G.K.Vishwanath	Assistant Veterinary Director	Bannerghatta National Park	02-01-2008
35	Manjunathappa	Forest Guard	Bhadravathi	07-06-2010
36	B.Prabhakar	Forester	Mangalore	09-02-2011
37	M.H.Nayak	Assistant Conservator of Forests	Haliyal	08-05-2012
38	Dhabbanna	Daily Wage Employee	Bannerghatta National Park	09-08-2012
39	Ramaiah	Daily Wage Employee	Bannerghatta National Park	
40	Panchalingiah	Watcher	Ramanagara	09-09-2016
41	Murigeppa Tammanagol	Forest Guard	Bandipur Tiger Reserve	18-02-2017
42	S. Manikandan, IFS	Conservator of Forests	Nagarahole National Park	03-03-2018

Appendix-II

EXPLANATION OF TECHNICAL (FORESTRY) TERMS

Coppice: Coppicing refers to the phenomenon of production of new shoots from the stump of a tree after the tree is felled. Coppicing is common among hardwood trees. It is rare among conifers. By and large, deciduous hardwood trees coppice well. Teak, Sal, Beete, Kutch, Bage, Ballate, Godda-hunase, Dindiga, Nerale, Karimuttal, etc. coppice strongly. Honne, Matthi, Nandi, Kamara, Tare, etc. coppice fairly well. Eucalyptus is an excellent coppicer. Evergreen species are poor in coppicing.

Pollarding: Pollarding is a pruning system in which the upper stem or branches of a tree are cut to induce formation of multiple shoots around the cut ends. Pollarding promotes branching and growth of dense foliage.

Rotation: Rotation of a tree species refers to the optimal period required to derive maximum value from a stand of the species. Tree species providing fuel wood, pulpwood, etc. are short rotation species with a rotation of 8/10 years. Timber yielding species have longer rotation periods such as 80 years, 120 years, 150 years, etc. Rotation of a tree represents the ideal age at which the tree needs to be removed, as the tree loses out on growth beyond this age i.e. its rate of growth declines. A new tree (seedling) introduced in place of the older tree will be more efficient in terms of growth.

Thinning: Thinning is a process of selectively removing trees from a forest or from a plantation. It is undertaken primarily to improve the growth rate or health of the remaining trees. In a plantation, such as in a Teak plantation, thinning is carried out at regular intervals. The number of thinning operations in a teak plantation up to its final harvest may be as high as six to eight times. First two thinning operations are generally mechanical in which the trees to be felled are selected mechanically such as, every alternate row, every alternate diagonal, etc. The remaining thinning operations are silvicultural in which the trees to be retained / removed are decided by factors such as quality of the site, growth and dominance of the trees, light conditions, etc.

Silviculture: The science of forestry is known as silviculture**.** It is a science dealing with the establishment, growth, composition, health and quality of forest vegetation for achieving a full range of objectives. Silvicultural practice consists of the various treatments that may be applied to forest stands to maintain and enhance their utility for any purpose.

Silvicultural system: A silvicultural system is the process of tending, harvesting and regenerating a forest.

Clear felling system is a silvicultural system in which all the trees in a coupe (portion of the forest) are felled. This may be done for the purpose of allowing natural regeneration to come up through seed fall or through coppicing. Sometimes clear felling is followed by *de novo* planting.

When regeneration is intended to be obtained through coppicing, the system is also called **Coppice system or Simple coppice system**. In this system, the main regeneration method is vegetative sprouting of either root suckers from the existing cut trees or shoots from cut stumps.

The silvicultural system in which regeneration is obtained from a combination of coppicing and seed fall from certain selected trees is called '**coppice with standards**' or '**coppice with reserves**' system. In this system, the forest area is not clear felled entirely. Certain numbers of uniformly distributed sound trees of valuable species (seed bearers) are retained in the coupe area. These trees also provide timber at a later date. The above silvicultural systems result in even-aged forest crop.

Selection felling system is a silvicultural operation in which exploitation of all or a proportion of the mature trees is carried out for the benefit of the growing stock and future production. Generally trees above a particular girth limit are extracted. Theoretically, selection felling can be carried out every year in the entire forest. However, extensive forests are divided into a number of convenient blocks and one block is worked every year. The number of blocks also indicates the number of years in which the entire forest will be worked after which the entire sequence of operations is repeated. This number is called **felling cycle**. Felling cycle is defined as the time that elapses between successive felling on the same area or block.

Improvement felling system refers to the removal of the less valuable trees in a forest crop in the interest of the better growth of the more valuable trees. Improvement felling comprises removal of dry, diseased, unsound, badly shaped and crowded trees, removal of subsidiary species in favor of major species, cutting back badly shaped or injured saplings, climber cutting, etc.

Selection-cum-improvement felling system refers to an operation which combines both the Selection and Improvement felling systems.

The above three silvicultural systems result in uneven-aged forest crop.

Shelterwood system refers to a sivicultural system in which the old stand is removed progressively through a series of fellings to promote the establishment of an essentially even-aged new stand under the shelter of the old one.

Working Plan: Working Plan is a document for scientific management of forest. The preparation of a working plan is a technical operation and the document is prepared within a time-frame for a definite period, namely, the **working plan period**. The document is prepared by the **working plan officer** after considerable survey, inventory and consultations. The working plan officer is generally a senior forest officer with sufficient field experience. Every working plan includes area-specific scientific prescriptions for proper management of forests of a particular forest division. The total forest area covered under a working plan is called **working plan area**. The working plan area is sub-divided into **working circles**; areas proposed to be worked under the same set of prescriptions constitute a working circle. Sum of the areas of all the working circles adds up to the working plan area.

Each of the working circles mentioned above is an exclusive working circle with specified area where prescriptions specific to the working circle are provided. However, there are certain forestry operations such as extraction and planting of species like bamboo, sandalwood, NTFP, etc. which are generally prescribed for areas already covered in one or more of the exclusive working circles prescribed in the plan. Prescriptions for such operations are contained in working circles which are called overlapping working circles, e.g. Bamboo overlapping working circle, Sandal overlapping working circle, etc. Needless to say, the areas of the overlapping working circles are not added while computing the working plan area.

For convenience of management, a working circle is further sub-divided into **felling series**. These are generally earmarked range-wise, i.e. felling series includes all the areas of the range which are worked under the same set of prescriptions. Sometimes for administrative convenience in heavy working areas, each felling series is further divided into **cutting sections**. The cutting sections are generally section-wise. (A range comprises of a few sections).

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Appendix-III

NAMES OF PLANT SPECIES (LOCAL AND SCIENTIFIC)

Sl. No.	Local name	Scientific name
1	Akasha mallige	*Millingtonia hortensis*
2	Aini, Hebbalsu	*Artocarpus hirsutus*
3	Ala, Goli	*Ficus benghalensis*
4	Alale, Harda, Hirda	*Terminalia chebula*
5	Anjan, Kamara	*Hardwickia binata*
6	Antawala	*Sapindus emarginatus, Sapindus trifoliatus*
7	Arali, Aswatha	*Ficus religiousa*
8	Ashoka	*Saraca asoca, Saraca indica*
9	Atti	*Ficus racemosa, Ficus glomerata*
10	Badam, Kadbadam	*Terminalia catappa*
11	Bage, Sirsal	*Albizia lebbeck*
12	Balangi, Havalige	*Acrocarpus fraxinifolius*
13	Balige, Balagi	*Poeciloneuron indicum*
14	Bamboo, Dowga, Hebbidiru, Mullubidiru	*Bambusa bambos*
15	Banni	*Acacia ferruginea*
16	Basavanapada	*Bauhinia purpurea*
17	Basari	*Ficus virens (infectoria)*
18	Benga, Honne, Nettaruhonne	*Pterocarpus marsupium*
19	Beete, Sissum	*Dalbergia latifolia*
20	Bevu, Neem	*Azadirachta indica*
21	Betta, Cane	*Calamus species*
22	Bela, Wood Apple	*Limonia acidissima, Feronia elephantum*
23	Bellary Jali	*Prosopis juliflora*
24	Betta, Cane	*Calamus species*
25	Bettavare, Holenekki	*Macaranga indica*
26	Bharanige, Naviladi	*Vitex altissama*
27	Bhende	*Kydia calycina*
28	Bidiru	*Dendrocalamus strictus*
29	Bilwara, Bilkambi, Godda-hunase	*Albizia odorotissama*
30	Bilijali	*Acacia leucophloea*
31	Bogi, Kiralbogi, Irupu	*Hopea parviflora*
32	Bore, Borehannu	*Ziziphus mauritiana, Ziziphus jujuba*
33	Bural, Buruga, Red Silk Cotton Tree	*Bombax ceiba, Bombax malabarica*

34	Buguri, Hoovarshi	*Thespesia populnea*
35	Burma Bidiru, Burma Bamboo	*Bambusa vulgaris*
36	Calliandra	*Calliandra calothyrsus*
37	Cassoda, Seemethangadi, Kasawad	*Cassia siamea*
38	Casuarina	*Casuarina equisetifolia*
39	Cashew, Geru, Godambi	*Anacardium occidentale*
40	Chandoda/Uptige	*Macaranga peltata*
41	Charcoal tree	*Trema orientalis*
42	Cherry, Singapore Cherry	*Mutingia calabura*
43	Chujjulu, Tugli, Sujjulu, Belkhambi	*Albizia amara*
44	Dalchini	*Cinnamomum verum (zeylanicum)*
45	Devadaru, White Cedar	*Dysoxylum malabaricum*
46	Dhaman, Tadasalu	*Grewia tiliaefolia*
47	Dhuma	*Dipterocarpus indicus*
48	Dhupa, Halamaddi	*Ailanthus malabarica*
49	Dindal, Dindiga	*Anogeissus latifolia*
50	Duabanga	*Duabanga sonneratioides*
51	Ebony	*Diospyros ebenum*
52	Ekanayakam	*Salacia oblonga*
53	Gliricidia	*Gliricidia sepium*
54	Gobli, Karijali, Babul, Jali	*Acacia nilotica*
55	Goni	*Ficus drupacea (mysorensis)*
56	Gowri mara, Maragowri	*Polyalthia fragrans*
57	Gulmohar, May-flower , Sankheswar	*Delonix regia*
58	Gulmavu, Kularmavu	*Machilus macarantha, Persea macrantha*
59	Gulla	*Mastixia arborea*
60	Hadaga, Hadang	*Cordia macleodii*
61	Halasu	*Artocarpus heterophyllus*
62	Halu betta	*Calamus pseudotenuis*
63	Handi betta	*Calamus thwaitessii*
64	Hasige mara, Kadu ashoka	*Humboldtia brunonis*
65	Hebbalsu	*Artocarpus hirsutus*
66	Hebbevu, Betta bevu	*Melia dubia*
67	Heddi, Etheyaga	*Haldina cordifolia, Adina cordifolia*
68	Hippe, Ippe, Madhuca	*Madhuca latifolia*
69	Hirda, Harda, Alale	*Terminalia chebula*
70	Honge, Hulgal	*Pongamia pinnata*
71	Hunase, Tamarind	*Tamarindus indica*

72	Holedaswala	*Lagerstroemia speciosa*
73	Holematthi, Thorematthi, Arjun	*Terminalia arjuna*
74	Hunal, Kindal	*Terminalia paniculata*
75	Huded, Uded	*Sterospermum chelenoides*
76	Jalari	*Shorea talura*
77	Jambe, Jamba	*Xylia xylocarpa*
78	Jamun, Nerale	*Syzygium cumini*
79	Jambu nerale	*Syzygium jambos*
80	Jarmal	*Tetrameles nudiflora*
81	Kadamba, Apate	*Anthoceplalus chinensis*
82	Kadbadam, Badam	*Terminalia catappa*
83	Kadgeru, Karigeru, Marking nut tree	*Semecarpus anacardiam*
84	Kaggli	*Acacia chundra, Acacia sundra*
85	Kaidhupa	*Canarium strictum*
86	Kakke	*Cassia fistula*
87	Kalam, Kadwala	*Mitragyna parviflora*
88	Kamara, Anjan	*Hardwickia binata*
89	Karanda, Karonda	*Carissa carandas*
90	Karagil	*Ammora canarana*
91	Karimuttal	*Ougeinia dalbergioides, Ougeinia oojeinensis*
92	Karikumar	*Diospyros paniculata*
93	Khair, Kutch, Kacho, Kachu	*Acacia catechu*
94	Kendala	*Dimocarpus longan*
95	Kindal, Hunal	*Terminalia paniculata*
96	Kukbuta	*Mallotus tetracoccus*
97	Kurigele	*Debregeasia longifolia*
98	Kumkuma	*Mallotus philippensis*
99	Kusum	*Schleichera trijuga*
100	Lantana	*Lantana camara*
101	Lavender	*Bursera delpechiana*
102	Mango, Mavu	*Mangifera indica*
103	Mashwal	*Chloroxylon swietenia*
104	Mahagony	*Swietenia mahagony, Swietenia macrophylla*
105	Mandara	*Bauhinia malabarica, Bauhinia racemosa*
106	Murugana huli	*Garcinia indica*
107	Mathi	*Terminalia tomentosa*
108	Mashe, Phadgus	*Alseodaphne semecarpifolia*
109	Nagabetta	*Calamus rotang*

110	Nagasampige	*Mesua ferrea*
111	Nandi, Nana	*Lagerstroemia lanceolata*
112	Nelli	*Emblica officinalis*
113	Nilgiri	*Eucalyptus species*
114	Nerale, Jamun	*Syzygium cumini*
115	Oomb	*Saccopetalum tomentosum*
116	Pali mara	*Palaquium ellipticum*
117	Panapuli, Devana huli	*Garcinia morella*
118	Pattuthali	*Litsea floribunda*
119	Peltophoram	*Peltophorum pterocarpum*
120	Peenari, Helu, Kodsa, Hedare, Durrasane mara	*Mappia foetida, Nothapodytes nimmoniana*
121	Raintree	*Samanea saman*
122	Rakta mara	*Myristica attenuata*
123	Rampatre	*Myristica malabarica*
124	Ranjal, Renja, Bokula	*Mimussops elengi*
125	Rudraksha, Dandele mara	*Elaeocarpus tuberculatus*
126	Saldhupa	*Vateria indica*
127	Sampige	*Michelia champaca*
128	Sandal	*Santalum album*
129	Seeme tangadi, Cassoda, Kasawad	*Cassia siamea*
130	Seeme bidiru, Marihal bidiru	*Oxytenanthera stocksii*
131	Seegekai, Shigekai	*Acacia concinna*
132	Seetaphal	*Anona squamosa*
133	Shanthi, Tare, Thare	*Terminalia bellirica*
134	Shivani	*Gmelina arborea*
135	Silver Oak	*Grevillea robusta*
136	Sissoo	*Dalbergia sissoo*
137	Some, Somi	*Soyamida febrifuga*
138	Spathodea	*Spathodea campanulata*
139	Tapasi	*Holoptelea integrifoila*
140	Tabebuia	*Tabebuia argentea, Tabebuia rosea*
141	Teak, Tyaga	*Tectona grandis*
142	Tumri, Tendu, Tupra	*Diospyros melanoxylon*
143	Tumri, Kat-kumbala	*Trewia nudiflora*
144	Udevu	*Sterospermum chelenoides*
145	Undimara	*Calophyllum inophyllum*
146	Uppagi, Punarahuli	*Garcinia gummi-gutta, Garcinia cambogia*
147	Wate	*Artocarpus lakoocha*
148	White Silk Cotton Tree	*Ceiba pentandra*

Appendix-IV

ABBREVIATIONS

ACF	Assistant Conservator of Forests
AIOA	Afforestation in Other Areas
ANR	Assisted natural regeneration
APC	Anti-poaching Camp
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CSS	Centrally Sponsored Scheme
CCF	Chief Conservator of Forests
CF	Conservator of Forests
CPT	Cattle proof trench
CZA	Central Zoo Authority
DCF	Deputy Conservator of Forests
DDF	Development of Degraded Forests
DRFO	Deputy Range Forest Officer
EDC	Eco Development Committee
EEC	European Economic Community
FAO	Food and Agriculture Organization
FC	Forest Conservation
FDA	Forest Development Agency
FPC	Fire Protection Camp / Forest Protection Camp
FDC	Forest Development Corporation, Fire Detection Camp
FDT	Forest Development Tax
FDF	Forest Development Fee
FRA	Forest Rights Act
FYP	Five Year Plan

GIM	Green India Mission
GTD	Government timber depot
GUA	Greening in Urban Areas
GIS	Geographic Information System
HRD	Human Resource Development
ICT	Information and Communications Technology
IFA	Indian Forest Act
IGA	Income generation activities
IWDP	Integrated Wasteland Development Programme
JBIC	Japan Bank of International Co-operation
JFM	Joint forest management
JFPM	Joint forest planning and management
JICA	Japan International Co-operation Agency
KFDF	Karnataka Forest Development Fund
KFD	Karnataka Forest Department
KIADB	Karnataka Industrial Area Development Board
KSHIP	Karnataka State Highway Improvement Project
KSRSAC	Karnataka Remote Sensing Application Center
KSFIC	Karnataka Forest Industries Corporation
MOEF	Ministry of Environment and Forests
MIS	Management Information System
NABARD	National Bank for Agriculture and Rural Development
NAP	National Afforestation Programme
NAPCC	National Action Plan on Climate Change
NCA	National Commission on Agriculture
NBM	National Bamboo Mission
NFC	National Forest Commission

NGO	Non Government Organization
NTFP	Non Timber Forest Products
NTCA	National Tiger Conservation Authority
NAEB	National Afforestation and Eco-development Board
NWDB	National Wasteland Development Board
NWAP	National Wildlife Action Plan
ODA	Overseas Development Administration
ODA	Official Development Assistance
PAMF	Protected Area Management Fund
PADF	Protected Area Development Fund
RFO	Range Forest Officer
SF	Social Forestry, State Forest
SFS	State Forest Service
SDP	Special Development Plan
SCP	Special Component Plan
SHG	Self help group
SHGY	Samagra Hasiru Grameena Yojane
TFC	Thirteenth Finance Commission
TSP	Tribal Sub Plan
UNDP	United Nations Development Programme
VFC	Village Forest Committee
Hectare	ha
Kilometre	km
Metre	m
WLPA	Wild Life Protection Act

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