REPORT OF

THE WORKING GROUP ON

RESEARCH, EDUCATION, TRAINING, CAPACITY BUILDING AND INFORMATION MANAGEMENT FOR THE ENVIRONMENT AND FORESTS SECTOR

FOR
THE ELEVENTH FIVE YEAR PLAN
(2007-2012)

Government of India
Planning Commission
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PREFACE

Indian Environment and Forests Sector is facing major challenges in the fast changing global and Indian scenario. It requires no less a revolutionary approach than the 'green' or 'white' revolution. The key environmental challenges that the country faces relate to the nexus of environmental degradation with poverty in many dimensions, and economic growth. Further, The role of forests in poverty alleviation, providing goods and services to the society, ensuring environmental security of the country and promoting carbon sequestration has assumed much greater importance than ever before. There are a number of other important ecosystems lying outside the traditional boundaries of the forests which require direct or indirect interventions of foresters in association with other stakeholders. The Research and Development (R&D) strategy has to take into account conservation and sustainable management of forests and forest production possibilities outside forests. We need a Common Research and Development Agenda.

Also, the level of expectations from the forestry profession has gone up. The foresters, scientists, researchers and educationists are required to play multifarious roles to deal with a variety of externalities besides coping up with the traditional forestry and emerging sustainable forestry demands. These roles demand high degree of expertise and competence in various fields requiring up-gradation of technical skills and development of professional capabilities in dealing with social, environmental, economic and developmental issues. All stakeholders need to get involved. The State and Central Research Institutions and Agricultural Universities have to work hand in hand to achieve national goals.

The Planning Commission (Environment and Forests Unit), vide its letter No. M-13033/1/2006-E&F dated 21 August 2006, constituted a Working Group on Research, Education, Training, Capacity Building and Information Management for the Environment and Forests Sector for the Eleventh Five Year Plan (2007-2012), under the Chairmanship of the Secretary, MoEF.

Keeping in view the enormity of the exercise and diversity of issues involved, four Sub Groups were created to deal with a specific themes. Sub Groups held meetings for deliberating upon the various issues pertaining to this topic. In between and later informal discussions through email amongst the members of the sub groups were also

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held particularly for those members who could not attend all the meetings due to their preoccupations.

The Chairman wishes to place on record his appreciation and thanks to all the members of the Working Groups and Sub Groups and for freely providing his time and actively participating in the deliberations.

(Jagdish Kiswan)
Director General, ICFRE
&
Member Secretary, Working Group

SUMMARY

The Planning Commission, Government of India resolved to set up a Working Group on Research , Education, Training & Capacity Building and Information Management for the Environment and Forests Sector for the Eleventh Five Year Plan (2007 - 2012) ,under the Chairmanship of the Secretary, Ministry of Environment and Forests GOI. The Terms of Reference (TOR) of the working groups ranged from making a critical review of achievements in the field of Environmental and Forestry related Research and Education during the X Five Year Plan to recommending strategy and approaches on research education, extension, training and capacity building and information management; critically examining the role of research institutes in the environment and forest sector and suggesting measures for effective coordination between the scientific ministries of the Govt. of India dealing with Environmental and Forestry related activities. The TOR further called for recommending on guiding principles for research priorities based on the global commitments or conservation and national needs and establishment of data and information base for understanding assessment planning and monitoring.

Considering the enormity of the task involved, four Sub Groups on (i) Environmental Research, Education and Extension; (ii) Forestry Research, Education and Extension; (iii) Training and Capacity Building; and (iv) Information Management were constituted by the chairman to deliberate on the issues and develop documents. The sub groups were to go into the ramification of the Terms of Reference. This document is the outcome of detailed discussions and the conclusions derived by these four sub groups.

The document spreads over seven chapters. The state of Environment and Forests in India during the last five decades along with the global challenges being faced currently have been dealt in the Introduction.

The vision, objectives mandate and activities of the major institutes under Govt. of India like, ICFRE, IGNFA, DFE ,FSI, IPIRTI and IIFM are dealt at length under chapter 2 . Universities and other institutes have also been dealt in this chapter. Review of the salient achievements by various institutes and organizations during the X Five-Year Plan have been elaborated in the third chapter. Chapter four deals with the major challenges and vision for future. Broad areas of research forestry extension and environmental research and education have been discussed in detail in chapter five under strategies and approach. The major thrust areas like agroforestry, watershed management, forest, fire, biodiversity conservation impact of diseases, medicinal and NWFP, forest

products and industries and technologies for transfer have been identified under chapter six.

Chapter seven contains recommendations and proposals of the Working Group with analytical justification of the same and highlighting the prioritized Action Plan for the XI Five Year Plan. Also major research programmes under which environment related research could be supported have been mentioned in this chapter.

Lastly, to meet the targets, budgets for Environment and Forest Research, Education ,Extension, Training & Capacity Building and Information Management have been worked out and an abstract of the total outlay given. A total outlay of Rs.70,319.43 lakhs has been proposed for the XI Five Year Plan .

Chapter 1
INTRODUCTION

"A diverse developing society such as ours provides numerous challenges in the economic, social, political, cultural, and environmental arenas. All of these coalesce in the dominant imperative of alleviation of mass poverty, reckoned in the multiple dimensions of livelihood security, health care, education, empowerment of the disadvantaged, and elimination of gender disparities. Across the political spectrum of the country there has been recognition of the vital role natural resources play in providing livelihoods, and securing life-support ecological services. Sustainable development concerns in the sense of enhancement of human well-being, broadly conceived, are a recurring theme in India's development philosophy. The present day consensus reflects three foundational aspirations. For this to occur there is a need for balance and harmony between economic, social and environmental needs of the country. India also plays an important role in several significant international initiatives concerned with the environment. It is a party to the key multilateral agreements, and recognizes the interdependencies among, and trans-boundary character of, several environmental problems." – Excerpts for The National Environment Policy 2006 (NEP).

1.1   During the last five to six decades it has been increasingly observed that the life-supporting potentials of our planet Earth has been eroding rapidly and may ultimately threaten the very existence of Biosphere. The root cause for depleting life supporting potentials of the earth is the environmental degradation through anthropogenically-mediate activities. The ozone depletion, climate change, desertification, tropical deforestation, species extinction, and pollution of water, soil and air are some of the environmental issues of global concern.

1.2   The Tenth Plan had recognized that environmental sustainability "is not an option but an imperative". Clean air, pure water, conservation of forests and wild life and generation of greenery are the essentials for a healthy environment. Prevention of degradation of land, controlling floods and droughts, preventing desertification, conservation of fragile eco-system, prevention of deforestation, conserving bio-diversity and mitigating water and air pollution all present challenges for planners and policy makers.

1.3   The concept of sustainable development has emerged as a prescription for human survival and at the same time ensures long-term maintenance of ecosystem health. One of

the priority requirements for achieving sustainable development is to create sustainable human societies. Environmental education and research are critical not only for the establishment of sustainable human societies but also to develop technologies, skills and expertise, which translate into tailor-made solutions to environmental problems.

1.4   Sustainable management of forests means the management and use of forests and forest lands in a way that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill in the future, relevant ecological, economic and social functions at local, national and global levels that does not cause damages to other ecosystems. A number of initiatives at the international level have been taken to determine criteria and indicators of sustainable management at regional, national and local levels. In India, too therefore, the tenth five-year plan must envisage funding research efforts in those areas, which are vitally linked with the well being and continued utility of the forests.

1.5   Education for a sustainable future should aim at: (i) conserving the earth's vitality and diversity, (ii) minimizing the depletion of non-renewable resources, (iii) improving the quality of human life, (iv) respect and care for the community of living world, (v) changing personal attitudes and practices, and (vi) enabling communities to care for their own environments. Forest education and research are components of environmental education and research. The environmental sector with forestry as one of its sub-sectors has also linkages with the agriculture, fisheries and health sectors. Consequently, educational and research programmes particularly at higher level must integrate all these different sectors.

1.6   From being an exclusivist profession, primarily charged with forest management for timber production, forestry today has expanded to encompass a wide range of roles varying from traditional forest protection & production to comprehensive bio-diversity conservation and sustainable use to eco-tourism promotion and so forth. In these new or expanded roles stakeholder participation has to become the presiding leitmotif of sustainable forest management. While societal expectations from the present day forester to fulfill these changing roles is increasing, more often than not the forest manager is left to his / her own devices to cope with the emerging challenges.

1.7   We are today living in the age of technology. The internet provides a global path way for information exchange, and literally any information is available at the click of a button. Yet, for many of us, the computer still remains more of a decoration piece and a status symbol. We have yet not made adequate and effective use of the entire capabilities of computers and have not totally capitalized on the IT revolution. It would not be wrong to state that forestry, for the most part, still relies upon age old dependence on manual

procedures and the human resource available. Forest inventory, growth and yield statistics, forest extent, species diversity and the like continue to be documented manually, as a result of which the activities are not just effort and time consuming but also subject to human error. Use of available and developing technology can help to a large extent in rapid assessment of forest resources as well as generating and updating the information and data that is the very basis for good planning. Geographic Information System (GIS) is an effective technology for storage, analysis and retrieval of spatial, temporal and tabular data for natural resources, yet a lot needs to be done by the State Forest Departments (SFD) in this area.

1.8 In the recent past environment and forestry research has been mainly focusing on the basic disciplines and these studies have led to the scientific advancement in the field. Though all these studies have immense relevance to the furthering the development of environment and forestry science in the country, however, in the changing scenario today the focus has to be shifted to research which could bring quick changes and improve the economy of the rural people leading to employment generation, poverty alleviation, etc.

1.9 The purpose of carrying out research today should be to generate benefit for the people by the application of new knowledge generated so far in the field of natural resource management. There is a need for user friendly and problem solving thrust in the field of research, education and extension. Research should be given due recognition and suitably placed at higher priorities to meet the new challenges . Research also needs adequate funding and possibility should be explored to involve the corporate and industrial houses in financing the research projects. While formulating the research projects research objective should be linked with the priorities of the nation such as poverty reduction, conservation and sustainable development and use of bio-resources.

1.10 Keeping in view the paucity of personnel in environment and forestry research and increasing the responsibility for managing large number of user groups institutional capacity with respect to trained man-power needs to be provided to cater to the needs. More thoughts are be given to a number of issues particularly in strengthening the structure of the organization, induction of new skills through organizing training of the existing staff at recognized national and international laboratories. Organizing orientation programme for scientists through visit to various national and international institutes in their respective field either through exchange programme or through fellow-ship in order to facilitate exchange of ideas and keeping them abreast with latest scientific and technology developments.

1.11 Adequate attention to transfer the technology from laboratory to the field has not been made in the recent past. Research extension linkages in terms of sharing of information and technology transfer is very weak. Research results are not transferred to the gross root level. One of the root causes of such a situation could be that research in most of the research institutions are conducted in isolation and development partners/stake holders were neither consulted nor made mandatory for implementing new technologies.

1.12 Today, more than ever before there is a need for partnership between research and educational institution, market/business entrepreneurs, financing bodies and policy makers, etc. Developing industries – institutional partner, have been found an effective tool in almost all developed countries in achieving the objectives and success for industries.

1.13 Forest Conservation Programme cannot succeed without the willing support and cooperation of the people. It is essential, therefore, to inculcate in the people, a direct interest in forests, their development and conservation, and to make them conscious of the value of trees, wildlife and nature in general. This can be achieved through the involvement of educational institutions, right from the primary stage. Farmers and interested people should be provided opportunities through institutions like Krishi Vigyan Kendras, Trainers Training Centers to learn agri-silvicultural and silvicultural techniques to ensure optimum use of their land and water resources. Short term extension courses and lectures should be organized in order to educate farmers. For this purpose, it is essential that suitable programmes are propagated through mass media, audio-visual aids and extension machinery.

1.14 'Habitat and Learning' is the theme of a focus group set up as part of the National Curriculum Review process. Habitat is where any specie finds conditions that permit it to thrive. Learning is a vital faculty of all animal species. First and foremost, animals learn about the features of their own habitat, picking up clues as to where they may expect to find food, where they may expect to encounter enemies, and where they may expect to meet social companions. For our ancestors, knowledge thus began with the exploration of their habitat. In that sense, this focus group may be said to be at the centre stage of education, an enterprise dealing with knowledge.

1.15 The Ministry of Environment and Forests, is classified as a 'Scientific Ministry' under the Government of India. Since its inception in 1985, the Ministry has funded research by diverse research institutions in several disciplines concerned with environmental protection. Some indicative areas include: forest conservation, wildlife protection, biodiversity inventories, R&D in environmental management technologies,

climate change, public health impacts of environmental degradation, etc. The existing guidelines set forth the objectives of research support, the thrust areas for research support, procedures for inviting / receipt and processing proposals for funding support, norms for funding, conditions of support and dissemination or research findings.

Chapter 2
EXISTING INSTITUTIONAL SET UP

A. National Level Forestry Institution

2.1 Indian Council of Forestry Research and Education (ICFRE)

The Indian Council of Forestry Research and Education (ICFRE) is an autonomous body under the Ministry of Environment and Forests, Government of India. The Council is apex body in the national forestry research system to develop holistic forestry research through planning, promoting, conducting and coordinating research, education and extension on all aspects of forestry. ICFRE ensures scientific management of forests, tree improvement, forest productivity through scientific and biotechnological research, bioremediation of degraded land, efficient utilization of forest produce, value addition, conservation of biodiversity, effective agro forestry models for various agro ecological zones, policy research, environmental impact assessment and integrated pest and disease management. ICFRE mission is to carry out research of forests, forestry and forest products at national level, and disseminate the results of this research to all concerned parties, including State Forest Departments, forest based industries, traders, farmers, and other user groups. ICFRE carries out research under various research programmes and eight-research institutes co-ordinate ICFRE in different parts of the country.

ICFRE has eight Regional research institutes and three research centers in different bio-geographical regions of the country to cater to the forestry research needs of the nation.

     (i)   Forest Research Institute, Dehradun
             (Uttar Pradesh, Uttaranchal, Haryana, Punjab, Chandigarh and Delhi)

     (ii)   Himalayan Forest Research Institute, Shimla
             (Himachal Pradesh and Jammu & Kashmir)

     (iii)   Tropical Forest Research Institute, Jabalpur
             (Madhya Pradesh, Chhattisgarh, Orissa and Maharashtra)

     (iv)   Institute of Wood Science and Technology, Bangalore
             (Karnataka, Andhra Pradesh, Goa, Daman & Diu)

(v)   Institute of Forest Genetics and Tree Breeding, Coimbatore
(Tamil Nadu, Kerala, Pondicherry, Lakshadweep and Andaman & Nicobar Islands)

(vi   Arid Forest Research Institute, Jodhpur
(Rajasthan, Gujarat & Dadra and Nagar Haveli)

(vii)   Rain Forest Research Institute, Jorhat
(Caters to research needs of the North Eastern Region)

(viii)   Institute of Forest Productivity, Ranchi
(West Bengal, Bihar, Jharkhand and Sikkim)

Advance research centers under the council are:

i.   Centre for Social Forestry and Eco-Rehabilitation (CSFER), Allahabad

ii.   Centre for Forestry Research and Human Resource Development (CFRHRD), Chhindwara.

iii.   Forest Research Centre (FRC), Hyderabad

2.1.1 Objectives

- To undertake, aid, promote and co-ordinate forestry research, education and its application.

- To extend the research findings from lab to land.

- To develop and maintain a National Forest Library & Information Centre.

- To provide consultancy services in the field of forestry research, education and training, and in allied sciences.

2.1.2 Mission

"To generate, preserve, disseminate and advance knowledge, technologies and solutions for addressing the issues related to forests and promote linkages arising out of interactions between people, forests and environment on a sustained basis through research, education and extension".

2.1.3 Vision

i.   Update, develop and provide knowledge, skill, technology and experiences to support development in forestry sector in accordance with priorities of

National Forestry Research Plan (NFRP) and National Forest Policy for sustainable forest development.

ii. As model organization undertake, coordinate, promote and aid forestry research, extension and education.

iii. Develop packages of technology and practices according to the needs of different stakeholders so as to contribute towards sustainability and promote these technologies through aggressive marketing.

iv. Focus research efforts on priorities as identified in NFRP and attain global leadership in few emerging strategic areas.

v. Optimize the use of research resources e.g. financial, human and infrastructure through establishing and nurturing symbiotic networking, with ICFRE providing a core of such network at national and regional level.

2.2. Indian Institute of Forest Management , Bhopal (IIFM)

The Indian Institute of Forest Management (IIFM) is premier autonomous Institute under the Ministry of Environment and Forest (MOEF), Govt. of India. The Institute has four main activities, namely research, teaching, training and consulting in the forestry and allied sectors. It was established in 1982 in response to the growing need for application of business methods in the management of forest and natural resources to ensure efficiency in resource use and conservation.

The Institute has about 25 faculty members working in the multidisciplinary faculty areas such as applied Computer Technology and Quantitative Techniques Communication Methods, Eco-system Management and Technical Forestry Financial Management, Accounting and Control , Forest Resource Economics and Management, Marketing Management, Personnel Management and Organizational Behavior, Sociology and Social Anthropology

2.2.1 The Institute conducts the following major programmes:

- Two year post graduate programme in forestry management (PFM, Equivalent to MBA)

- One year post masters programme in Natural Resource Management (NRM, Equivalent to M.Phil.)

- Management Development Programmes for industry, development sector, government sector, non government sectors, covering forestry policy and institutional aspects, rural livelihoods, community participation, micro finance etc.

2.2.2 Research and Publications Activities

Research and publications are among the key priority activities of the Institute. As a result, the IIFM faculty members have been undertaking various types of research projects related to the forestry and allied sectors. As a sectoral management institute, its research activities are primarily applied in nature. Drawing on the strength of multi disciplinary faculty, the institute promotes research projects of interdisciplinary nature. The research projects generally emphasize upon sustainability of natural resources benefit flow to the disadvantaged communities dependent on the forestry resources.

In addition to the internal research funding, the research projects receive funding support from a number of national and international organization. Among the international funding agencies supporting research projects at IIFM include International Tropical Timber Organization (ITTO), Yokohama, Japan; the International Development Research Centre (IDRC), Canada; the United Kingdom Department for International Development (DFID); the Food and Agriculture Organization of United Nations, CIFOR; the World Bank; the International Union for Conservation of Nature and Natural Resources (IUCN); the United State Forest Service (USFS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

2.2.3 Main Research areas

- Sustainable Forest Management and Forest Certification;

- Community Forestry including Joint Forest Management;

- Micro-Finance and Micro-Enterprise;

- Participatory Forest Resource Assessment, Monitoring and Evaluation;

- Legal and Policy Analysis in Forestry;

- Forestry and Livelihood;

- Valuation of Forests and Natural Resource Accounting;

- Remote Sensing and GIS Applications in Forestry;

- Gender in Forestry;

- Protected Area and Biodiversity Conservation;

- Management of Non-Wood Forest Products (NTFP) including Medicinal Plants and Wood fuel;

- Wetlands Management;

- Trees Outside Forest.

The Government of India has been supporting the IIFM research projects through funding form the Department of Science and Technology (DST), the National Afforestation and Eco-development Board (NAEB), the Ministry of Tribal Affaris, the Ministry of Textiles etc. The State Government Forest Departments also sponsor number of research studies of IIFM. The Institute has also undertaken some collaborative research projects with institutions such as the Cambridge University and the Kerala Forest Research Institute. Other organization like Sir Dorabji Tata Trust Mumbai have been providing support for research at IIFM.

2.3   Directorate of Forest Education (DFE)

The Directorate of Forest Education has been functioning directly under the Ministry since 1991 to cater to the training needs of the SFS officers and Range Forest Officers of the states and union territories in the country.

The forestry training institutes under the direct administrative control of the Directorate of Forest Education are

(i)   State Forest Service College, Dehradun (Uttaranchal)

(ii)   State Forest Service College, Coimbatore (Tamil Nadu)

(iii)   State Forest Service College, Burnihat (Assam Mehgalaya)

(iv)   Eastern Forest Rangers College, Kursenon (West Bengal)

The Directorate is responsible for

- Conducting induction training for the direct recruits to the State Forest Service (SFS) and exercising technical control over the induction training for RFOs being organized by the colleges under the State Governments.

- Conducting in-service training for SFS officers and FROs, and organize courses for the frontline staff in the form of short term refresher and theme based courses.

2.4 Indira Gandhi National Forest Academy

Indira Gandhi National Forest Academy (IGNFA) was constituted in the year 1987 by renaming the erstwhile Indian Forest College, which was originally established in 1938 for training senior forest officers. IGNFA is currently functioning in Dehradun as a Staff College for the officers of the Indian Forest Service (IFS). The primary mandate of the Academy is to impart knowledge and skills to the professional foresters and help them to develop competence for managing the country's forest and wildlife resources on a sustainable basis. It also enables them to act as catalysts for environmental protection, economic development and social change. In the Academy training is provided at different levels of seniority in the IFS besides training the new entrants to the service. The Academy also imparts skill upgradation training to officers inducted into the IFS on promotion from the State Forest Service (SFS). The Academy also imparts Advanced Forest Management (AFM) training to contemporary batches of IFS officers belonging to three different senior levels, viz, executive, supervisory and policy development levels, and thematic training to IFS officers in a vertical integration format.

Direct recruitment to IFS is made through the Union Public Service Commission (UPSC) examination. The successful candidates are appointed to the IFS on probation for a period of three years. This is the period during which IGNFA imparts professional training to the young entrants into the IFS. Foreign trainees are also imparted training. This includes Foundation Course at LBSNAA, Professional Phase Training at IGNFA and OJT in the Cadre States. The professional training of these IFS officers is imparted mainly by the in-house faculty members drawn on deputation basis from among the serving professionals working in various States and Union Territories. Inputs from guest faculty are also drawn from eminent persons of repute from various institutes and organisations including non-governmental organizations on certain specialized aspects of forest service. Study tours to various parts of the country and specialized field exercises form an integral part of the training.

IGNFA is placed directly under the administrative control of the Ministry of Environment and Forests (MOEF), Government of India (GOI). Accommodation for officers undergoing training at IGNFA comprises three hostels – the New Hostel, the Old Hostel and the Executive Hostel. These hostels are provided with mess and other facilities. There are billiards room, badminton court, table tennis hall and gymnasium in the Old Hostel complex. The Academy has spacious play-grounds adjacent to the New Hostel complex, which are used for physical training and out-door games. The Executive Hostel provides 30 rooms residential facilities to the senior officers coming to the Academy for in-service courses. A state-of-the-art pavilion-cum-indoor sports complex overlooks the playing ground at New Hostel. The two storied impressive structure houses multi gymnasium hall, billiards and table tennis room besides providing seating for 200

people to enjoy outdoor games. Adjoining the New Hostel, a modern, spacious assembly hall with a seating capacity of 600 is provided for holding cultural, academic and social functions.

A residential complex for providing accommodation to the faculty and staff of IGNFA is situated on Chakrata Road, opposite the FRI campus. Medical facilities for both outdoor and indoor patients are available at the New Forest Hospital. The Academy has a Guest House having 22 sets of rooms The Guest House is mainly used for accommodating visiting faculty and middle and senior level in-service officers who come to the Academy time to time for attending in-service training courses, workshops, seminars, etc. The primary mandate of the Academy is to impart capacity building and professional level training to the IFS officers.

2.5. Indian Plywood Industries Research and Training Institute (IPIRTI)

The Indian Plywood Industries Research and Training Institute (IPIRTI) institute was established in 1961-62 as a Central Research Laboratory of the Indian Plywood Manufacturers' Research Association under the Cooperative Research Scheme of the Government of India from out of the funds provided by CSIR and voluntary contribution from the Plywood Industries (in pursuance of Ministry of Commerce and Industries Resolution No.CI-9(5)/50 dated 22.9.1951). Consequent to the reorganization of the CSIR during 1977-78 (vide letter No. 5(15)/77-IED dt. 21.3.1978 of the Secretary, DST and Notification No.CD-261/78 dated 6-4-1978), IPIRTI was one of the several cooperative research laboratories, museums etc. that were transferred to various user Ministries. With this transfer the erstwhile cooperative research laboratory of plywood industry got converted into an autonomous body of the Ministry of Industry. Subsequently, vide Government Order No.2/1/88-CI of the Ministry of Industries, Department of Industrial Development dated 30-4-1990, the Institute was transferred to the administrative control of Ministry of Environment and Forests from 1.5.1990. This change was notified by the Government of India (GOI/Allocation of business rules 1959) amended vide Cabinet Secretary notification dated 15.5.1990 i.e. (GOI/Allocation of business 211 Amendment). The name of the Institute was changed to Indian Plywood Industries Research and Training Institute (IPIRTI) in the year 1992.

2.5.1 Mandate

Research on all aspects of production of sawn timber, manufacturing plywood and other allied engineered and reconstituted wood or lignocellulosic products, including improvement of materials, manufacturing processes, improvement of machines and appliances, conditions of work time and motion studies - standardization of methods of

work conditioning of factories, Inspection, certification and marking of all forest products viz. plywood, wood, timber, hardboard, particleboard, chipboard, furniture, gluelams, compreg, doors, panel doors, blockboard, flush doors, veneered panels, energy consuming, non biodegradable and on the whole highly environment friendly. A two pronged approach is essential to bridge this gap.

i. Rationalizing the utilization of available wood resources through appropriate technological intervention, and

ii. Development of wood alternates from other natural/renewable fibers.

At IPIRTI, R&D activities have already been reoriented to achieve these twin goals. Consequently, two main areas of applied research are: development of efficient technologies for wood and wood based composites, and evolving technologies for manufacturing wood alternates from natural/renewable fiber.

Guided by the fact that plantation grown wood will be the major source of industrial raw material for wood products, the main R&D activity of the Institute aims at efficient utilization of fast growing plantation timber species for production of sawn timber, plywood, and other wood composites. Wood produced in fast growing plantations has several characteristics compared to wood available from traditional forest grown tree species, viz. smaller diameters, lower dimensional stability and low natural durability, necessitating technological intervention for their proper utilization in meeting the societal needs in respect of wood and wood products.

Training in connection with forest product utilization for plywood industries and trade and for allied industries. Imparting technical education or/and training at undergraduate, post graduate and any other level of technology.

2.6 Forest Survey of India

Forest Survey of India (FSI) was created with effect from June 1, 1981 as a successor to "Pre-investment Survey of Forest Resources" (PISFR), a project initiated in 1965 by Govt. of India and sponsored by FAO and UNDP. The main objective of PISFR was to ascertain the availability of raw material for establishment of wood based industries in the selected areas of the country. Further the National Commission on Agriculture (NCA), in its report in 1976, recommended the creation of a National Forest Survey Organistaion for collection of data on scientific lines through country-wide comprehensive forest resources survey at regular intervals. Consequently, PISFR was reorganized into FSI. After a critical review of activities undertaken by FSI, Government of India, in 1986, redefined its mandate as follows in order to make it more purposeful

and relevant to the needs of the country. To prepare a comprehensive State of Forest Report (SFR) including National Vegetation Map once every two years. It will also prepare thematic maps through use of remote sensing data with minimal essential ground truth verification (most ground –truth verification would be done by the respective state government) on a ten year cycle. To collect, store and retrieve necessary forestry and forestry related data for national and state level planning and to create a computer based National Basic Forestry Inventory System (NBFIS).

2.7   Wildlife Institute of India

Wildlife Institute of India (WII) set up in 1982, has emerged as an eminent regional centre for training and research in the field of wildlife conservation in South Asia and South East Asia. It is an autonomous institute under the Ministry of Environment and Forests. The mission of the Institute is "To nurture the development of wildlife science and promote its application in conservation, in consonance with the cultural and socio-economic milieu".

The mandate of the Institute is (i) Build capacity, develop human resources in wildlife; (ii) Develop as a centre of excellence in wildlife science; (iii) Provide consultancy & advisory services to Central and State Governments in matters related to wildlife. Since its inception, Institute has trained more than 900 field managers through its flagship programmes of 9-months Post-gradate Diploma Course in Wildlife Management and 3-months Certificate Course in Wildlife Management. This includes 113 foreign trainees belonging to 19 countries. About 200 wildlife professionals have been trained by Institute through its M.Sc. Wildlife Science and doctoral programmes. Institute has been actively engaged in undertaking research on different facets of wildlife science across the country and has generated scientific database in the form of research reports (about 115) and technical papers (about 600). WII has also provided about 25 consultancy services to different states of India as well as to other neighbouring countries. Institute has also taken up additional responsibilities assigned by the MoEF for implementation of activities under National Wildlife Action Plan 2002 - 16. Currently, a country wide tiger and prey base estimation programme is underway in WII as per the requirement of Project Tiger Directorate.

Increasing human induced changes are posing new threats to conservation of wilderness resources today. The forests harboring wild animals are deteriorating in terms of quality and quantity (fragmentation) thereby threatening survival of species particularly mega species like elephants, tigers, rhinos and other large bodied animals. As habitats shrink and populations become increasingly isolated, factors like poaching, disease, population structure (sex-ratio) and stochastic events like droughts, fire and

floods which once were part of natural processes causing manageable oscillations are now becoming limiting and critical factors. The situation is throwing enormous challenges to managers and policy makers alike. WII, with its sound foundation in wildlife sciences, needs to respond to these emerging challenges adequately by implementing innovative approaches to manage wildlife resources in the country.

2.8 Forestry Research Institutions under the aegis of Indian Council of Agricultural Research (ICAR)

The forestry research is attempted in several institutes falling under crop science and natural resource management institutes of ICAR . Besides the work done in the research institute, there is an All India Coordinated Research Project on Agroforestry involving about 30 centers, many of them located in State Agricultural Universities across the country.

The activities in the major area of forestry research (including allied fields) under Indian Council of Agricultural Research (ICAR), including Indian Grassland & Fodder Research Institute (IGFRI) may be broadly classified into three parts – (i) Agroforestry Research (targeting primarily farm lands); (ii) Silvipastoral Research (targeting degraded forests and other wastelands); (iii) Grassland Ecology and Management (targeting natural grasslands and community grazing lands).

List of major research institutions of ICAR imparting forestry research

1   Indian Grassland & Fodder Research Institute, Jhansi (IGFRI)

2   National Research Center for Agroforestry, Jhansi (NRCAF)

3   Central Arid Zone Research Institute, Jodhpur (CAZRI)

4   Central Soil Salinty Research Institute, Karnal(CSSRI)

5   Central Soil & Water Conservation Research & Training Institute, Dehradun

6   ICAR Research Complex for North Eastern Hills Region , Shillong (ICAR- RC- NEH)

7   Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (VPKAS)

8   Central Research Institute for Dryland Agriculture, Hyderabad (CRIDA)

9   Central Agricultural Research Institute , Port Blair (CARI)

B   NATIONAL LEVEL INSTITUTIONS IN ENVIRONMENT SECTOR

2.9   Centre for Science and Environment (CSE)

The Institute deals subjects of Ecology and Environment; Environmental Education; Pollution Monitoring/Control; Water Management; Health.

Environmental activities include communication for awareness; rainwater harvesting; climate change; research and advocacy; education and training; documentation; CSE's pollution monitoring laboratory is an independent analytical, research and development laboratory that monitor and document pesticide residues, conducts water quality analysis and monitors ambient air quality in cities and communities across India; lab services include analysis over a wide range of parameters for food, water, soil, air, and biological materials; including blood, tissue and other environmental analysis.

Publications: State of India's Environment – The Citizen's Report, Down to Earth, Air Pollution Booklet etc.

2.10   The Energy and Resources Institute (TERI)

Environmental activities include providing environment-friendly solution to rural energy problems to help in shaping the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry. All activities in TERI move from formulating local – and national – level strategies to suggesting global solutions to critical energy and environment related issues.

2.11   Centre for Environmental Education (CEE)

Environmental activities include Environmental education and training; conservation of biodiversity; eco-development; networking for environmental education; adapting to different geographic, culture, social and economic contexts built into the basic design of programmes and material; CEE in association with the Environmental Law Institue, Washington DC, has launched a project for capacity building of judiciary in Uttar Pradesh with funding from the Ford Foundation. The objective is to help the judiciary plan an informed and effective role in protecting the environment and upholding and strengthening environmental law in India.

2.12   G. B. Pant Institute of Himalayan Environment and Development

G.B. Pant Institute of Himalayan Environment and Development was established in August 1988, at Kosi-Katarmal, Almora, as an autonomous institute of the Ministry of Environment and Forests, Government of India. The Institute is identified as a focal agency, to advance scientific knowledge, to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources and to ensure environmentally sound development in the entire Indian Himalayan Region (IHR). Apart from undertaking research and technology development and/or demonstration on its own, the Institute has established linkages with National and International Organizations committed to environment and development linked issues in the mountain regions. The Institute has been recognized as a nodal agency for research and development programs in the Indian Himalaya by the Planning Commission, the Ministry of Environment and Forests, Government of India, and many International organizations. All R&D activities of the Institute are essentially multi-disciplinary in nature, and based on a conscious effort to interlink natural and social sciences to promote sustainable development. The vision and area of operation of the institute are as follows:

- To undertake in-depth research and development studies on environmental problems of the Indian Himalayan Region.

- To identify and strengthen the local knowledge of the environment and contribute towards strengthening researches of regional relevance in the scientific institutions, Universities/NGOs and Voluntary agencies working in the Himalayan region, through interactive networking.

- To evolve and demonstrate suitable technological packages and delivery systems for sustainable development of the region in harmony with local perceptions.

Chapter 3
THE SALIENT ACHIEVEMENTS OF X PLAN

A. SALIENT ACHIEVEMENTS IN THE FORESTS SECTOR

3.1 Indian Council of Forestry Research and Education (ICFRE)

i. Enhancing Productivity of Forests

- Developed cost-effective micro-propagation protocols for mass propagation of *Dendrocalamus strictus, Bambusa arundinacea*, *B. arundinacea var. gigantean, D. membranaceous, B. nutans* and *Oxytenanthera stocksii*.

- Standardized in-vitro propagation methods for mature tissues of *Azadirachta indica*.

- Rejuvenated difficult to root clones of *E. tereticornis* and *E. camaldulensis* rejuvenated and 10% rooting achieved. Methods developed for the micro-propagation of tropical hybrid *Eucalyptus urophylla X E. grandis*.

- Maintained germplasm bank for 400 clones of Poplar (*Populus deltoides*) for tree improvement studies.

- Identified twelve clones of *Casuarina equisetifolia*, as superior performers, selected for fingerprinting using RAPD and AFLP techniques. Developed DNA finger printing for molecular base characterization of germplasm of - Pine, Shisham and Eucalyptus.

- Identified 1156 plus trees of neem in different agro-climatic zones of Madhya Pradesh, Chattisgarh and Orissa.

- Standardized the clonal propagation technology for mass multiplying the high yielding neem tree.

- Standardized a procedure for rapid multiplication of *Dalbergia sissoo* (Shisham) through axillary bud proliferation and clonal propagation technology and micro-propagation package for teak has to produce high quality-planting stock.

- Selected twenty outstanding clones each of *Casuarina equisetifolia* and *C. junghuhniana sub-sp. timoresnsis* and vegetatively propagated in a hybridization garden.

- Developed molecular cataloguing of 36 plus trees of teak from 11 states of India and one allied species (*Tectona hamiltoniana Wall*) endemic to Myanmar using RAPD markers.

- Developed in-vitro shoot proliferation mehods for large-scale multiplication of mature clumps of *Bambusa nutans* and *Dendrocalamus giganteus*.

ii. Conservation of Forest Genetic Resources

- Established 1300 ha. Seed Production Areas, 351 ha. Seed Seedling Orchard and 170 ha. Clonal Seed Orchard and Model Nurseries in different parts of the country for Quality planting Material (QPM).

- Standardized seed testing procedures for more than 120 species.

- Developed guidelines for certification of forestry seeds.

iii. Silviculture for Forest Management

i. Initiated work on benchmarking biodiversity and preservation of gene pool of important species/forest types through preservation plots in. 15 States of the country.

ii. Developed technology for artificial regeneration of *Buchnania lanzon* in U.P.

iii. Volume tables, site index equations and growth/yield functions for *A. indica, E. camaldulensis* and *D. sissoo* also developed.

iv. Field trials laid with two forestry important species of *Alnus nepalensis* and *Exbucklendia populenia* for reclamation of highly eroded site at Cherrapunjee, Meghalaya.

v. Growth of most common tree species planted in South-West Bengal viz., *Acacia auriculiformis, A. mangium, Azadirachta indica, Dalbergia sissoo, Eucalyptus, Gmelina arborea, Shorea robusta* and *Tectona grandis* from 132 plantation sites under alluvial, coastal and lateritic soils were compared for the soil vegetation interaction with special reference to nutrient cycling.

vi. Development of Agro-forestry Models

- Developed package for "Economic Production of *Casuarina equisetifolia* in Agroforestry system".

- Developed and standardized management practices for most promising existing agroforestry systems in central Narmada valley and Satpura plateau agro-climatic regions of M.P., arid and semi-arid regions of Rajasthan, semi-arid tropics of Andhra Pradesh.

- Developed agroforestry model consisting of tree species (*Tectona grandis, Gmelina arborea* and *Emblica officinalis*) and crop species (soyabean and wheat).

- Organized awareness campaigns for promotion of agroforestry amongst farmers.

vii. Protection of Forests

- Developed insect database for 200 species for National Insect Reference with the collection preserved at FRI.

- Studied Shisham Mortality - Temporal changes in the physical properties of soil and soil maturation, water stress, water logging, environmental stress and ecological succession are observed to the main causes for shisham mortality.

- Studied management of Sal Heartwood borer in natural forests.

- Tested promising plant derived chemicals against key pests against the major defoliators of forest tree species.

- Multiplied 3,00,00000 wasps of *Trichogramma rosi* and introduced in 200 hectare teak plantations of Maharashtra and Madhya Pradesh to minimise the out break of Teak defoliator and skeletonizer.

- Deodar mortality in around Shimla was studied and causative factors identified.

- Identified natural enemies of *Ectropis deodarae* comprising of eleven parasitoids, eight predators and nine entomo-pathogens of Himalayan forest.

- Two new species of the genus *Angulitermes* (*A. bhagsunagensis sp.* now) from Himachal Pradesh and *Mecrotermes* (*M. vikaspurensis* sp. now) from Uttaranchal have been identified.

- Identified *Phloeobius crassicollis* (Coleoptera: Anthribidae) damaging green culm of *Bamboosa bambos* for the first time.

- Identified causes of mortality of *Prosopis cineraria* trees and suggested remedial measures for protecting the infested trees.

viii. Forest Products

- Electronic database of available Physical and Mechanical properties of timber species tested so far since 1911 belonging to 510 records prepared. Various calculations of suitability indices and safe working stresses of timber species completed and tested.

- Standardized methods for vegetable dyes from *Ageratum conyzoides, Parthenium hysterophorus*, *Eupatorium glandulosum* and *Azadirachta indica*.

- Obtained VAC-FRI technology for treatment of green bamboo.

- Developed Plasticisation technique for palms and selected bamboo species.

- Studied post harvest technologies on non-traditional, under-exploited locally available timber species for suitability to handicraft and other small scale Industries.

- Assessed wood quality of *Simarouba glauca* for its timber value.

- Developed alternative preservatives of more economic value and schedules for their incorporation in wood.

- Standardized seasoning and preservation technique for Rubber wood.

- Reconstituted wood from lops & tops of Eucalyptus, Poplar, Lantana and Bamboo.

- Furniture made from preservative treated (CCA and Chloropyriphos) under pressure treatment plant and seasoned wood of all the three plantation of lesser-known timber species viz. *A. tortilis, P. juliflora* and *P. cineraria*.

ix. Non Wood Forest Produce

- Launched a website on medicinal plants market trend http://marketinfoherbs.icfre.org by FRI.

- Initiated studies to propagate high altitude medicinal plants –*Microstylis wallichii*, *Berginia ciliata, Valeriana jatamasi* and *Swertia chirayita* by following non-destructive methods at lower elevation).

- Isolated the parthenium lignocellulosic material and converted into fibres, which were analysed for physical properties for development of Medium Density Fibre Board.

- Established agroforestry based medicinal plant cultivation research plots in Haryana and at Dehradun. The cost economics of cultivation of different medicinal plants under different agroforestry and horticultural species studied.

- Studied lac cultivation on non-traditional host *Flemingia* spp. and its possibility in sustainable plantation forestry.

- Studied economic evaluation of NTFPs in tribal belt of Madhya Pradesh and standardized methodologies for extraction and value addition of NWFP providing sustenance to tribals.

- Standardized Nursery Techniques for Mass Propagation of Selected Medicinal Plant Species.

- Estimated heavy metals (lead and arsenic) in vegetable dye of *Butea monospema* and *Woodfordia fruticosa*.

- Studied production of alpha cellulose from *Lantana camara* and its chemical modification for industrial applications.

- Extraction and dyeing trials with dyes from *Lantana* leaves, *Cassia tora* seeds and *Eucalyptus* hybrid leaves using different mordant were carried out.

- Methods standardized for production of alpha cellulose and its derivatives from *Lantana camara* for a variety of applications.

- Methods standardized for vegetable dyes from *Ageratum conyzoides, Parthenium hysterophorus*, *Eupatorium glandulosum* and *Azadirachta indica.*

- Methods standardized for compost making from *Parthenium* for effective utilization of weeds.

x. Eco-restoration Studies

- Reclaimed problem soils like quartz dumps, magnesite / lime stone mine spoils using suitable tree species and proper soil amendments.

- Studied biological reclamation of fly ash dumps at Thermal power station area, Korba and Chachai.

- Standardized afforestation technique for sodic soils and reclamation of wastelands- FRI.

xi. Environmental Impact Assessment

- Conducted comprehensive Environmental Impact Assessment & Management Plan for Bodhghat Hydro Electric Project, CSEB, Raipur, Chhattisgarh.

- Environmental Impact Assessment of Seismic Operations in Krishna Godavari Basin (KG-ON-1) for Reliance Industries Ltd., Mumbai.

- Prepared final mine closure plan for Kudremukh Iron Ore Company Limited (KIOL), Bangalore – This has been prepared first time in the Country, as per the directive of Honorable Supreme Court to KIOCL.

- Ecological Assessment of forest areas falling Under Kol Dam Hydroelectric Project in Bilaspur District of H.P.

xii. Biodiversity Conservation and Assessment

- Ecological assessment of Dipterocarp forest with reference to distribution, abundance rarity and profile sketch of evergreen forest is carried out in Gibbon Wildlife Sanctuary.

- Spatial distribution mapping and population dynamics of 21 threatened medicinal plants carried out in Silent valley and kolli hills MPCAs of Kerala and Tamil Nadu.

- Collected 640 plant species belonging to 90 different families from the cold desert areas. Three hundred forty five species have been identified as unique species. Twenty-seven species of medicinal importance declared as red listed medicinal plants.

- Forest Invasive Species: (FIS) is a priority issue under the Convention on Biological Diversity, accordingly, based on information received from regional ICFRE Institutes, a brochure published on 'Forest Invasive Species' as per revised format for Asia Pacific Forest Invasive Species Network (APFISN).

xiii. Climate Change

- Given observer status of UNFCCC at COP 10 in 2004 in accordance with Article 7, Paragraph 6 of the Convention.

- Studied Carbon mitigation potential of farmlands in Betalghat, Nainital, Uttaranchal.

- Studied Carbon sequestration potential under farm forestry and community forest.

- FORCLIMIT India (MoEF- USEPA Programme – Forests and Climate Change Mitigation Networks). First phase in Udhampur, Nainital, Uttaranchal

for farm forestry and forestry was completed. Industrial Potential approach at Singareni coalfield is in progress.

xiv. Research on Jatropha curcas

- Isolated and estimated oils and anti-nutritional constituent, phytae in different provenances of *Jatropha curcas*. Separated toxic fraction of jatropha oil and assessed for antifungal and antibacterial activities.

- Identified provenance for high oil content for Jatropha from the clonal germplasm bank.

- Established a trial of 32 provenances has been established.

- Established germblasm bank of Jatropha in different institutes of ICFRE.

xv. ICFRE and Forestry Extension

- Conducted number of workshops/ seminars during the year 2002-2007 where researchers, foresters, NGOs, industrialists, Govt. officials, farmers and other entrepreneurs participated.

- Developed agroforestry models for different agro climatic zones by ICFRE institutes, primarily for the economic gains of farmers were demonstrated with the help of workshops, seminars and trainings.

- Made available biological control measures of forestry pests and diseases to stakeholders through extension activities.

- Envisaged application of biofertilizers to increase productivity of forestry crop through extension mechanisms like brochures, films shows.

- Organized training-cum-demonstration on modern techniques of lac cultivation organised at Raipur (Chhattisgarh), Chandwa (Jharkhand), Katghora (Chhattisgarh) and Malichak (Jharkhand).

- Developed VAM production facility at TRC, Gandhinagar, State Forest Department, and Gujarat.

- Conducted training programme for bamboo artisans at Angamalli Cluster, Kerala.

- Uploaded about 3000 herbarium plant species into the 'Image Analyzer' programme and made available to the entire country through website.

- Developed and published training module for Committee Members and Forest Frontline Workers on Joint Forest Management (JFM), Forest Development Agency (FDA), Watershed, Micro Planning and Monitoring Issues as per the guidelines of the National Afforestation and Eco-Development Board (NAEB), Ministry of Environment and Forests, Govt. of India.

xvi. Patents Registered

- Micro-propagation of bamboos- patent No. 1137/ MUM/ 2000.

- Technology VAC-FRI for Treatment of Green Bamboo- Patent No.19.14/03012/2003.

- Lignin Copper Complex A and B - Patent No. 963/DEL/2004.

- An Apparatus for Post Harvest Treatment and Preservation of Bamboo - Patent No. 425/KOL/2003 on the subject.

3.1.3 ICFRE and Forestry Education

ICFRE, Forest Research Institute (Deemed University) runs Masters and doctoral programmes in various disciplines of forestry at different institutes of ICFRE. In addition, Post Graduate diploma courses on Plantation Technology, Pulp and Paper Technology and Bio-diversity Conservation were also imparted. Three M. Sc. Courses of 2 Years duration-Forestry (Economics & Management) (25 seats) ,Wood Science & Technology (25 seats) and Environment Management (25 seats), two P. G. D Courses of one year duration were run viz. Sixteen recognized research centers across the country were established for conducting the doctoral program. In the Research Degree Programme, 340 research scholars were registered for Ph. D. degree in different disciplines related to forestry and forest products. These included in-service scientists and forest officers as well were inferred on Ph.D.

3.1.4 Grant in Aid to Universities

The ICFRE has been providing Grant-in-Aid for developing technical capabilities and strengthening infrastructure in forestry faculty in the Universities imparting forestry education at graduation and post-graduation level. The component of Grant-in-Aid to these Universities from ICFRE was meager during IX Plan. However, in the X Plan a total outlay of Rs. 20.35 crore has been provided. The ICFRE has set up guidelines and constituted committee to consider the proposals for Grant-in-Aid received from the Universities. A system of monitoring and evaluation for effective and meaningful utilization of Grant-in-Aid has also been put in place. However, since the quantum of

Grant-in-Aid being limited share for each University works out to be less than Rs. One crore during plan period or on an average about Rs. 20 lakhs per annum. The major part of Grant-in-Aid has been utilized for creation of infrastructure such as classroom facility, College labs, hostels, computer center etc. In addition, support is provided for strengthening of library facilities, equipments and conduct of educational study tours. There are, in all, 26 Universities to which Grant-in-Aid is provided.

Forestry Education which was aimed at imparting knowledge on various aspects in forestry to the students took a new dimensions during X Five Year Plan period. The various subjects were classified into basic applied technical and optional at the UG level and more technical, applied and optional at M.Sc. and Ph.D (Forestry Level) to impart more technical skills to the students for meeting the challenges of the forestry sector. New courses like GIS and Remote Sensing in Forestry, Soil Survey & Land use planning, forest ethno-botany, forestry inventory and biometry, introduction to computer technology, dry land horticulture etc. were included along with revision with latest information in forestry in the other regular courses.

3.2   Indian Institute of Forest Management, Bhopal (IIFM)

The IIFM faculty members have completed about 142 research projects (IIFM sponsored 33, NAEB sponsored 70, other externally sponsored 39) up till the academic year 2005-06 and 16 projects are on-going (IIFM sponsored 04, NAEB sponsored 06, externally sponsored 06). As a logical output of research projects, the faculty members have been publishing research articles in various journals, workshops, and various national and international seminar / conference proceedings. The faculty members have published about 371 articles in various journals, have published 16 books, and have contributed 17 book chapters on various topics and themes.

The Institute is also recognized as a research centre for pursuing doctoral research of the Forest Research Institute (Dehra dun), a Deemed University. Four candidates have successfully been awarded Ph.D. degrees by the Fri – DU from IIFM research centre and 15 candidates are pursing their doctoral studies in Forest Management related topics in the Institute.

The faculty members have been developing various types of teaching materials such as teaching cases and technical notes for enriching its academic programmes i.e. Post Graduate Diploma in Forestry Management (PFM), Post-Masters in Natural Resources Management (NRM). These teaching materials also enhance the effectiveness of the Management Development Programmes conducted for Industry, Development Sector, Government sector, Non Government sectors, covering Forestry Policy and

Institutional Aspects, Rural Livelihoods, Community Participation, Micro Finance related topics.

The above academic outputs have been listed year wise starting from the academic year i.e. 2004-05, followed by earlier academic years in the descending order. A brief summary of the research projects undertaken during the academic years 2004-05, 2003-04, 2002-03 and 2001-02 has been presented, while for the remaining years, only the list of the research projects completed in the respective academic year could be included. The order of academic outputs presented in this report is as follows:

At Indian Institute of Forest Management, Bhopal so far 14 batches consisting of 396 students have completed the two year Post Graduate Diploma in Forestry Management (PGDFM). The 15th batch of PGDFM consisting of 42 students has passed out in March 2004 and the 16th batch is underway.

3.3   Directorate of Forest Education (DFE)

- Imparted induction training in the form of "Two years diploma and certificate courses" for newly recruited SFS and Range Forest Officers of the States and UTs.

- Imparted in-service training of SFS and Range Forest Officers through short-term refresher and theme based courses. Such courses been organized during the Plan period.

- Organized capacity building training courses (computer application-basic and advanced and theme based).

- Promotion-linked skill upgradation courses for SFS and Range Forest Officers.

- Organized courses on basic training skills (TOT) for training of front line cadres (forest guards, foresters and deputy range officers) in the forestry schools run by the state governments, which are under the technical control of the Directorate.

- Refresher and theme based courses have started since December 2003 in the constituent colleges under the direct administrative control to further enhance capabilities of the front-line cadres viz., deputy, rangers, foresters and forest guards, as a regular feature from the financial year 2004-05.

3.3.1   Refresher and theme-based courses

In order to update the knowledge and skills of the forestry professionals deployed all over the country, the Directorate conducts general refresher course, theme-based

courses and computer application courses which also include brief exposure to remote sensing and geographical information system applications. The duration of the courses is two weeks for officers of the rank of Divisional Forest Officers and Assistant Conservators of Forest. The courses were conducted in the following areas:

- Computer Application in Forestry (Basic)

- Computer Application in Forestry (Advanced)

- General Refresher Courses

- Joint Forest Management and Sustainable Development

- Biodiversity Conservation and Watershed Management

- Project Formulation and Environmental Impact Assessment

- Policies and Legal Issues and International Conventions

- Special course in forestry for the senior executives of the National Thermal Power Corporation

3.4   Indira Gandhi National Forest Academy

3.4.1   Professional Forestry Training for IFS Probationers and Foreign Trainees

During the X Five Year Plan, IGNFA conducted training for Indian Forest Service Probationers and Foreign Trainee officers. 497 IFS Probationers and 26 Foreign Trainees successfully completed Professional Forestry Training as required under the rules and received the IGNFA Diploma.

3.4.2   Advanced Forest Management Courses

Advanced Forest Management Courses were conducted for senior IFS Officers who are in the 10th, 17th and 21st years of service. During the X Plan period a total of 1396 IFS Officers attended the AFM Course. These courses are aimed at senior IFS officers who are in the 10th, 17th and 21st years of service. These correspond to the executive, supervisory and policy levels respectively. At each level the job requirements are different. The courses were introduced with a view to orient the approach of the officers to suit the job requirements of their respective levels. These courses are a part of the efforts of the MOEF, GOI, to promote changes in approaches and attitudes in Forest Officers in the light of the priorities set in the National Forest Policy, 1988. The emphasis is on emerging trends and recent developments in the field of forestry, both in the national and international perspective.

The basic objective of AFM Course is to help senior officers to refresh their professional approaches to match the requirements of senior positions held by them in view of fast changing national and international scenario and to update their knowledge, sharpening their skills and develop expertise on the recent transformations in the forestry sector. The purpose was also to enhance their administrative capability and to make them more responsive to the needs of the people.

The coverage of the programme included subject areas of Information Technology, computer applications in Forestry, project management, Protected Area management, policy and legal issues, advancement in Forest Management and Research and Human Resource Management issues, etc.

The courses were designed keeping in view the seniority of the participants who have worked as IFS Officers in different capacities as senior DFO, Conservator of Forest or as CCF over the last 9, 16 & 20 years. The selected thrust areas were computer application in Forestry, HRD, JFM, Biodiversity Conservation & Wildlife Management, tree improvement programme, policy & legal issues and Remote Sensing & GIS. The participants are taken to sites for study of participatory planning, implementation and monitoring processes. Visits to the local Institutions like Wildlife Institute of India, Dehradun, Forest Survey of India, Dehradun, ICFRE and Forest Research Institute, Dehradun are also undertaken to make the participants appreciate the contemporary works carried out by these institutions.

Training methodology covered classroom sessions, panel discussion, group work and exercises, hands on computer sessions, simulation games, experience sharing sessions, presentations, self-study, preparation of individual reports, excursions & field visit, audio-visual aids etc.

3.4.3 Skill Upgradation Courses

Professional Skill Upgradation Course for officers inducted into IFS on promotion from SFS was conducted for a total of 128 Officers during the X Plan. Besides direct entry through UPSC examination system, induction into IFS also takes place by promotion of the SFS officers from various states. The Skill Upgradation courses are designed to upgrade the capacity of the officers.

The major objectives of the Skill Upgradation Course are:

- To sensitize and orient the inducted officers to the ethos and functioning of the All India Services.

- To keep them abreast with the rapidly changing scenario of forest management, development and administration.

- Upgradation of knowledge and skills taking into account the latest development in forestry arena.

- To appraise them of the strategies for development and administration in forestry.

3.4.4 Thematic in-service Vertical integration courses

This training is a part of the Government of India's efforts of vertical integration of skills within the Forest Service. Under this pattern, the participants belonging to different levels of seniority in the IFS come together and exchange the experience gained by them on certain identified theme of concern to forestry management and administration. IGNFA integrates capacity enhancing inputs with vertical integration approach to impart thematic training to the participants.

3.4.5 IFS Compulsory In-Service Training Courses

For updating the knowledge and sensitizing the officials on recent concepts in forest management and facilitating vertical integration within forestry infrastructure, the Academy conducts short duration training courses (vertical integration) of one-week duration for middle and senior level IFS officers. They provide a common platform for officers of different levels and seniority for exchanging their ideas on recent developments in their respective states.

3.4.6 Senior Foresters' Workshop

Every year an in-house workshop is organized in which the IFS officers who have completed 25 and 30 years of service are invited to participate, deliberate and share their experiences on emerging issues on forestry and biodiversity conservation. This exercise projects the ground level realities and acts as a realistic feedback which can provide pointers for policy formulation. The forum also provides an opportunity for the young IFS Probationers to interact with the senior officers. A total of 7 Senior Foresters Workshops, 8 Thematic Workshops and 5 IFS Compulsory Training Courses on various topics were also organized during the X Plan.

3.4.7 Syllabus Review of the curricula of IFS Probationers Professional training Course was undertaken.

3.5   Indian Plywood Industries Research and Training Institute (IPIRTI)

Forests play a very significant role for the welfare of not only the present generation but also of the future generations. They are essential component of the environmental conservation efforts and degradation of forests has adverse impact on bio-diversity, water/soil resources, climate, as also on the subsistence living of people living in and around or in close proximity of forests. Many benefits of the forests are not accounted for due to their being non-market, external benefits, or traditional uses taken for granted.

One of the major direct contribution of forests has traditionally been in meeting the need for shelter, one of the three basic human needs, the other two being food and clothing. Wood, bamboo and other natural fibers from forests have been in use in times immemorial in house construction and still wood continues to be the favoured material for housing and construction and other sectors of use.

There is a huge gap between supply and demand for wood, including the gap in respect of industrial wood raw material, which is of the order of 25-30 per cent of the demand. The gap may decrease gradually when the benefits of the intensive efforts now being made to grow trees through agro/social/farm forestry, other plantation and better management of natural forests through innovative practices including JFM approach activities start flowing to the society. Wood is the most eco-friendly and can be sustainably produced to meet the increasing demand of growing population.

The so called wood-substitutes, like metal and plastics, that have been advocated in the recent past in the wake of the perceived need for conservation of natural forests, are high

The Indian Plywood Industries Research and Training Institute (IPIRTI) Bangalore, conducted the post graduate diploma courses in "Technology for Forests Products" and several short-term courses for the industry personnel. The institute also organized three special training courses for senior Indian Forest Service Officers (IFS).

3.6   Forest Survey of India

3.6.1   Forest Type Mapping of India's Forests

Methodology of Forest Type Mapping as per Champion & Seth classification has been finalized and consists two stages. In stage I, Forest Type Reference maps are prepared by using existing information viz inventory records, thematic maps, forest type

maps at 1:2 million prepared by FSI, ground truth information, maps prepared by French Institute, Pondicherry, Indian Institute of Remote Sensing, Dehradun, Wildlife Institute of India, Dehradun and stock maps prepared by State Forest Departments. Entire country is divided into 2½ x 2½ grids and on the basis of above information forest type is assigned to each forest grid. For 226 districts work of Stage- I has been completed. Stage II is the preparation of final Forest Type maps by using satellite data, extensive ground truthing and ancillary data of soil, altitude, aspect, drainage, temperature, rainfall etc.

3.6.2 Status and Change in forest cover in Tiger Reserves of India

In 1993 a study was conducted for assessing the forest cover in Project Tiger Reserves for the periods of 1983 & 1989 for 18 Tiger Reserves by visual interpretation of Landsat data on 1:250,000 scale. With the creation of some more Tiger Reserves, present study has been undertaken to assess status & change in forest cover of 28 Tiger Reserve by digital analysis of IRS-LISS-III data on 1;50,000 scale for the two periods of 1997 and 2002. This study involves three steps *viz*. preliminary interpretation, ground verification and output of final maps with area figures. Preliminary interpretation for all the 28 Tiger Reserves has been completed and ground verification is in progress.

3.6.3 Forest Cover Assessment

The most important mandate of FSI is to assess forest cover of the country on a two year cycle and to publish the information in the form of " State of Forest Report" (SFR). Its first assessment was published as SFR 1987. The latest assessment, ninth in the series i.e. SFR-2003 has been completed and the draft report has been submitted to the Ministry of Environment & Forests for approval. Steady improvements have been made in the forest cover assessments for preparation of each report by employing latest data with higher resolution and scale, with more intensive coverage under ground verification and by using superior techniques of interpretation. In the ninth assessment high resolution (23.5mx23.5m) data of IRS, LISS-III has been used and interpretation has been done on 1;50,000 scale.

3.7 Wildlife Institute of India

S. No.	Activities	No. of Courses/ Programmes etc	No. of Participants
A)	Training and Capacity Building		
a)	Regular Training Programmes for Forestry and Wildlife Personnel	10	184
b)	Short Courses/ Workshops/ Seminars for	104	4795

S. No.	Activities	No. of Courses/ Programmes etc	No. of Participants
	Capacity Building of Managers and Frontline Staffs of various agencies		
c)	M.Sc course in Wildlife Science	3	24
B)	Research	17 (completed)	--
a)	Projects/Programmes	33 (ongoing)	--
b)	Papers/Publication on Research activities	37 (International Peer Reviewed Journals)	--
		43 (National Peer Reviewed Journals)	--
		87 (Technical Reports)	--

3.8 Forestry Research Institutions under the aegis of Indian Council of Agricultural Research (ICAR)

3.8.1 Achievements

i.   Evaluation of Multipurpose Trees and Shrubs (MPTS)

Experiments conducted in many parts of India (Madhya Pradesh, Karnataka, Haryana and Uttar Pradesh) *Acacia nilotica* and *Prosopis juliflora* performed well in saline water logged soils as well as those irrigated with saline water. However, in gypsum treated sodic vertisols species like *Acacia auriculiformis* and *Eucalyptus tereticornis* performed better.

ii.   Tree Improvement

Genetic improvement work was carried out in *Azadirachta indica, Dalbergia sissoo, Anogeissus pendula* and *Pongamia pinnata* based on a wide range of collection from various parts of the country. 10 and 2 superior collections were indentified in *A. indica* and *D. sissoo*, respectively, 5 trees of *A. pendula* and 13 trees of *P. pinnata* were identified in Uttar Pradesh and Maharashtra, respectively.

(iii)   Agroforestry Management

Agri-silvicultrral systems involving MPTS and crops at various locations in the country have shown that selection of proper tree provenance/ alone and crop variety besides correct geometry and pruning management it is possible to optimize yields in rainfed as well as irrigated conditions.

Introductions of fruit trees in association with crop fields or cultivation of crops in the interspaces of established orchards is an area that was found to be quite popular in various agro- ecological of the country. Several Agri-horticulture systems have shown that higher returns to farmers are possible through adoption of such systems.

Several combinations of fruit tree+ forest tree + crops (Agri- silvi- horti System) have shown prospects of a variety of products from the same piece of land. Such systems are better equipped to face the challenges of drought as well.

A comprehensive agroforestry data base containing information on four independent modules viz., MPTS, Research Projects, Economic Analysis, Agroforestry Interventions/ Innovations has been designed and developed. This data base is expected to serve a very useful purpose for administrators and planners. There is plenty of scope to include more information and expand its scope.

(iv)   Silvipastoral Managememt

Designs of silvipastoral and hortipastoral systems for arid, semiarid and humid regions were standardized. In semiarid regions under silvipastoral systems increase in tree crown area led to decline in 4x3 m and 4x4 m spacing where as in 4x6 m spacing no such trend was observed.

In semiarid regions, studies on productivity and patterns of nutrient turn over in silvipastoral systems indicated highest nutrient accumulation in *Albizia amara* based systems followed by *Acacia tortilis* and *Hardwickia binata*. Similarly nutrient recycling through litter was highest in *Albizia amara* based systems.

In semiarid regions, silvipastoral systems for small, medium and large farm holdings were designed based on land holding and farmers forage needs and likely management , intensive to extensive.

Scientific lopping management in respect of selected fodder trees were standardized in respect of intensity and interval with a view to optimize forage yields. Especially during lean periods besides opening of the canopy for pasture growth.

(v)   Grassland Ecology & Grassland Management

In arid regions, pasture improvement through introduction of improved perennial grasses, sbrubs and fodder trees supported more number of animal days, especially during drought, when compared to the protected natural pasture.

In semiarid regions, re- vegetation of ravine lands through introduction of grasses and legumes and some trees like *Acacia nilotica*, *Azadirachta indica* and *Ficus rumphii* led to forage production in the range of 2.2-8.9 t/ha depending of the habitat and reduced soil erosion from 1.496 t/ha to 0.152 t/ha.

Grassland projects on Community Property Resources (CPR) and Joint Forest Management (JFM) concluded that promotion of local primary succession grass species along with some promising and tested pasture species and top feeds like *Leucaena leucocephala* increase livelihood options, especially of women, on account of increased choice of livestock production systems.

B.   SALIENT ACHIEVEMENTS IN ENVIRONMENT SECTOR

3.9   Plan Scheme entitled 'Environment Education, Awareness and Training' was continued during 10th Five Year Plan. The scheme aims at enhancing the understanding of people at all levels about the relationship between human beings and the environment and to develop capabilities/skills to improve and protect the environment. The scheme strives:

- to develop educational/teaching materials and aids in the formal education sector;

- to encourage non-governmental organizations, mass media and other concerned organizations for promoting environmental awareness among the people at all level;

- to promote environment education through existing educational/scientific /research institutions;

- to ensure training and man-power development in environment education; and

- to mobilize people's awareness for preservation and conservation of environment.

The major programmes under this scheme are mentioned below:

3.9.1   National Green Corps Programme

The National Green Corps (NGC) Programme is being implemented all over the country, with underlined objective of spreading environmental awareness amongst school

children. This goal is furthered by establishment of eco-clubs in each district of the country with the focus on action oriented environment programme through the active involvement of the students. Though State Govts./UTs are at liberty to set up any number of eco-club in a district but the financial assistance under the programme is restricted to 250 eco-clubs per district @ Rs. 2,500/- per annum. Apart from stimulating awareness among the school children through physical programme of activities about the environmental conservation and protection issues the programme visualizes the role of children as agent of change and for dissemination of environmental information among public at large.

3.9.2 National Environment Awareness Campaign (NEAC)

The NEAC was launched with the objective of creating environmental awareness at the national level. In this campaign, nominal financial assistance is provided to NGOs, schools, colleges, universities, research institutions, women and youth organisations, army units, government departments etc. from all over the country for organising conducting awareness raising activities. The activities could be seminars, workshops, training programmes, camps, padyatras, rallies, public meetings, exhibitions, essay/debate/painting/poster competitions, folk dances and songs, street theatre, puppet shows, preparation and distribution of environmental education resource materials etc., followed by action like plantation of trees, management of household waste etc. Diverse target groups encompassing students, youths, teachers, tribal, farmers, other rural population, professionals and the general public are covered under NEAC. The programme is implemented through designated Regional Resource Agencies (RRAs) appointed for specific States/Regions of the country.

3.9.3 Seminar/Symposia /Workshops

This programme provides a platform to scientists/environmentalists/ University professionals/ technocrats, etc, to share their knowledge on various subjects related to environment. The Ministry provides financial assistance to the Universities/other institutions/NGOs to organise the events (seminars /symposia/workshops/conferences) and to publish the proceedings. The scheme facilitates the transfer of technical know-how to different people including local population.

3.9.4 Mass Awareness

The broad objectives of the programme is to bring about an attitudinal and behavioural change amongst people by spreading awareness about environmental issues and projecting in a positive manner government's environmental policies and regulations,

so that people, specially the youth, can adopt sustainable life styles and voluntarily follow environmental regulations. These objectives are sought to be achieved through the electronic and print media, the film and theatre media, etc.

3.9.5   Grants- in- aid to Professional Societies

The underlying objective of the programme is to encourage the expertise available with the professional societies and institutions and to help augment the capabilities in the identified areas by developing programmes and activities in the areas of environmental education, ecology and wildlife.

The major objective of the scheme was to provide one time grant to professional societies and institutions to develop their activities and projects in the field of environment with an ultimate objective of enhancing their capabilities in the various activities relating to protection of environment and conservation of natural resources. The grant is not available for construction, office equipment, goods and services which are not related or do not facilitate environment education. The grant under the programme is also not given for research, collection and compilation of data/information or to any individual/ business houses.

3.9.6   Publications

Under this programme subscription to professional, scientific and technical journals to update the knowledge base of officers and staff of the Ministry is funded. Publication of resource material for benefit of eco-clubs is also supported.

3.9.7   GLOBE

The Global Learning and Observations to Benefit the Environment (GLOBE) Programme – an international Science and Education programme – provides a unique opportunity to its students to carry out various measurements so that they can learn about scientific protocols and perform environmental learning activities, which have already been introduced as theory in the textbooks. The GLOBE programme not only helps the students to appreciate the contents of the textbooks through better understanding but also assists them in gaining complete knowledge of environment.

It facilitates research through a worldwide research team comprising of students, teachers and scientists.

3.9.8   Other Awareness Programmes

Even though financial assistance is provided for awareness programmes under the NEAC which are usually held within a specific time frame and are short-term projects restricted to a specific area, other proposals for creating awareness among diverse target groups are also received throughout the year from various NGOs and other agencies. These are considered on merit as and when received and supported. Few examples of these are:

- An international written Environment Quiz programme known as Green Olympiad followed by a televised Quiz programme TERRA-QUIZ.

- Written environmental quiz programs in different regional languages. The winners of written quiz participate in a televised quiz programme.

- Awareness activities / events by NGOs, academic institutions etc. on the occasion of special environmentally significant days like Earth Day, World Environment Day etc.

- Organisation of an annual Vacation Program on Environmental Resources for high school level students namely "Vacation programme on Natural Resources Building a Broader constituency of support for conservation" by ATREE.

3.9.9   Environment Appreciation Courses

In order to provide interested persons an opportunity to learn in detail about specific environmental issues, the Ministry provides a course module through IGNOU for Environmental Appreciation Courses. Delivery of these courses is through distance education mode. The course module developed for appreciation courses is also used by the IGNOU as compulsory component of its undergraduate courses. This is in pursuance of the directives of the Hon'ble Supreme Court of India.

3.9.10   Formal Environment Education in Schools

Since the adoption of the National Policy on Education 1986, Environment Education (EE) has received a sharper focus in the school curriculum framework. Though Formal Education is the mandate of the Ministry of Human Resource Development (MHRD), the Ministry of Environment & Forests interacts with the MHRD, NCERT, and State Departments of Education etc. to ensure that environmental components are adequately covered at the school level. The Ministry also interacts with the UGC to ensure coverage of these components at the college level education.

3.9.11 Strengthening Environment Education in Professional Education

As part of its efforts to strengthen EE in professional education, the MoEF launched an initiative during 10th Five Year Plan to integrate environmental concepts and issues in the Management Education Syllabi of various professional Management courses. The initiative inter alia includes examination of course contents, development of new curricula and resource base for teaching material besides sensitising the faculty of management colleges towards environmental issues. The programme includes preparation of an inventory of the courses offered in India and abroad and that of resource material.

3.10 Achievements of National Council of Education, Research and Training (NCERT)

- Continuing the practice of teaching Environmental Studies (EE) as EVS (science) and EVS (social studies) at the primary stage.

- The curriculum of general education for the upper primary and secondary stages, developed following the directives and guidelines provided in the National Curriculum Framework (NCF), has been quite wide-ranging on all aspects of the environment although EE was not perceived as a separate subject.

- Development of training modules for pre-service training by District Institutes of Education and Training (DIET) (one each for the northern, southern, eastern and western regions of the country).

- In-service training of key resource persons and teachers.

- Dissemination about EE through NCERT journals, e.g. *School Science.*

3.11 Initiatives at the State/UT levels

Along with their own initiatives, the States/UTs have either adopted or adapted the syllabi and instructional material of NCERT. An analysis of syllabi and textbooks prescribed in different States/UTs for the primary and upper primary stages in the mid 1990s revealed that there were many content areas pertaining to EE that were common to all of them.

3.12 Initiatives by Other Agencies

A number of other agencies, both governmental and non-governmental, have also been engaged in EE. These programmes pertain to both curricular and co-curricular

interventions in school education. Notable among the governmental agencies are the Union Ministry of Human Resource Development (MHRD), Union Ministry of Environment and Forestry (MoEF), Department of Science and Technology (DST), Government of India, and their counterparts in the States. Some of the major initiatives include:

- 'Scheme of Environmental Orientation to School Education' launched by MHRD in 1988.

- Establishment of institutes offering pre- and in-service courses at different levels by MoEF.

- Establishment of the National Museum of Natural History (NMNH) and its regional centres (MoEF).

- Environment Education in the School System (EESS), a sub-component of the India Environmental Management Capacity-Building Project undertaken by MoEF and supported by the World Bank, with the Centre for Environment Education (CEE) as the consultant.

- National Green Corps aims to establish 150 eco clubs in each district of the country (MoEF).

- Establishment of Centres of Excellence by MoEF.

3.13 G.B. Pant Institute of Himalayan Environment and Development

The GBPIHED has many achievements during the Tenth Plan ranging from Restoration & Rehabilitation, Impact Mitigation, Capacity Building & Awareness to those related to Biodiversity Conservation and Biotechnological application and Indigenous Knowledge documentation and database.

All research and developmental activities of the Institute are essentially multi-disciplinary in nature, and are based on a conscious effort to interlink natural and social sciences to promote sustainable development of the Indian Himalayan Region by preserving the fragile ecosystems, indigenous knowledge and customs in complete harmony with the perceptions of the local inhabitants. The project sites are selected carefully, keeping in mind the heterogeneous heritage of the region and its specific needs. The thrust of research and development efforts is to provide solutions to location specific problems through time bound projects. The present efforts are implemented through seven Core Programs, viz.,

- Land and Water Resource Management,

- Sustainable Development of Rural Ecosystems,

- Conservation of Biological Diversity,

- Ecological Economics and Environmental Impact Analysis,

- Institutional Networking and Human Investment,

- Environmental Physiology and Biotechnology, and

- Indigenous Knowledge Systems.

C.   ACHIEVEMENTS IN INFORMATION MANAGEMENT

3.14 National Environmental Information System (ENVIS)

The Ministry of Environment & Forests has set up a National Environmental Information System (ENVIS) as a decentralized network for collecting, collating, storing, retrieving and disseminating information in the field of environment and its associated areas. ENVIS is a comprehensive environmental information system network designed, developed and implemented from the end of Sixth Five Year Plan period. It is a decentralized information network of databases consist of a Focal Point located in the Ministry and supported by a chain of network partners, known as ENVIS Centres located in the potential institutions/organizations/ universities/research laboratories/ voluntary organizations throughout the country.

At present, the ENVIS network consist of 75 network partners out of which 45 ENVIS Centres are on specific subject-areas on environment like control of air and water pollution, toxic chemicals, hazardous substances management, floral diversity, faunal diversity, avian ecology, solid waste management, etc. and the remaining 30 are located in the various State Government departments dealing with the "Status of Environment Related Issues" concerning the respective States. All the Centres are engaged in information collection, collation, storage, retrieval and dissemination to all concerned. The information repository is built up in the National Focal Point in order to disseminate the requisite information to policy planners, decision makers, researchers, scientists, environmentalists, parliamentarians, students and the general public. ENVIS also acts a major repository of information to provide the requisite information for all queries related to RTI Act, 2005 received in this Ministry.

In order to meet these objectives, ENVIS has been gradually expanded to cover the various environmental disciplines to meet the information requirement of both national and international users. The State ENVIS Centres have been provided the requisite database namely, Indian State Basic Environmental Information Database

(ISBEID) covering 23 modules so that the State Centres could provide the necessary information to their respective agencies with an objective of developing a State of Environment Report (SOER) of the concerned States.

The Ministry of Environment & Forests, apart from the ENVIS programme, mentioned in above is also implementing a Sustainable Development Networking Programme (SDNP) as an externally aided project, to provide information on various thematic areas ranging from pollution, biodiversity, wildlife conservation to agriculture, biotechnology, poverty and climate-change. The SDNP also disseminates knowledge on sustainable development and acts as a distributing clearing house of information and functions in close association with ENVIS.

The ENVIS and SDNP networks located in the Ministry of Environment and Forests have set up nodes in various private sector organizations for collecting information on several thematic areas related to environment. Within the ambit of the Technology Information Forecasting and Assessment Council (TIFAC), an autonomous body set up by the Government, support has been provided to establish databases on energy and environmental technologies at the Tata Energy Research Institute (TERI), New Delhi and the National Chemical Laboratory (NCL), Pune respectively. The National Environmental Engineering Research Institute (NEERI), Nagpur has a project on the preparation of an information package on cleaner technologies of industrial production. The experience gained in the establishment of information networks and databases, including manpower training and skills development to handle these systems, is an important strength.

Some of the studies completed with TIFAC support include areas like human settlements, industrial raw water treatment, industrial waste water treatment, water treatment technologies, technologies for disposal of thermal power station fly ash, energy conservation technologies (cement industry), energy saving technologies, biotechnology for waste water treatment, and technologies for the treatment of molasses from distillery effluents.

Chapter 4
EMERGING MAJOR CHALLENGES AND VISION FOR FUTURE

A. FORESTRY RESEARCH

4.1 Compatibility with Overarching National Priorities

Forestry research has traditionally been following an isolated path insulated from the topical national developmental priorities. This approach has resulted in relegation of the subject of forestry in general and that of forestry research in particular to a much lower level of importance in the matter of allocation of resources. This alienation needs to be stopped, and forestry research brought within the ambit of, and in consonance with the National Developmental Priorities.

Forestry research needs to reorient itself to fit into the national priorities, e.g., poverty alleviation, literacy and drinking water supply. This would mean focus on farmers and communities to enable them produce more from their landholdings, and consequently earn more. The research would, thus, need to be focused on integrating planting of trees and other non-traditional herbs and shrubs with the traditional agricultural crops with overall aim of increasing useful biomass production.

4.2 Shift from Traditional Research Approach to Community Welfare

Hitherto research has been strongly inclined towards traditional forestry within the confines of silviculture of well known timber or NTFP species. This approach manifested in research and studies on regeneration problems, spacing, tending, thinning, increment, planting and nursery techniques of well known forestry species or their produce like teak, sal, deodar, tendu leaves, resin, rosin and gums etc. This trend, however, was not helpful in making the community realize the importance of forestry in improving their livelihoods. As a result, people at large, and local community have developed apathy towards forests being perceived as of no use to them, rather having obstructive value to the local development projects.

Forestry research needs to move from the boundary of traditional silviculture to the realm of community welfare by focusing more on subjects, practices and problems

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that directly affect the economic well being of the local community. This would mean initiating and giving impetus by application of forestry science, to the research related to increasing productivity of private and community landholdings, removing or rationalizing barriers to the marketing and utilization of tree/forest produce, and developing management models of JFM based on the experience gained.

4.3   Increased Focus on Environmental Services

Although forests provide wide range of goods and services to the human society such as, wood, water, medicinal plants, recreation, soil amelioration, biodiversity and carbon sequestration, research, however, focused mainly on different aspects of goods being provided by the forests. No worthwhile research was commissioned on the property and ability of forests to generate environmental services. This is despite the increasing realization that most of these services are essential and invaluable for the very existence of mankind. This has resulted in undermining the economic contribution of the forests in the general economic and social well being of the citizens of the country. Even today, the contribution of these services is not recognized in the balance sheet of the national economy.

These services include watershed protection, biodiversity conservation and carbon sequestration. People are becoming aware of the implications and costs of allowing these services to go unrecognized, and consequently get degraded or lost. Forest degradation and loss of vegetation can have local impacts, such as floods and landslides, as well as broader impacts, such as global climate change. This growing awareness is drawing attention to the economic benefits of healthy forest ecosystems, benefits that until recently have often been taken for granted. This growing awareness about the positive role of forests needs to be matched by commissioning of appropriate research for quantification and valuation of the forests. Research also needs to be initiated to develop a recognized system and set of processes and procedures for proper valuation of the services from forests to enable proper accounting of such services in the national economy. Valuation exercise must encompass the spectrum of forest types, soils, topography and other related parameters, and different combinations thereof.

4.4   Global Competitiveness in Productivity

Productivity of our forests is one of the lowest in the world. Even the output of plantations under farm forestry and agroforestry is not high to match the productivity figures in other countries. Major reason for low productivity is the non-availability of quality planting material. So far this issue was being addressed on the technological front but without much success.

There is need to develop legislative framework to regulate the availability of good quality planting material in the market on the lines of Seed Act of the agriculture sector. The legislative framework would need to be supplemented by research on development of cost effective protocols and technologies for mass propagation of planting stock.

4.5   Simple, Adaptable Technologies

Forestry research undertaken so far can be termed as hardcore research without much use to the farming community. Because of this, there is hardly any appreciation for the research by the local community. All the same, potential of forestry science for providing alternate or supplementary sources of income to the rural community should not be underestimated.

There is need to channelize forestry research into development of simple technological packages that could easily be adopted by the farming community for supplementing its income. The packages could relate to establishment of nursery for raising quality planting stock, incorporating tree component with agricultural crops, soil improvement, value addition to NTFP, legislative and regulatory measures to promote tree planting on private lands etc.

4.6   Regulatory Reforms

Main regulatory framework of forestry sector comprises National Forest Policy, 1988; Indian Forest Act, 1927; Forest (Conservation) Act, 1980; Wildlife (Protection) Act, 1972; and Biodiversity Act, 2002. Present policy and legislative prescriptions need to be reviewed, analyzed, researched and adjusted to suit the changing developmental perspectives and scientific knowledge. This analysis can also be used to develop synergies between different statutes and to remove obsolescence, as also to decide upon the degree of decentralization of the particular statute. Research studies may also be launched to streamline the processes and procedures for statutory forestry clearances.

4.7   Wildlife Research

4 .7.1 Participatory Approach

Wildlife management has, by and large, evolved in isolation, insulated from the local community. This has inculcated an attitude of apathy and at times of negative disposition on part of the local community towards the protection of wildlife. Even the statutes governing establishment and management of protected areas (PAs) have not been of any help as these turn the communities residing within the declared premises of the PAs as illegal occupants to be shifted outside the PAs. These communities who suddenly

become *persona non grata* lose any interest, if any they had, in the protection of wildlife. There have been innumerable instances of such people colluding with poachers and smugglers of wildlife to earn money.

There is need to orient the philosophy of wildlife management in the country as it would be extremely difficult to ensure protection to wildlife without involvement of the local community, and without recognizing them as the important stakeholder. Research needs to be initiated to develop participatory models involving local communities for protection of, and discharging assigned responsibility for management of PAs. Participation should be based on the principle of sharing of income with the local community. Eco-tourism that promotes income generation in favour of the local community needs to be encouraged.

4 .7.2 Balance between Environment and Development

Present approach of summarily rejecting developmental projects in the PAs has led to discontent in the local community, and in some government quarters as well. Research is required to review and analyze policy options to ensure protection and management of PAs without hindering the local development.

4 .7.3 Conservation and Propagation of Animals and Plants

Plant and animal species have been included in the Schedules of Wildlife (Protection) Act, 1972 without considering the hard data about their populations and population dynamics. This has affected the traditional use and economic benefits to the local community resulting in hardship.

Research needs to be undertaken to develop and standardize norms for inclusion and exclusion of animal and plant species in the Schedules. Schedules should be reviewed at regular intervals to determine status of species for the purpose of their inclusion in and exclusion from the Schedules. Also, research based scientific norms should be developed for identification of animal species for propagation through captive breeding.

4.8   Biodiversity Research

Till recently, there has not been any worthwhile research on various aspects affecting the biodiversity of an area. No systematic attempts have been made to document biodiversity at local, regional or national level.

Research needs to be initiated to study impacts of development like construction of roads, railways, dams, and mining activities in areas rich in biodiversity. Also, a systematic programme should be launched to document Phytodiversity including angiosperms, gymnosperms, bryophytes, fungi etc. in a phased manner.

Forestry Education

4.9   Linkages of ICFRE and ICAR

Agricultural universities supported by ICAR are running graduate and post-graduate courses in forestry. Funding from the ICFRE supports infrastructure development of forest faculty in these universities. However, the linkages between ICFRE and ICAR are non-existent in the matter of development of appropriate curricula and regular quality control, monitoring and upgrading of courses.

There is need to establish and institutionalize linkages between the two Councils for continuous monitoring and evaluation of the forestry courses. This can be done by constituting coordination mechanism having representation of both the sides for the purpose.

4.10   Harmonization and Integration of Courses with Developmental Priorities

Presently, the courses run in the universities and other organizations are not oriented to take care of the responsibilities expected to be discharged by the successful candidates. Many a time the students and trainees find their education of no practical use while dealing with field situation or working in the field. Most often, it is found that their training or education is not geared to address issues contributing to achievement of national development priorities like poverty alleviation. This results in isolation of the forestry professional from the mainstream development process.

As in case of forestry research, the forestry courses in universities and in the central government organizations must bear relevance to the job requirement of the students and trainees. Also, the compatibility of the courses with the national developmental priorities like poverty alleviation is of utmost importance. The academic and professional courses and trainings need to be remodeled and revised taking into consideration this essentiality.

4 .11   Need based Specialization

Present system does not provide for formulating and imparting need based training programmes for different target groups. This results in permanence of wasted efficiency and efforts.

Mechanism needs to be evolved and institutionalized for catering to such specific training needs. Such system has the potential of attracting even foreign candidates and thus help in augmenting financial resources of the academic institution or training organization.

Forestry Extension

4.12   Lab to Land: Effective Dissemination

Extension has been the weakest link in the system of forestry research. No effective mechanism exists that could disseminate the adaptable research findings to the user groups including farming community. Fine-tuning of research to suit the local needs could not be pursued due to absence of a proper dissemination mechanism including trained and skilled extension staff.

Subject of extension should receive one of the highest priorities in the 11th Plan. Mechanism on the lines of the Krishi Vigyan Kendra needs to be evolved and put in place to facilitate lab to land transfer of research, and also its fine-tuning in on the basis of regular feedback received from the research users mainly farmers. Capacity building of staff at grass root level needs to be ensured and institutionalized to raise a cadre of effective extension workers.

4.13   Strong and Extensive Coverage

Extensive coverage cannot be thought of at present due to absence of a proper extension mechanism in the first place. Coverage of extension system is as important as its initiation. To cater to the adaptation potential of the vast rural community, it will be imperative to have an extension mechanism that has extensive as well as effective reach. This would require a structured programme of capacity building of the existing staff of the ICFRE institutes and centres, state forest research institutes, forest department officials and village level workers of other sister departments like agriculture, horticulture, animal husbandry, rural development and tribal welfare etc.

Environment Research

4 .14   Freshwater Resources

Research to evaluate the impacts of pollution and climate change on freshwater resources is in nascent stage. Systematic research needs to be commissioned to evaluate the impacts of climate change on glaciers and river flows. Research based integrated approaches need to be developed for management of river basins taking into account the upstream and downstream seasonal inflows and withdrawals, land and water interface, pollution loads, and natural regenerating capacities of the rivers. Research is also required to study and mitigate the impacts of river valley projects, power plants and industries on riverine and estuarine flora and fauna.

4.15   Regulatory Reforms

Regulatory framework for environment sector comprises National Environment Policy, 2006; Environmental Protection Act, 1986; Water (Prevention and Control of Pollution) Act, 1974; Water Cess Act, 1977; Air (Prevention and Control of Pollution) Act, 1981; and Biodiversity Act, 2002. There is need for continuous review of the regulatory framework with a view to making adjustments in it with changing times.

The present policy and legislative prescriptions need to be analyzed, researched and adjusted to be in tune with the changing developmental perspectives and scientific knowledge. Such analysis will also be used to develop synergies between different statutes and to remove obsolescence, as also to decide upon the degree of decentralization of the particular statute. Research studies may also be launched to streamline the processes and procedures for statutory environmental clearances.

Also, Coastal Regulation Zone (CRZ) Notification needs to be reviewed and analyzed with a view to making the underlying approach holistic to provide protection to the composite coastal ecological system.

4.16   Living Modified Organisms (LMOs)

Apprehensions have been raised time and again about the negative impacts of introduction on LMOs. Research studies need to be commissioned to ascertain risks posed by LMOs to the ecological resources with a view to defining safe processes and procedures for introduction of LMOs.

4.17   Land Degradation

Scientific substantiation and validation of traditional land use practices need to be done on priority followed by effective demonstration and extension projects with the overall aim of arresting degradation of soils and improving productivity of desert ecosystems.

Research needs to be initiated to develop workable multi-stakeholder partnership for adoption of science-based, traditional and sustainable land use practices with a view to optimizing production. Research based modules for increasing green cover in desert ecosystems incorporating the traditional knowledge need to be developed.

4.18   Mountain Ecosystems

Mountain ecosystems being one of the most fragile ecosystems, have traditionally suffered due to deforestation, unplanned urbanization, pollution of freshwater sources, and inadequate sanitation infrastructure. Research studies are required to be commissioned to develop best practices norms for infrastructure development, housing, other developmental activities, and for participation of local community in ecotourism activities.

4.19   Pollution Abatement

Pollution increases because of rising energy demand by individual consumers, and the industry. The problem needs to be tackled on technological as well as legislative fronts. Policy research needs to be initiated to effect statutory reforms to incentivize the use of renewable energy technologies, decentralization of energy generation and distribution, and use of bio-diesel to gradually replace fossil fuel. Research also needs to be accelerated to develop technology for reducing transmission losses, and bringing down cost of solar photovoltaic cells. Research studies need to be initiated to indicate regulatory shortcomings and to recommend efficient pricing of fossil fuel based energy. Research and development is also required for development of low cost technologies for sewage treatment. Research based models of sewage treatment, and solid waste disposal to be financed and managed by local community should be developed.

Environment Education

4.20   Need For A Paradigm Shift

4.20.1   Despite many major initiatives, there is still very inadequate exposure of the students to their 'habitat' there is little active learning from the natural and social worlds

around them. The prescribed activities may simply be routinely taught as set material to be memorised through teaching in the classroom instead of being pursued by students on their own with an open mind. Activity-based projects may again be carried out in a routine fashion, sometimes with improper involvement of parents or even commercial agencies. It is clear that we need to recognise and address the challenges posed by these shortcomings as we attempt to forge ahead. This would be difficult to accomplish within the constraints posed by the current framework. Instead, we need to shift to a new paradigm.

4.20.2 The main focus of EE should be to expose students to the real-life world, natural and social, in which they live; to enable them to analyse, evaluate, and draw inferences about problems and concerns related to the environment; to add, where possible, to our understanding of environmental issues; and to promote positive environmental actions in order to facilitate the move towards sustainable development. To achieve these goals, the curriculum may be based on:

- Learning about the environment;

- Learning through the environment;

- Learning for the environment.

These objectives assume great significance as humanity increasingly realises, after a long journey from Stockholm through Rio de Janeiro to Johannesburg, that a development paradigm that largely ignores the environment has disastrous consequences. In a world entering the new Information Age, education is becoming increasingly central to the development process. It has to help raise awareness, and build the capacity of communities to elaborate a vision and participate in the pursuit of environmentally and socially sustainable development. It must draw upon the new tools of Information & Communication Technology (ICT) to do so. Truly meaningful EE is, then, a crucial activity that must lead the way for a paradigm shift in education to promote the pursuit of sustainable development.

4.20.3 Presently environment education is being imparted at school and college level. However, at both the levels, there is general lack of adequately trained teaching staff as also of effective teaching aids and material. Field training required for graduate and post-graduate levels as per UGC norms is difficult to arrange for want of adequate resources. It is proposed to create a network of Nature Awareness Areas and Interpretation Centres to address this lacuna. State level infrastructure would require strengthening to institutionalize mass awareness. Capacity building of individuals and state based resource

agencies would be essential to ensure efficient functioning of the awareness apparatus in the states.

F.   Training and Capacity Building

4.21   Forestry sector, like any other sector, requires new technologies and management tools to keep pace with the developments at the local, national, regional and global levels. With the shift towards sustainable development and participatory mode of forest management, the forestry has been undergoing fundamental changes in recent times. There is an increasing emphasis on conservation practices and collaborative management by involving the stakeholder communities and individuals. On the other hand, there is pressure for increasing the productivity of wood and other Non-Timber Forest Products (NTFPs) using modern technical inputs. Issues like biological record keeping, environmental impact indicators, biodiversity valuation principles, trade and intellectual property rights, biopiracy, gene pool management, protected area effectiveness, environmental economics, environmental valuation techniques, forest certification, monitoring indicators, carbon sequestration, sustainable development of forests and people, participatory natural resource management, new techniques for raising productivity of forests, bio-economic modeling, valuation of eco-system services, are gaining importance in the forestry sector. Though some of these issues are addressed in regular in-service courses offered by the training institutions and other organizations, there is need to further consolidate and streamline the capacity building regime to adequately address the emerging issues to achieve excellence in forestry sector.

4.22 The traditional approach to forest management demands adequate mix of many aspects of modern scientific management practices such as nursery techniques, seedling demand analysis, nutrient analysis, tree growth modeling, monitoring systems for afforestation, application of geographical information systems, impact assessment methodology, holistic approach to watershed management, soil and water conservation techniques in watersheds, low impact harvest technology, controlled burning using fire modeling, wood technology, international trade in wood products, cross border marketing of NTFPs including medicinal plants, forest research methodologies, protected area management, process documentation, forest management information system etc. The present-day foresters have to deal with a number of non-technical issues also, e.g., inter-sectoral policy and programme linkages, social mapping, community mobilization, forests as tool for rural development including income generation, micro-credit, micro-enterprise management, alternate energy technology, quality control skills, inventory management, accounting and fund management skills.

4.23 Hence, to build capacity of the forestry personnel at different levels enabling them to deal with the emerging issues efficiently, it will be imperative to pool forestry resources and establish linkages with other training and academic institutions not only from within the country but also with international organisations. The forestry training institutions in the country have been taking due care of the above mentioned issues while imparting training to the forestry personnel. However, every training institution has limited capabilities. The resources available to support forestry training are generally insufficient to sustain the requisite expanse and quality of training. It is important that the forestry personnel are provided opportunities to present their views at the international events related to forestry and environment. This will help in capacity building of not only the officer as an individual but also the forestry sector as a whole. Exchange of faculty among the forestry training institutions and other academic institutions including IIMs, sponsoring/organizing Training of Trainer (TOT) courses for the faculty of forestry training institutions, and encouraging forest officers to undertake higher studies in the institutions within the country and abroad, would be a right step for capacity development of the forestry sector. Creating awareness among the industrial houses about the conservation ethos and clean environment with a view to attracting their attention for investment in forestry projects will also help in achieving the goal of sustainable development of the people.

Information Management

4.24 We are today living in the age of technology. The internet provides a global path way for information exchange, and literally any information is available at the click of a button. Yet, for many of us, the computer still remains more of a decoration piece and a status symbol. We have yet not made adequate and effective use of the entire capabilities of computers and have not totally capitalized on the IT revolution. It would not be wrong to state that forestry, for the most part, still relies upon age old dependence on manual procedures and the human resource available. Forest inventory, growth and yield statistics, forest extent, species diversity and the like continue to be documented manually, as a result of which the activities are not just effort and time consuming but also subject to human error. Use of available and developing technology can help to a large extent in rapid assessment of forest resources as well as generating and updating the information and data that is the very basis for good planning. Geographic Information System (GIS) is an effective technology for storage, analysis and retrieval of spatial, temporal and tabular data for natural resources, yet a lot needs to be done by the State Forest Departments (SFD) in this area.

4.25 Substantial amount of information and data relating to the forestry sector have been generated over the last century and more, yet these are not readily available to anybody seeking them. Information exists and is available with SFDs, Institutions and universities, or even in the form of traditional knowledge in the minds of tribal and forest dwellers, but it needs to be brought together in a central repository if it is to be of any use for research, education or planning. So far not much emphasis has been placed on information compilation and dissemination. Today, with the importance being given to the citizens' right to information, it has become mandatory for the forestry sector to create a central repository of forestry data and to use existing and future IT capabilities to link various existing sources of forestry information, an aspect that is one of the focus areas in this report.

Development of the forestry sector is intrinsically linked with the availability of data on forestry resources as data or information is the key to planning process. In the case of the forestry and environment sector all policy issues, planning and development activities are formulated on the basis of available data.

4.26 Even though forestry in the country is around 150 years old, the availability of data is very fragmented. It is true that over the years, a wealth of data has been generated regarding the forest resource available in various parts of the country. Apart from data regarding the species diversity, the extent of different types of forests, their legal and ecological status, data also exists regarding the growth of trees, volume and yield, nursery and regeneration practices *etc*. Policies have been framed, Acts and Rules notified, and management plans, maps *etc* have been generated over a period of time. These are all available with the individual Forest Departments, as well as with the Ministry of Environment and Forests.

4.27 Most of the information on forest resources is linked to maps or spatial data. However, there are many data/information which will be statistical in nature like data pertaining to afforestation, harvesting, diversion of forest lands for various purposes, employment, forest dependence, various forest products, status of wild flora and fauna, budgetary data, and the like. This information too needs to be compiled and collated in a central repository, from where it can be availed of by interested planners, researchers and students. The database, which is needed, therefore, has to be essentially a spatial database with GIS capabilities and also having capability of processing and analyzing non spatial or statistical data. Organization and structuring of data which is available with a large number of institutions, State Forest Departments, NGOs etc would be the most challenging task in creation of the database. A mechanism will have to be evolved for regular updating and entry of data at different levels. Considering the complexity of the issue and technicality involved in creation and management of the desired kind of

information management system, obviously the task will have to assigned to an expert organization having capability in such a field. Adequate resources in terms of manpower and funds would be essentially required for the endeavour.

4.28   In so far as environmental matters are concerned, the Ministry of Environment & Forests is the nodal agency for decision-making on environment-related matters at the national level as well as for dissemination of information to the users in its allotted field. The Ministry of Environment & Forests has set up a National Environmental Information System (ENVIS) as a decentralized network for collecting, collating, storing, retrieving and disseminating information in the field of environment and its associated areas.

Since environment for sustainable development is a broad-ranging, multi-disciplinary subject, a comprehensive information system on environment has necessitated effective participation of institutions/ organisations in the country that are actively engaged in work relating to different subject areas of environment.

4.29   Data Gaps in Forestry

Though scientific forest management in India for the last 150 years has yielded considerable data on the forest resources of the country, the gaps in the database are still significant. The high diversity of forest types in the country and the vastness and spread of the forest resource are primarily responsible for this gap. As a result, the value of forest resources and its contribution to the country's GDP is poorly understood and grossly undervalued. Many important information on forestry resources for planners and policy makers are still not available. Some of them are availability of precise data of timber resources in the country for wood supply, accurate data on plantations (both young and old), data on availability of Non-timber Forest Produce (NTFP) including medicinal plants, carbon stock in forest & forest soil, accurate and precise data on forest fire, grazing, regeneration, fuel wood availability and demand, impact of forestry on livelihoods specially in JFM areas etc. In absence of these information, it is very difficult for planners to make any short/long term strategy for conservation and sustainable development of forestry resources. Besides lack of proper data on tangible benefits from forests, benefits occurring from intangible data of forest resources have not been estimated and assessed which is reflected in the grossly undervalued contribution of forestry sector to the nation's GDP.

4.30   Substantial amounts of information and data relating to the forestry sector have been generated over the last century and more, yet these are not readily available to anybody seeking them. Information exists and is available with SFDs, Institutions and universities, or even in the form of traditional knowledge in the minds of tribal and forest

dwellers, but it needs to be brought together in a central repository if it is to be of any use for research, education or planning. Harmonization of data collected by various agencies (Central govt. institutions/State Forest Departments/ NGOs/Researchers etc.) is the need of the hour.

4.31 There is an urgent need to develop a unified database for forestry related data by all concerned agencies without duplication of efforts. So far not much emphasis has been placed on information compilation and dissemination. Today, with the importance being given to the citizens' right to information, it has become mandatory for the forestry sector to create a central repository of forestry data and to use existing and future IT capabilities to link various existing sources of forestry information. The importance of forestry data has been recognized both for policy formulation and planning purposes on one hand and for monitoring and evaluation of programmes on the other hand at all levels. For effective planning at various levels (national, state, region, district, village etc) a reliable, accessible and regularly updated data base on traditional as well as non-traditional aspects of forest resources containing spatial and non-spatial information is essential as it will improve efficiency of sustainable planning, evaluation and monitoring of forest resources.

4.32   Data Gaps in Environment Sector: Some Challenges

- Conservation programmes of mangroves, wetlands, estuaries, etc.;
- Biodiversity conservation;
- Control of pollution in air, water including marine;
- Hazardous substances management;
- Development of eco-friendly products;
- Coastal zone regulations and managements;
- Joint Forest Management;
- Documentation of medicinal plants, both traditional and herbarium based; and
- Development of eco-cities and eco-villages, etc.
- The user-groups like decision-makers, scientists, environmentalists are at the first level, researchers at the second level and the general public at the tertiary level.

4.33 In order to achieve an economically sound society and environmentally friendly development system, it is necessary that a comprehensive information system is established. Presently, no systematic approach has been adopted to collect and collate

data on conservation of forestry resources. The study of controlling parameters through generation and digitization of forestry data along with bio-physical factors on a continuous basis is essential to objectively monitor and evaluate the current and future forestry growth and development. This has been made possible with the advent of computer era and availability of computer network and advanced software packages for storage, retrieval, analysis and dissemination of information in a systematic manner, to develop a data warehouse that is easy and has rapid accessibility. This effort can supplement and strengthen the existing database and generate new data, if required, to form an information management system at the national level that will be of great help to the forest managers and planners.

4.34 The major critical gaps identified are as follows:

- No systematic approach adopted to generate collate and correlate data on natural forest resources.

- Non-standard and scattered database are not in a position to give holistic views on the present problems, causing hindrance in forestry development.

- No modern information system i.e. warehouse has been conceptualized for creation of database on natural resources.

- No appreciable accessibility of information available.

- Psychological data sharing blockage as data are normally thought to be something very personal /institutional.

4.35   Long Term Vision

The forthcoming 21st century will experience its own uniqueness in the light of growing population, shrinking resources and advancement in technology. The management of India's vast forest resources needs a balance between the ever-increasing demands and conservation of the fragile eco-system. This entails the judicious use of the forest resources to promote sustainable development and environmental protection. The creation of central forestry information management system is a huge task, but once put in a logical framework, the information can be updated and revised based on the need and use.

4.36   Information Demand Analysis

The information that are either generated and/or used for planning and management at national level can be broadly categorized as: Natural Forest Resources, Forest Inventory, Research Projects, Institutional inventory, Technologies Generated,

Genetic Biodiversity Resources, Meteorological Data, Market Intelligence (Prices, Trade, Commerce), State Level Information, Online Forest Library, NWFP, Finance, Budget and Expenditure, etc. This information can be obtained from the already existing forestry and allied institutions in different forms like tables, text files, databases (non-spatial and spatial) publications etc.

Chapter 5
STRATEGIES AND APPROACH FOR THE XI FIVE YEAR PLAN

A.   RESEARCH

5.1   Steering Research to Address National Priorities

The Environment and Forest sector of the country is facing an uphill task of satisfying an exponentially rising country-wide demand of goods and services from a limited land area, which is already under extensive local use, and simultaneously subjected to a variety of restrictions to safeguard biological diversity and environmental imperatives. It is essential that the Research Institutions and Organizations in cooperation with the Ministry and State Departments define research priorities and strategies to steer forestry research to address emerging national priorities, and to link research with the redefined objectives of forest management, and extension of tree planting on non-forest lands in tune with the national priorities of poverty alleviation, and enhanced environmental services. Conceiving appropriate scenarios for development of the environment and forest sector in tune with the national priorities should form the main platform for the 11th Five Year Plan (FYP) approach. Analyzing these scenarios and reducing the same to the most appropriate scenario after thorough discussions with stakeholders including policy makers, scientists, people representatives, forest industries and other concerned organizations, would be the next logical step.

5.1.1   The National Environmental Policy (NEP) 2006 has set as its objectives, conservation of critical environmental resources, livelihood security of poor, inter and intra generational equity, integration of environmental concern in economic and social development, efficiency in the environmental resource use, in environmental governance, and in enhancement of resources for environmental services. It further states that while a large number of actions are already currently underway, some new themes will have to be pursued to realize the objectives of NEP at all levels – Central, State, and Local which will further require empowerment of the *panchayats* and the urban local bodies.

The National Environment Policy, 2006 has evolved from the recognition that only such development is sustainable, which recognizes finiteness of resources, respects ecological constraints, and the imperatives of justice. The multistakeholder character of

environmental issues and continuous developments in the field of environment, make it necessary to have a continuous focus on capacity building in all concerned institutions: public, private, voluntary, academic, research and the media.

5.1.2 National Forest Policy, 1988 lists the priority areas of research and development, needing special attention for achieving the policy objectives of environmental stability, and increasing productivity. Forest productivity is envisaged to be enhanced by increasing productivity of wood and other forest produce per unit area, per unit time by the application of modern scientific and technological methods, through re-vegetation of barren/marginal/waste/mined lands and watershed areas, and effective conservation and management of existing forest resources, mainly natural forest ecosystems.

5.2   Reorienting Research towards People/Community Welfare

India is a true, vibrant democracy where entire governance is directed towards achieving the ultimate goal of upliftment of the people, and ensuring their all-round welfare. The mandate, agenda and direction of any sector and its underlying themes including research, education and capacity building have to be attuned to the principles of democratic polity, and, if need be, reoriented accordingly. Forestry research also, which has mainly focused on scientific achievements and has remained a major tool for knowledge enhancement so far, should be focused towards community welfare in general and problem solving activities in particular.

5.3   Expanding Research to encompass Biodiversity and Ecosystem

A major part of research effort has either been focused on single species or has considered forests as commercial entities and not as ecosystems. Grassland and wetland ecosystems have been largely left out from the ambit of forestry research, although they are very important landscape components of forest biomes. There is a need to adopt a more integrative approach instead of the current disciplinary fragmentation of the forest science community located in forestry institutes as well as universities. Scientific efforts need to be integrated to deal with the large-scale changes affecting the land based systems. Research is needed to identify species, which have key ecological functions that affect productivity, diversity and sustainability of forest communities as a whole. Effects of chronic and acute disturbances (e.g. periodic vs. accidental fire, head load removal of biomass vs. deforestation), and those of invasive alien species on structure, functioning and regeneration of forest need to be examined through long-term field experiments. Economic evaluation of ecosystem services and their delivery in response to disturbances and global changes across social groups need to be focused upon in future researches. Urban forestry is another emerging area needing attention of forest scientists.

5.4 Assessing International Research Needs

There has been a growing concern about conservation and sustainability of resources, and the rise in environmental problems, such as global warming, biodiversity loss, pollution of water, depletion of the ozone layer, desertification and carbon release in atmosphere. These concerns and related research obligations were manifest through international conventions and agreements including the Agenda 21 of the Rio Conference. The international forestry-related instruments are discussed in Chapter 18 of the Agenda 21.

CIFOR (Centre for International Forestry Research) and ICRAF (International Centre for Research in Agroforestry) have identified the following forestry research priorities on international basis: causes of deforestation, forest degradation and poverty in forest margin, landscape conservation and management of forest ecosystems, multiple resource management of natural forests, and agroforestry research under the natural resource strategies and policy.

5.5 Coordination of Collaborative/Joint Research by ICFRE

As multidisciplinary research is vital for addressing global issues in environment and forestry research, the research programmes and schemes need to be carried out by different stakeholders in consultation and collaboration with each other. Also, Public Private Partnership (PPP) or more correctly Multi-stakeholder Partnership (MSP) is the right strategy in the changed economic and global scenario. These partnerships are intended to bring together the respective institutional, technical and financial strengths and capabilities of the collaborating partners in pursuing research agendas of common interest. However, to ensure that such composite efforts are within the framework of the national research priorities, the ICFRE shall assume the lead role of facilitating and guiding such collaborations together with vetting of the research subject/agenda. ICFRE being the apex research body shall oversee the coordinated implementation of all research schemes and programmes. Some other important areas where joint/collaborative research input could be vital are: homestead forestry/agroforestry, watershed management, coastal area management, bioshields and protective afforestation (coastal areas), high yield germplasm/plantation, technological factors limiting yields, wildlife conservation and management, multipurpose forest management, genetic resources conservation, etc.

5.6 Strengthening Inter-Sectoral Linkages

There are institutions specializing in different sectors, which carry out research on similar or closely aligned subjects. Areas like geosphere and biosphere interactions, soil

microbiology, eco-friendly technologies, natural disaster management, e.g., floods, coastal cyclones and landslides, coastal resources, mountain ecosystems, freshwater resources and wetlands etc. invariably have multisectoral research programmes. Purposeful pursuit of such programmes makes the exchange of information among the sectors unavoidably essential. Also, academic and infrastructure exchange, and sharing and updating of information and knowledge among different sectors are also important. To make aforesaid possible, strong and effective linkages need to be established amongst different sectoral institutions.

5.7   Focusing on need based Simple Technologies

Based on scientific advancement, modern technologies are being developed, and to a small extent being implemented also. However, large-scale adoption of such technologies by farmers, rural communities, and urban dwellers is not possible as these technologies are complex, cost prohibitive and, therefore, unviable. In this background, there is an urgent need to undertake research that would result in development and validation of simple, viable and adoptable technology packages. Common rural and urban dwellers and village communities need such technologies not only for improvement of livelihood and employment generation, but also to have access to a cleaner and healthier environment.

5.8   Developing Green Accounting Models

One of the emerging global issues relates to development of rational and acceptable accounting methodologies in order to accommodate values of the intangible and tangible benefits provided by forest ecosystems. Also, this is the high time when numerous environmental services provided by forest and biodiversity resources ought to be quantified and properly reflected in the national accounting system. Research needs to be commissioned with a view to developing practical green accounting methodologies that could be used by agencies and authorities at local, regional and national level.

5.9   Approach

5.9.1   Coordinated and Integrated Approach

Forestry and environment research by its very nature is multi-disciplinary and multi- sectoral. The research initiatives, therefore, in the sector need to be coordinated at the conception, formulation and implementation stage at the highest level. This would require exchange of adequate and appropriate information amongst all the research stakeholders, and ultimately lead to integration and dovetailing of the objectives of their

strengths and capabilities. All India Forestry/Environment Coordinated Research Programmes on themes of multisectoral interest coordinated by ICFRE are intended to be launched. There should be national integrated research programmes approach.

5.9.2 Partnership Research

Apex environment and forestry research bodies like ICFRE ought to make use of strengths and capabilities of the SAUs, private sector and NGOs to pursue national research agenda. In other words, apex organizations like ICFRE should be technically and financially capable to farm out research to partner entities like SAUs, industry and NGOs. A Research Grant Fund (RGF) may be instituted for the purpose.

5.9.3 Research as an Essential Component of Schemes/Programmes

Each important scheme/programme requires input of research as it encounters problems during its course of implementation. It is, therefore, essential that every sizable scheme/programme has an inbuilt component of research. This would facilitate mobilization of more resources for carrying out project related research.

5.9.4 Flexible and Rolling

The research programmes and schemes should be flexible as well as rolling in nature. Based on regular evaluation and monitoring of progress, there should be provision of intermediate course correction of as also for continuance or strengthening or termination of the schemes.

5.9.5 People-centric, Participatory

Bottom up approach in research is the need of the hour with essential provision for proper input from local community projecting its research requirements. This will make research programmes people centric, and usable and adaptable by the community.

5.9.6 Ecosystem (holistic) Approach

It is well understood now that research pertaining to natural resources should be carried out at ecosystem level. This holistic research approach is essential for understating the sum total effect of individual elements of the ecosystem and for replication of research results. The researches of environment and forest sector should not be done in isolation but in a holistic manner taking into account the influences and interaction of other natural elements and resources.

B. EDUCATION

5.10 Visualizing New Paradigm

The new paradigm of education, embodying the spirit of science, of democracy, and of caring for the environment, would emphasize a number of key elements:

- Learning rather than teaching;

- Building capacity for critical thinking and problem solving;

- Locale specificity in the context of a global vision;

- Multidisciplinary approach;

- Multi-sourced and accessed, rather than top-down, controlled and orchestrated in nature;

- Participatory with broad involvement of peers and other community members;

- Life long and continuous in character;

- Sensitivity to diversity, equity and gender;

- Knowledge generation; and

- Empowerment, rather than indoctrination.

5.11 Scientific Method of Imparting Education

Human knowledge has progressed through a series of stages. In its early stages, knowledge grew very slowly through a process of trial and error. It was often viewed as being revealed from some divine source, and called for an unquestioning acceptance of such an authority.

Modern science has elaborated a far more effective way of growing knowledge. This involves rejection of all authority other than that of empirical facts. Science has thus firmly grounded itself on the hard rock of empirical facts. Simply put, the methodology of science entails: observing facts directly; discerning patterns; inferring processes that give rise to observed patterns; making models of the working of the system under consideration; formulating hypotheses about the system; making predictions; verifying predictions through fresh observations of facts; revising models of the working of the system; and then making new predictions in an ever-continuing process. In the march of science anybody is welcome to challenge any assertion, whether it be of facts supposedly observed, or of models of how the system works. Along with rejection of all authority, science has also given up claims of arriving at any absolute truth. Science deals in

knowledge that is always treated as provisional, that is, open to being supplanted by newer and more effective observations and theories. This open, democratic and participatory exercise of science has proved tremendously effective in rapidly increasing our knowledge of the natural world.

Science should, therefore, be learnt as a dynamic experience rather than as a mechanical accumulation of facts. Engaging in the process of science; of undertaking first-hand observation of facts; of looking for patterns; of postulating models of processes that might be generating the observed patterns; of making predictions based on such hypotheses; of attempting to verify the predictions—this is by far the best way of imbibing the spirit of science. Of course, one must also endeavour to become acquainted with the great deal of knowledge that has been accumulated thus far—with the facts, patterns and processes ascertained by others and with the models of the working of the world developed by them. But reading all these accounts second hand in books and journals can never be a substitute for first-hand engagement with scientific activities, and there should be a proper balance between learning the facts of science and first-hand engagement in scientific activities. Many of these elements of the scientific method are equally pertinent to the exploration of other branches of knowledge as well. Science thus, very importantly, incorporates the first two elements of the new paradigm of education outlined above, namely, (1) learning rather than teaching, and (2) building capacity for critical thinking and problem solving.

5.12 Analysing Systems: Simple and Complex

There are significant differences in the nature of scientific activities focused on the simpler physical and chemical systems and the more complex ones of concern to the environment. Simpler physical and chemical systems may be described with the help of a small number of parameters; this permits the design of replicated experiments to test predictions. As a result, our understanding of simpler systems has progressed enormously. Observing new, hitherto unknown facts pertaining to such systems, therefore, calls for highly sophisticated equipment and chemicals, and this is out of the reach of most educational institutions. Hence, the laboratory exercises of physics and chemistry necessarily tend to take students over well-trodden ground.

But with more complex systems, the situation is different. Complex systems characteristically require a large number of parameters for their specification. As a result, each manifestation of the system tends to be unique. Thus, every cyclone in the Bay of Bengal is different from every other recorded so far; each takes a slightly different course. Every patch of forest harbours a set of animal species slightly different from every other forest patch in the world. With these animals variously serving as grazers,

pollinators or seed dispersers, and because of many other differences in the environmental regimes, the rates of regeneration of the different plant species in any given forest patch also differ greatly from patch to patch.

The experimental method of science depends on the experimenters' ability to control all relevant parameters and to replicate conditions at will. This poses serious difficulties in the case of complex systems. The experience of a group of Bangalore-based ecologists investigating the fate of wild amla populations on the nearby BRT Hills provides an interesting example of dealing with a complex system. Their hypothesis was that the regeneration of amla is governed by the amount of fruit collected for commercial use, and that the low levels of regeneration in recent years were related to excessive harvests of the fruit. So they laid out statistically well-designed randomised block experiments to test the influence of different levels of harvests of fruit. The local Solliga tribals told them that these experiments would yield no results of interest, because, according to their understanding of the ecosystem based on many years of first-hand observations, the levels of regeneration were primarily influenced by forest fires. Amla seeds require fire to germinate well, and the Solligas felt that the low levels of regeneration were related to the suppression of forest fires in recent years. The scientists did not initially give credence to this view and continued with their experiments. Only later did they come to the conclusion that the Solligas had indeed been right. Thus, since it is so difficult to discern what the relevant parameters are in a complex system, it is difficult to design meaningful experiments. The study of the environment thus necessarily incorporates the third and fourth elements of the new paradigm of education outlined above, namely, (3) locale specificity, of course, in the broader context of our overall understanding providing a global vision, and (4) multidisciplinarity.

5.13 Evaluating Observations

The first-hand observations of the BRT Hills forest ecosystem by the Solligas had evidently provided them with an understanding of much value. On the other hand, elaborately designed experiments yielded little understanding because the experimenters had failed to identify the key parameters. Actual observations of these complex systems are, therefore, of vital importance in becoming acquainted with the empirical facts. Disciplines such as geology, hydrology, meteorology and ecology as well as the social sciences are, therefore, not amenable to the use of laboratory experiments in the same way as is possible in the case of physics or chemistry to acquaint students with empirical facts. Laboratory exercises do have a value in these fields as well, but the experiments must be complemented with actual observations in the field. Fieldwork has to be a vital component of learning in the study of complex natural and social systems. Hence, the

study of the environment has to incorporate the fifth element of the new paradigm of education outlined above, namely, being (5) multi-sourced and accessed, often with one's own initiative, rather than being a discipline with a top-down, controlled and orchestrated nature.

5.14   Adopting Comparative Method

Because of these difficulties, advancing knowledge through hypothesis testing in the sciences of complex systems has to take another route—that of the comparative method, taking advantage of natural experiments. The comparative method is based on compiling extensive information on a number of systems that differ from each other in a few features and generating hypotheses about the effects of such factors and testing them. For instance, lichens, symbiotic associations of algae and fungi that grow on rocks or tree trunks, are known to be sensitive to air quality in some parts of the world. India has several species that have not been studied in this fashion. So the best way for us to acquire an understanding of this phenomenon is to compare lichen floras on the trunks of the same species of trees growing on roads carrying heavy traffic and elsewhere where the air is cleaner. Similarly, one may use the comparative method to assess the impact of water pollution on fish and aquatic insect communities.

5.15   Recording New Facts

Because of these limitations, science has made far more limited advances in documenting and understanding the behaviour of complex systems. A corollary of this is that new facts are being continually added to the storehouse of human knowledge. Even non-scientists may participate in this adventure. Thus, amateur astronomers find new comets and asteroids from time to time, and amateur bird watchers routinely publish lists of birds from new localities. Indeed, the barefoot ecologists of the country, common people close to the natural world, such as the Solliga tribals of the BRT Hills, have with them an enormous store of facts well above and beyond those recorded in the scientific literature. This is why high school or college students and teachers, too, can contribute their mite towards building a scientific understanding of the environment. Indeed, the systematic recording of such facts by students could help flesh out the picture of the state of human habitat; the students could engage not only in recording the basic facts, but also attempt to discern emergent patterns and understand underlying processes. This would be a most worthwhile learning experience as well. The study of the environment evidently incorporates the sixth and seventh elements of the new paradigm of education outlined above, namely, being (6) participatory with broad involvement of peers and other community members, and being (7) a life-long and continuous enterprise.

5.16 Adopting Step-by-Step Approach

The changes envisioned in this new paradigm involve a major shift in our thinking of education as a process of 'learning' rather than 'teaching', and, going even further, of involvement in the active generation of knowledge. This cannot be done by merely changing the curriculum and the textbooks, but needs a more fundamental change in the way that teaching-learning happens and the way that knowledge is viewed in the school. Unfortunately, the current examination system is not just a way of measuring what the student has learnt but it also actually governs what is learnt. The final examinations, especially for Classes X and XII, determine a child's future in a way disproportionate to his or her achievements in other faculties. This is likely to continue to be the case for some time. Unless a change in the examination system happens simultaneously, one cannot expect to make a fundamental change in the system of school education.

The other major determinant of change is the teacher and his/her role. To move away from the traditional role of a teacher and to become a partner and facilitator in the process of the child's learning and knowledge-generation activities is not a small step. First of all, it calls for a major change in perspective. It also involves learning certain new skills, competencies and techniques. In pre-service training, such changes would eventually and very gradually lead to such a transformation. To hasten the change, a very effective and efficient in-service training programme needs to be implemented.

The changes in the curriculum and teaching–learning materials need to be seen in this context. A lot of good materials are available and one can draw on the experiences of numerous experiments and projects. However, a system that links learning and the process of knowledge generation to the environment cannot be one that can be wholly based on centralised materials. It needs to capture local flavours, to be adapted to the needs of a particular region, to become locale specific. This will necessitate a change in the way that curricula are written and textbooks and teaching materials are prepared.

The education system in India is hampered by its huge inertia. Change in such a system cannot be brought about merely through a shift in policy. It will involve a total system change carefully executed in a step-by-step fashion, with the active involvement of both the Central Government and the governments of States/UTs. It needs to be stressed here that education being a subject on the Concurrent List, the involvement and commitment of the governments of States/UTs is vital.

5.16 Developing Material: Conventional Media

EE will require the development of locale-specific teacher, student and classroom material. 'Greened' textbooks, which are written from a holistic environmental perspective in terms of both their content and pedagogy, and which encourage flexibility to bring in locale specificities, are at the core of this endeavour. In order to arrive at such instructional material there needs to be a serious rethinking on the approach to writing textbooks. Teachers need handbooks that help them to teach the texts effectively. For the hands-on part of EE, student workbooks and teacher manuals are required. Charts, reference material, etc. are also needed. This would involve not only the print medium, but also audio and audio-visual material as well as the new electronic media. The approach need not have all the material developed centrally, but should be designed to facilitate the development of quality material regionally and locally.

5.17 Taking advantage of ICT

EE could lead the way in effectively including the manifold capabilities of the new media in changing the paradigm for education. Already, many students, especially in the metropolitan schools, are using computers to access curricular material. They also surf the web to access related information, especially to carry out project assignments. We are suggesting that we go beyond these activities, and use these media as tools to augment the knowledge base on India's environment by getting students involved in generating knowledge. This calls for developing software to support EE project work of students through communicating proper methodologies of data collection, help validate identification of plant and animal species or of soil and rock types, and organise databases capable of accepting data from many sources. We need to design appropriate websites and put in place mechanisms for the moderation of the content. We need to organise experts' and citizens' discussion groups to comment on and add to the quality of the material on this website.

C.   Training and Capacity Building

5.18 Analyzing Need for Capacity Building

Forestry sector, like any other sector, requires new technologies and management tools to keep pace with the developments at the local, national, regional and global levels. With the shift towards sustainable development and participatory mode of forest management, the forestry has been undergoing fundamental changes in recent times. There is an increasing emphasis on conservation practices and collaborative management by involving all the stakeholder communities and individuals. On the other hand, there is

pressure for increasing the productivity of wood and other Non-Timber Forest Products (NTFPs) using modern technical inputs. Issues like biological record keeping, environmental impact indicators, biodiversity valuation principles, trade and intellectual property rights, biopiracy, gene pool management, protected area effectiveness, environmental economics, environmental valuation techniques, forest certification, monitoring indicators, carbon sequestration, sustainable development of forests and people, participatory natural resource management, new techniques for raising productivity of forests, bio-economic modeling, valuation of eco-system services, are gaining importance in the forestry sector. Though some of these issues are addressed in regular in-service courses offered by the training institutions and other organizations, there is need to further consolidate and streamline the capacity building regime to adequately address the emerging issues to achieve excellence in forestry sector.

5.19 The traditional approach to forest management demands adequate mix of many aspects of modern scientific management practices such as nursery techniques, seedling demand analysis, nutrient analysis, tree growth modeling, monitoring systems for afforestation, application of geographical information systems, impact assessment methodology, holistic approach to watershed management, soil and water conservation techniques in watersheds, low impact harvest technology, controlled burning using fire modeling, wood technology, international trade in wood products, cross border marketing of NTFPs including medicinal plants, forest research methodologies, protected area management, process documentation, forest management information system etc. The present-day foresters have to deal with a number of non-technical issues also, e.g., inter-sectoral policy and programme linkages, social mapping, community mobilization, forests as tool for rural development including income generation, micro-credit, micro-enterprise management, alternate energy technology, quality control skills, inventory management, accounting and fund management skills.

5.20 Hence, to build capacity of the forestry personnel at different levels enabling them to deal with the emerging issues efficiently, it will be imperative to pool forestry resources and establish linkages with other training and academic institutions not only from within the country but also with international organisations. The forestry training institutions in the country have been taking due care of the above mentioned issues while imparting training to the forestry personnel. However, every training institution has limited capabilities. The resources available to support forestry training are generally insufficient to sustain the requisite expanse and quality of training. It is important that the forestry personnel are provided opportunities to present their views at the international events related to forestry and environment. This will help in capacity building of not only the officer as an individual but also the forestry sector as a whole. Exchange of faculty

among the forestry training institutions and other academic institutions including IIMs, sponsoring/organizing Training of Trainer (TOT) courses for the faculty of forestry training institutions, and encouraging forest officers to undertake higher studies in the institutions within the country and abroad, would be a right step for capacity development of the forestry sector. Creating awareness among the industrial houses about the conservation ethos and clean environment with a view to attracting their attention for investment in forestry projects will also help in achieving the goal of sustainable development of the people.

5.21 Approach

Education

5.21.1 Convergent and Unified

The education which is being dealt by numerous institutions- governmental as well as non-governmental require convergence, unification, and uniformity so as to enable the students and scholars to get a level playing field and better environment for career progression and higher learning.

5.21.2 Universal and Updated

A dynamic approach is needed to keep abreast of the contemporary topics of education and to get a grip of the global issues; through periodic and regular review of syllabi and curricula.

5.21.3 Knowledge Management Driven

In a multisectoral and varied stakeholder scenario, and in order to pool resources and interlink institutions/organizations, a knowledge management based approach to establish and consolidate knowledge augmenting/sharing framework to be adopted.

Extension

5.21.4 Capacity Building of Line Departments for Forestry Extension

It is essential to dovetail forestry extension activities with the general activities of the line departments to make up for the shortage of the trained extension personnel. This would require structured capacity building of the extension staff of the line departments to enable them to disseminate information about adaptable forestry technologies.

5.21.5 Synergy and Harmony

The extension programme and activities need an approach of synergy and harmony so as to make the programmes more clearly pronounced and more cost effective.

Chapter 6
MAJOR THRUST AREAS FOR XI PLAN

A.   Forestry Research, Education and Extension

6.1   Farm and Agroforestry

Farm and agro forestry have immense potential to support rural livelihood, generate employment, increase production of fuel, fodder and wood alongwith agriculture crops. There is need to wean away rural people from being dependent on government forests for fulfilling their need of fuel wood, fodder and timber. This re-emerging land use system has been recognized as a major alternative for the future. It can be practiced in temperate as well as tropical areas. There are a myriad of aspects in agro-forestry, which need intensive research efforts. These are:

- Interactive role of fodder tree on hill slopes.

- Plantation crops like tea and coffee in agroforestry with N_2 fixing shade giving trees. Research on future choice of trees on farms, especially with regard to the desirability of tree with respect to their and use i.e. timber, fodder, fruit, fuel wood yielding or N2 fixing or a combination of two or more of these characteristics. Research on MPTS.

- Timber production in agro forestry systems.

- Agroforestry and biodiversity of crops and trees.

- Indigenous knowledge of farmers and forestry science.

- Agroforestry systems in sustainable forest management.

- Development and management of pastures.

- Research on the extent of damage caused by migratory herds of cattle to the forests on way.

- Introduction of suitable tree species to wean away 'jhum' cultivators of North Eastern India.

6.2   Watershed Management

Water is a very important output from forests. The important research areas required to be covered are:

- Effect of forest cover on water balances in catchments area and run off dynamics.

- Hydrological pathways.

- Surface erosion and slope stability.

- Remote sensing and hydrology.

- Surface water management.

6.3   Non-wood forest products (NWFP)

These are also known as non-timber products (NTFP) and are extremely important because a large number of rural people specially tribals are engaged in its collection and sale for their livelihood and existence. Proper management of this product is very crucial for a long term benefit and poverty alleviation programmes.

The important research areas may include:

- Preservation and multiplication of endangered medicinal plants.

- Exploitation of non-timber forest products for the benefits of rural and tribal masses.

- Establishment of center of excellence for medicinal plants to be examined and implemented at Tropical Forest Research Institute, Jabalpur.

6.4   Bamboos

Bamboos are poor men's timber. Important areas of research include: -

- Study of bamboo diversity in the country.

- Clonal multiplication of bamboos.

- In situ and ex situ conservation of bamboo species.

- Research on various aspects of bamboo utilization like artifacts, bamboo mat boards, bamboo mat veneer, bamboo mat overlaid particleboard, bamboo mat molded articles and bamboo as construction material.

- Improved production, management and utilization of Bamboos and rattan especially in the western and central parts of the country. Bamboos need to be grown widely.

6.5 Productivity

Research on forest productivity has many facets, Timber resources changes in national forest cover, Forest production, growth and yield models, Remote sensing and GIS techniques, etc.

6.6 Landscape rehabilitation

A need is felt to rehabilitate and restore the natural landscape, as it existed in the past. Research on the following lines will be pertinent:

- Visualization of the landscape in land planning in the rural areas, hill areas, tribal areas, North Eastern areas and other problem areas.

- Protection against natural calamities like flood, earthquake, landslide in the mountains, cyclones etc.

- Strategies for the rehabilitation of the deforested landscape with a view to recover biodiversity.

- Studies on the role of Joint Forest Management.

- Wetlands and mangroves, mountain and desert ecosystems, degraded ecosystems.

- Lantana and other exotic weeds, weeds of water bodies.

- Forest conservation research and the 'Periyar Model'.

- Eco-agriculture concept.

6.7 Forest industries

Some important identified thrust are as follows:

- Involvement of user industries to support teaching programmes

- Technology adoption

- Product improvement mainly with a view to export

- Industrial toxicology

- Wood technology

- Linkages with the trade

- IPR and forest industry

- Utilization and consumer aspect

6.8   Forest fire

The prevalence of forest fires in the country is an annual affair. The loss due to forest fires is enormous and depleting our forest quality. ICFRE jointly with NRSA/DOS centers could initiate a research program on fire mapping and slowly evolve a fire alarming system development as part of decision support system. The role of satellite technology and IMD need to be optimally integrated.

Fire in the forest plays a very vital role either by way of diversifying successional trends or by destroying vegetation. The important research areas in this direction are:

- Forest fires and their control.

- Fire and weather relationship with special emphasis on wind and humidity, and fire forecasting models.

- Fire and natural regeneration of commercial species like teak, chir pine, etc.

- Fire and loss of biodiversity.

- Fire and forest soil microbiology.

- Shifting cultivation (jhum).

- Detection and Monitoring of Forest Fires.

6.9   Conservation of forest genetic resources

The important research areas include:

- *In situ* conservation of tropical and temperate forest genetic resources.

- Impact of silviculture and management practice on genetic diversity of trees. Assessment, conservation and monitoring of biodiversity.

- Population genetics and gene conservation.

- Social and economic considerations of conservation.

- Impact of pollution on forest tree populations.

- Wild life.

- Sustainable natural forest management.

- Development of indicators of sustainability and models of sustainable development.

- Development of bio-resources approach and technologies.

6.10 Impact of pest, diseases and air pollution on forest sustainability

Research on forest insect and pathogen along with effect of pollution on forest health needs to be strengthened. Health of trees under urban environment needs special attention. Mortality of Shisham and problem of sal heartwood borer need further exploration. Strategies to control the insect pests by use of bio control agent need to be strengthened. To achieve the above goals research in the following areas is recommended:-

- Sal borer Identification, Mapping and analysis for prevention

- Teak defoliator studies

- Shisham Mortality

6.11 Wood products

- Production of slow growing valuable timber trees like teak, sal, rosewood, shisham, toon, etc.

- Plantation forests and their social impacts.

- Plantation forest and their impact on the environment.

- Plantations for fuel wood production.

6.12 Services

Forest provide many types of recreational services like hiking, mountaineering, camping, eco-tourism, etc. the social functions of the forests should be researched on the following aspects.

- Recreational functions of national parks, botanical gardens, religious forests, and mountain forests should be documented.

- Social functions of the village forests and their sustainability should be documented.

- Amenities obtained form forests should be investigated.

- Research on public education vital to the well being of the forests and the communities living in and around forest areas.

- Quantification of indirect benefits from forests.

- Human rights and especially women rights component, gender issues in forests and mean of livelihood.

6.13   Silviculture, physiology and genetics

The Indian forests contain nearly 4000-5000 tree species and their compositional pattern though studied extensively, but lacks the synthesized tree diversity maps needed for the forest management on a large scale. Towards this direction the detailed forest taxonomical studies with systematic phyto-sociology and GPS based surveys may significantly contribute in revising the forest tree floras of the states. These inputs contribute as valuable information in conservation, preservation and introduction of declining tree species in the region. This aspect ensures our rich heritage of tropical biodiversity as a first step.

Some of the important areas would be:

- Silviculture of tropical trees in southern and eastern parts of India.

- Short rotation forestry for biomass production. Some of the fast growing shrubs and small trees must be evaluated.

- Rehabilitation of mined areas through afforestation with a variety of tree species. Other waste lands along railway lines, canals and roads too must be afforested after developing suitable plantation technologies on the suitable species.

- Forest meteorology and climate and dendrochronolgy the Indian forests though occupy nearly 22% of the geographical area does not contain systematic meteorology data collection platforms to serve as inputs on the changing conditions and influence on forest composition and productivity. In this direction, establishment of automatic weather stations across the Indian forest would provide considerable forest meteorology data and micro-climatic conditions. This kind of scientifically organized data is required for better understanding of the forest influences on climate and weather.

- Development of vegetation propagation techniques for mass scale multiplication of elite clones.

- Most of the Indian forest trees of commercial importance are not properly researched from genetic variation point of view. There is need to study

provenance variation and selection of superior trees for further genetic improvement work.

- Seed physiology and seed technology.

- Conservation and management of forest gene resources.

- Establishment of seed production areas, progeny trails and seed orchards of different important trees in each region/zone. Seed certification and timber certification.

- Research on improvement of planting stock of important plantation forestry tree species.

- Enhancing production through scientific management of insects pest and diseases.

- Forest biotechnology research should be given an impetus in the fields of clonal forestry, cryopreservation, DNA finger printing, genetic transformation studies, biofertilization etc.

- For most part of the Silviculture practices the lianas are considered as weeds and parasites, compete with the tree cover in resource allocation. However, the lianas also represent highly diverse and fast growing plant species. The record of their diversity, the inter-relationship with forest ecosystem, productivity potential may require sufficient attention to understand their role. Apparently their luxuriance also indicates as a measure of disturbance in the ecosystem. In this context the role and functional aspects of lianas and their taxonomy in different forests of India may be given adequate emphasis.

6.14   Forest inventory techniques

Inventorization of the forest resource with the help of modern techniques is of great importance. The monitoring of forest types and specific tree species and attack of pests and diseases are mandatory. We must pay attention to research needs in the following areas:

- Stand dynamics and growth models and their use for better forest management.

- Environment changes and forest growth.

- Forest products collection and sustainability.

- Use of remote sensing techniques in inventory and integration with GIS.

- Estimation and production of national bio-resources through biometrical approach.

- Research on continuous cover forestry and build up of growing stock, especially for such forest areas in the county where the growing stock is very poor.

India's rich forest wealth and diversity together constitutes a rich heritage supporting our environment through many tangible and intangible benefits. The increased population pressure and demand for it's resources require continual effort on forest research to ameliorate the growth conditions to meet the basic requirements and also to combat the changing ecology of the region. Towards this direction, the advent of modern technologies especially Satellite data applications, air-borne multispectral imaging, biotechnology and fast communication and information technology should be taken to the best advantage for forest research in the 10th five year plan by ICFRE.

6.15 Forest type distribution and analysis

The India's forest types were defined by Champion and Seth way back in 1968 and subsequent to that there was no concerted effort to properly redefine the spatial distribution and analysis of forest types in the country. NRSA, Hyderabad have made some patch scale attempts in this direction using satellite, metrology and physiographic data. However the continental scale attempt is one of the research gray areas, which can be taken up by ICFRE in joint collaboration with NRSA and large university infrastructure in the country.

6.16 Forest products

Wood is now rarely used in the natural form. A lot of advancement has occurred in the areas of wood technology. The following areas need attention for better and economical use of wood.

- Quality of wood produced under different plantation regimes. The quality and value of the product depends upon the quality of wood produced so it should be monitored.

- Protection of wood against decay and attack of insects and pathogens.

- Processing of wood through modern treatments, and use of wood bonding, utilization of wood waste.

- Research on composite and reconstituted wood products, reconstituted wood from bamboos.

- Wood carbonization, energy and chemicals from wood biomass.

- Utilization of a versatile product such as bamboos and rattan.

- Collection, processing, sale and utilization of non-wood products and threat of their extinction.

- Research on the domestication, cultivation, processing and standardization of aromatic and medicinal plants and their conservation in nature.

- Research on recycling of paper.

6.17   Social, economic and information sciences

Major strategies are as follows:-

- People's participation and impact of JFM

- Economic analysis of forest degradation

- Sociological research on forest and society

- History of forest in India

- Research on social forestry

- Indigenous technical knowledge

- Role of forests in natural disasters e.g. floods, coastal cyclones and land slides.

SPECIFIC ISSUES

6.18   Carbon sequestration

Researches need to be carried out on the carbon sequestration capabilities of different forest eco-systems with special reference to some selective tree species. Emphasis should be laid upon those trees, which can grow very well in the urban environment and bind carbon dioxide more efficiently/effectively. Role of some tree species in binding heavy metals should also be studied from environment amelioration point of view. Besides this commercially important and valuable timber species should be encouraged which have such capabilities. The concept of modern nurseries, technologically equipped to produce large number of healthy seedlings from genetically superior sees must be realized during the ensuing plan period so that impetus can be given to mechanized nursery production so as to give a boost to commercial nursery production for undertaking large scale plantations. Similarly, mechanized seasoning and fumigation facilities must be researched and their economic viability be assessed for going into large scale timber production and value addition. Emphasis must be put on the use of such chemicals, which have very little harmful effect on the environment.

The sources and sinks of carbon have always been an unresolved scientific issue. The systematic effort on the Indian forest biomass and subsequent carbon storage potential through wood analysis samples may contribute the sink potential of Indian forests and their distribution pattern in various forest types.

The first human being was not much different from wild animals in their daily livelihood. The human race differentiated from rest of the animal kingdom through rational thinking, which led them to civilized life. Rational thinking and scientific discovery have led human society from various human societies differ among themselves due to difference in the philosophy of life and standard of living. However, the basic need of all social being-food, cloth and shelter-have remained the same.

Man has gathered the basic amenities for living from the gift of nature. Undoubtedly, it is the forests, which have supplied human beings more for his livelihood then anything else in nature. Trees have given food, fuel wood to make fire, timber to make shelter and bark to cover his body. Life and life-style have changed over time. Man of today does not use the natural products from forest in the form it is available. Through scientific input they have modified forest produce into forms more suited to his modern life.

6.19 Bio-diesel plantations

Production of energy and fuel from forest biomass are yet another important area of investigation. A number of forest trees have the potential to yield fuel after chemical processing. It is, therefore, very important that research efforts should be concentrated on standardization of the chemical processing method for conversion of forest biomass into fuel. Once these techniques are developed and standardized, the bio-diesel plantations can be taken up.

6.20 Development of bamboo and rattan

Bamboo and rattan are very versatile materials, finding advantages of uses such as household, industrial and pulp material. These are fast growing with easy multiplication. Their short rotations make them very valuable material to grow at the village level. Research on choice of species, growth behavior, culm properties and utilization needs to be strengthened, so that their significant role is realized in the country's economy during the coming years.

The vast stretches of Bamboo and its occurrence through out the country in various proportions limit the resource managers to properly account the bamboo potential

available in the region. Complying with the forest action plan requirements the Bamboo resource assessment in the country state wise can be made through use of satellite data supplemented by adequate ground verification. Subsequent to the mapping efforts should be made to identify the species and generate a database on the possible sources of germplasm collection and to create gene bank of Bamboos based on the growth conditions.

6.21   Bamboo gregarious flowering

Bamboo resources in the country contribute significantly for the paper, agarbatti and minor forest produce for the tribal community. The valuable resource at several ecological regions prone to spurious flowering causing the complete desiccation of Bamboo forests in the habitat. The role of microclimate, soil etc., is rather inexhaustive. Towards this the areas affected due to spurious flowering and their frequency of occurrence over a region can be studied as base line data to pick up the hotspots for detail analysis in an integrated manner. In this direction high-resolution satellite data with multi-temporal analysis in the time frame of Resource Sat (IRS 2 series) may enhance the capability.

Research efforts should be made to spatially map through GIS based spatial models in conjunction with ground observations on the extent and location of Canes and Reed resources in various forest ecosystems. The record of various genetic diversity and germ plasms be made through a database creation.

6.22   Identification & documentation of sound technologies

This is high time to strengthen research in the fields of wood technology, use of sawmill waste, composite wood, wood adhesives, plywood and laminated wood vis-a-vis wood preservatives. With the current interest in alternative systems of medicine and herbal cosmetics the medicinal and aromatic plants of the country have come under a lot of pressure. Many of the species are fast depleting from their known source of habitat. There is need to generate/document technologies related to conservation, growing, processing, value-addition, marketing and utilization of these plant resources. Eco-friendly technologies already developed in these areas must be documented and popularized. Again, the dwindling wild life calls for immediate intensive research and development of technology in this sub-sector. Technology for the development of various kinds of wastelands, including tree crop cultivation technology should be area based and need oriented. Tried technology should be used rather than trying a new one.

6.23 Contours of economic tree species

ICFRE during the 11th Five Year Plan could consider the first top 20 economic tree species and their spatial distribution pattern across the country be made through systematic organized surveys and through use of GPS instrument. These kinds of contours of spatial mapping of tree species extent provide the spread conditions as baseline information. As an example the extent of teak is believed from south to north up to Madhya Pradesh. Beyond certain latitudes its occurrence is negligible. Likewise the establishment of the contours of the tree species may give adequate reasons to interpret the controls governing the growth of these economic species.

6.24 Permanent silvicultural database

Though ICFRE maintains the record of permanent plots information; it may now be extended to large number of habitats accounting not only the structural aspects but also involving biophysical and biodiversity aspects. This kind of information database may be kept open to the all academia through a website such that the populating of information and research contributions from individuals may enhance understanding the behavior of India forests. The locations and database organization may need to be updated every year with all the parameters plot wise with analysis be made open to the public.

6.25 Role of protected areas in preserving biodiversity

Nearly 4% of forested area is reserved for protected area management. There should be detailed studies as to what extent these PA's are contributing to the biodiversity enrichment.

6.26 Tree growth models

The first top 20 economic tree species and their growth conditions have to be studied in detail such that the growth models of each species is very well understood both silviculturally and physiologically. The growth model analysis is required to simulate the growth profiles in the naturals systems where they are predominant and to assign the site quality depending on the dynamics. These kinds of studies are very limited in the Indian context and hence deserve attention in the Eleventh Five Year Plan.

Other areas for the research identified may be as follows:

- Micro-Finance and Micro-Enterprise

- Participatory Forest Resource Assessment, Monitoring and Evaluation

- Legal and Policy Analysis in Forestry

- Valuation of Forests and Natural Resource Accounting

- Gender in Forestry

B.   ENVIRONMENT RESEARCH

- Status assessment, Monitoring, Documentation

- Yield increasing technologies

- Income generating technologies

- Life support technologies

- Value addition and other supporting activities

- Conservation and Mangement

- Development Options/Strategies/Plans

- Demonbstration and Disseminations

Within the framework of the NEP, the subgroup on training and capacity building has assessed the following to recommend the action plan for the Eleventh Five Year Plan:

- Assessment of the current capacity and existing system of training in all key thrust areas of NEP including forestry and wildlife research and management, pollution control management, monitoring and enforcement, health risk analysis and risk management, environment and economic risk assessment and the capacity for international negotiations in the specific areas of climate change, biodiversity, and land degradation.

- Assessment of available and projected need of skills, capacity of institutions for regulatory development and mainstreaming of training in all regulatory programmes.

- Assessment of the current infrastructure for training and suggest improvement for quality training.

- Ways to build skills within the Ministry and its agencies for its own research, monitoring, data generation, regulatory impact assessment, compliance assurance, public consultation etc related tasks.

- Assess the ways to work with other scientific agencies and stakeholders within and outside the government sector to build capacity for training of the staff and the trainers.

- Recommendations for capacity building and training have been made to cover the following regulatory segments:

- **Pollution control and management and health risk assessment** (air, water and hazardous waste), risk assessment, standards setting process, environmental clearance monitoring of compliance, use of economic instruments.

- **Forest and wildlife management** and conservation of environmental resources which will cover land degradation, desert ecosystem, biodiversity and traditional knowledge, freshwater resources, mountain ecosystem, coastal resources, pollution abatement, among others.

- **Enabling participation and steering negotiations on international environmental treaties and bilateral cooperation** on environmental matters.

- Workshops for training college teachers on implementing the UGCs core module course on Environment.

- Developing material as handouts for the classroom to supplement UGCs prescribed Text Book on Environment Studies.

- Developing audio visual programs to supplement teaching the course.

- Training for implementing the field work component and utilizing the output for developing competencies in managing local environment through data collected by the college students.

- Support for college level activities and action programs such as greening the campus , use of canteen waste for vermicomposting, documenting local biodiversity and natural resources and documenting sustainable practices in traditional communities.

- Support for sharing of experiences through competitions, exhibitions , quiz programs, biodiversity festivals etc.

C.   TRAINING AND CAPACITY BUILDING

6.27   Knowledge Management System in the Forestry Sector

'Knowledge Management' is the management of knowledge within organizations. It caters to the critical issues of organizational adaptation, survival, and competence in

the face of increasingly discontinuous environmental changes. Knowledge Management System (KMS) for forestry will be evolved to systematically and formally share and transfer learning concepts, best practices, innovations and other implicit knowledge among all the conservation lovers. It will provide an open and transparent way of sharing knowledge and information amongst the forestry personnel and all others persons and organizations interested in subject of forestry and environment.

Proposed Activities under the KMS

- Developing an on-line link knowledge base (network) in which know-how is stored and is made widely accessible

- Building thematic groups/focus areas

- Building of sectoral best practices and making available key sectoral statistics

- Building a directory of expertise/resource persons on different themes

- Providing a dialogue space for professional conversations/debates/discussions

- Establishing access and outreach to external agencies, e.g., NGOs, people and others

- Providing access to users about relevant information

- Establishing help desks and advisory services

- Databases (up-to-date) managed by the State Forest Departments (SFDs)

- Modalities for encouraging forestry personnel to develop expertise/undertake in-depth studies on topics of their interest

IGNFA has been made the nodal agency for KMS in the forestry sector. A 'Knowledge Management Cell' (KMC) is being established in the Academy with responsibilities for coordinating the activities of different committees on domains besides assisting the monitoring committee in suggesting policy interventions etc. This Cell will share some of the infrastructure of the IGNFA to reduce costs. It will develop and maintain the website on KMS which will have links with websites of the SFDs, various central organizations, NGOs and other related organizations. The 'KMS' will have database of resource persons, specialist and consultants and information on various knowledge domains and their contents such as case studies, success stories, innovations, best practices, workshop reports, project documents, working plans, video & audio records, photos etc. The infrastructure will be developed to fully operationalise the KMC in the IGNFA. The KMCs being established in the SFDs will also be strengthened by providing some financial support for outsourcing services of the data-entry operators,

software development and purchase of information and communication technology and related hardware etc. The GOI will provide only catalytic support and all other expenses will be born by the SFDs. In most of the SFDs, IT Cell/Research/Extension wing already exists. To avoid duplication of works presently being done by these wings, one of such wings can establish KMC and co-ordinate the activities of KMS. The IGNFA will hold annual meetings of all the State KMC nodal officers to review the progress of KMS in different SFDs.

6.28 Exposure of Forestry Personnel to Developments at International Level

The forestry profession has gained tremendous importance in view of the recent developments and concerns expressed for protection of global environment. The forest and wildlife management being a dynamic subject, the forest officers need to keep themselves abreast of latest developments in the sector at national, regional as well as global levels. They need to broaden their horizon by availing opportunities of participating in international workshops, seminars, short-term training courses, study tours and meetings relating to forest and wildlife management, biodiversity conservation, climate change and other environmental issues etc.

6.29 Organizing/Sponsoring Courses for Other Stakeholders

Over the years, the SFDs have been managing the forest and wildlife resources mainly through policing. However, in the last two decades there has been increasing realization that these resources cannot be managed in isolation without actively involving the local people, who have larger stake in these resources including various types of rights and concessions being enjoyed by them in the forests since long. In the changing scenario in the forestry sector, local people's participation is now considered essential for better management and conservation. It is, therefore, necessary to create awareness among the people and different stakeholders about the importance of conserving forests and their sustainable management. A number of specially designed short-term courses, study tours, workshops, seminars and interactive meetings on various aspects of forest and environmental conservation are required to be organised for different stakeholders which may include NGOs, students in educational institutions, personnel of banking institutions, nature clubs/eco-clubs, panchayats, public representatives, social activists, press and media persons etc.

6.30 Organizing/Sponsoring In-service Training for Personnel of Other Services

Forest management being a multi-disciplinary subject, it cannot be practised in isolation. Recent initiatives on eco-development have given enough lessons that there should be strong linkages between conservation and development strategies. The responsibility for providing clean environment rests with different sectors of the government as well as the society. It is in this context that the sensitization and capacity building of officers and personnel of other services on the importance of conservation of natural resources and environmental protection, is highly essential.

D. Information Management

The status of data collection for Forestry Statistics in India has not been up to the mark due to inertia on the part of State Forest Department and also due to lack of institutional framework for this. The issue of strengthening the Forestry Statistics was taken up by various forums most importantly by the National Statistical Commission, which has pointed out the current status & deficiencies and has also given recommendation for strengthening the Forestry Statistics of India. The workshop on Forestry Statistics, "FORSTAT - 1996" was held at ICFRE on 28th February, 1996 in which many important recommendations were given and several formats for data collection were finalized. Unfortunately, the data flow in these formats has reduced in the successive years. This has raised concern not only in India but also in the various International Organizations.

The non-spatial data collected by ICFRE and the spatial data collected by Forest Survey of India (FSI) forms two major components of the national forestry database. The methodology to link these up to make them compatible and synchronize them for dissemination is one of the major exercises that has to be undertaken to bring about uniformity in database management. There is a need to develop a synergy of these two organizations that can provide reliable and precise data of high integrity in time. In addition, the capacity of state forest department needs to be developed on the same line so that the data collection efforts of the Central Warehouse and the data providing efforts of State Forest Department dovetail at some point.

As part of the recommendation of the Sub-Group on Information Management, capacity building in forest informatics at the Central and State level needs to be looked at critically. As has been mentioned in the earlier chapters that a central organization (FSI/ICFRE) who will be the repository of all forestry related data will be the nodal point for collection, analysis and dissemination of both spatial and non-spatial data. The data

flow will be from the concerned forest divisions to the Sate Forest Department headquarters and the on to the Central Nodal Organisation. Dissemination of data will follow the reverse route.

To achieve the above, it is mandatory to strengthen both the Central Organisation (FSI/ICFRE) as well as State Forest Departments (SFDs) in terms of manpower and infrastructure which will include both hardware and software. The important tasks to be carried out by different focal points for data collection and the requirement in terms of staff, training, equipment are highlighted below:

6.31 National Forest Geomatics Center (NFGC): The center will

- Develop standards (Code) for forest mapping within the Forest Sector to enable smooth integration of databases and exchange within and between Sectors;

- Assist in establishment of State Forest Department Geomatics Units and provide them technical support to grow;

- Provide regular training courses for development of GIS for forestry planning within the Sector;

- Assist in digitizing / editing/ integration of GIS databases of All-India importance within State Forest Domain and other domains;

- Provide value added standard RS products on a five year cycle of direct use in working plan preparation and other studies of State's FD.

6.32 State Forest Data Centers (SFDC): The State Data Centers will consist of two arms viz. States Forest Geomatics Unit and State Forest Statistical Unit, which will link with corresponding units in FSI and ICFRE respectively.

The Statistical Unit will be another arm of SFDC and work closely with Geomatics Unit. It will be responsible for organizing attribute data needed for Annual Administrative reporting and making a databank of all historic information. This arm will work closely with ICFRE two yearly statistical reporting and receive traing and other technical support from ICFRE.

6.33 Working Plan Modernization: This module is a logical corollary of information and technology (IT) induction in the forest sector. The planning system will immensely benefit from introduction of modern tools like remote sensing, GPS, GIS and database management systems. The opportunity will be made use of to provide linkage between forest planning and Sate Forestry data Centers proposed in the 11th Five Year Plan. As FSI, among new activities, is proposed to include supply and demand studies, the State

Forestry planning will be strengthened to provide support to nation wide activities (e.g. landscape level strategic planning) and certificate regarding availability of resources for starting new ventures. Working Plan preparations will be benefited from FSI two yearly forest mapping activities, forest inventory and survey of trees resources out side forests, farm forestry and waste land afforestation. For modernization of planning, State FD will be provided human resources, technology and technical support. Pilot projects are proposed to be formulated and implemented by main regions on the topic.

6.34 Community Capacity Building for Sustainable Management of NTFP: Again, this is a very important activity closely linked with conservation and sustainable use of forest biodiversity. It is proposed to undertake a rapid nation wide assessment of NTFP resources and the rate of annual changes on account of subsistence use and commercial sales and market prices and benefit to local communities from NTFP and to develop a system of sustainable forest management planning and community capacity building to achieve this goal. For the purpose, a forest biodiversity conservation network will be established and system of 5 yearly reporting on State of Forest Biological Diverty introduced. Wildlife Institute of India could play an important role in planning and implementation of this module building on biodiversity mapping by NRSA and nation wide field inventory by FSI.

E. Wildlife Research and Training

6.35   Building capacity to manage wilderness resources through effective training programmes for various target groups and developing human resources through Master degree programme in Wildlife Science are the major mandates of the Institute. In order to rapidly build capacity it is proposed to conduct customized training programme for various target groups (forest and wildlife managers; para military and enforcement agencies; custom and revenue officials etc.) of varying duration at headquarters as well as in field locations in national parks and wildlife sanctuaries.

6.36   It is also necessary to sensitize the judiciary, politicians, senior administrators, armed forces about various facets of wildlife conservation through short-term training programmes. Currently, the Institute is offering a Master degree programme in Wildlife Science every alternate year with a limited intake of 10 students. In response to the growing demand for trained manpower it is proposed to offer this course every year; increase the number of seats; diversify this course into an integrated six-year course leading to a doctorate degree and introduce greater flexibility in both curriculum design and delivery of the course. To implement the proposals indicated above in, an enhanced allocation of Rs. 1250 lakhs is proposed.

6.37 The Institute has recently developed a *'Research Priority Matrix'* based on a landscape approach. A review of research priority has indicated several *'gap'* areas. New thrust areas have also been identified in consultation with the stakeholders. In order to meaningfully address the wildlife research needs of the country, the Institute's research agenda has to be substantially enhanced. There is a need to conduct *'status surveys'* of key species especially those which have become endangered and are involved in wildlife trade. e-Knowledge portals have also to be developed for rapid and effective dissemination of data and information on wild species status, distribution and threats and on the species and the products involved in wildlife trade. Long term research on key species in identified landscapes have to be initiated/ continued using modern tools and technology (remote sensing, GIS, GPS, satellite telemetry etc). To implement the proposal indicated above, an allocation of Rs. 1500 lakhs has been proposed.

6.38 It is proposed to set up a National Wildlife Library and Documentation Centre in the XI Plan period. This would entail upgradation and further modernization of the existing library facilities. Efforts will be made to establish digital libraries through subscription of e-journals. It is proposed to provide cubicles with computer facilities inside the library to be used by visiting academics and senior researchers. A range of *'value added'* services will be offered to various users for which manpower and financial resources in the library and documentation centre will have to be augmented. To implement the proposals indicated above, an allocation of Rs. 450 lakhs is proposed.

6.39 The importance of state-of-the-art computer facilities in a training and research institution cannot be over-emphasized. From VIII Plan onwards, the Institute has made considerable investment in setting up of a modern computer & GIS facility. This facility has to be continuously upgraded to keep abreast with latest technology advancements. The huge quantity of data gathered during the All India Tiger Population Estimation needs to be properly stored and retrieved using a modern Information Storage System using sophisticated computer hardware and software systems. It is also proposed to extend the existing local area network to a wi-fi system across the sprawling Institute's campus covering various hostels, guest houses and faculty residences. To implement the proposals indicated above, an allocation of Rs. 450 lakhs is proposed.

6.40 During the X Plan period the Institute has set up a modern wildlife forensic facility in response to the growing need for identifying the species and their parts/ products involved in wildlife trade. Apart for analyzing the samples received on the basis of morphometry techniques for which the Institute has developed basic protocols and infrastructure, there is a need to strengthen the wildlife forensic capability by establishing a state-of-the-art DNA facility for developing DNA profiles of key species and using modern techniques for analyses of specimens received in wildlife offence cases from

various enforcement agencies. It is proposed to set up a Central Wildlife Forensic Facility (CWFF) at the Institute during the XI Plan period along with four Regional Wildlife Forensic Laboratories in Regional Wildlife Warden offices in Delhi, Kolkata, Mumbai and Chennai. The CWFF will mainly be the R&D centre to develop and standardize various techniques and protocols for identifying plant and animal parts and products involved in wildlife trade. In order to meet the safety, security and sanitation issues relating to wildlife forensic analyses, it is proposed to construct a separate building to house the forensic facility. To implement the proposals indicated above, an allocation of Rs. 1000 lakhs is proposed.

6.41   During the IX and X Plan periods, the Institute had set up research laboratories to service the research and training activities. There is a need to further upgrade these facilities and to develop modern analytical capabilities for dealing with soil, water, plant and animal samples. The Wildlife Health and Wildlife Genetics laboratories set up in the X Plan need to appropriately strengthened. To implement the proposals indicated above, an allocation of Rs. 450 lakhs is proposed.

Chapter 7
PROPOSALS FOR XI FIVE YEAR PLAN

7.1 Forestry research

The following schemes/projects are proposed under the identified thrust areas to address major challenges of Forestry Research in a comprehensive manner

A.1 Indian Council of Forest Research and Education

(i) Development of Agroforestry/Social Forestry Models/ Participatory Forest Management/ Joint Forest Management

- Development of agroforestry models for different agroclimatic zones
- Development of sustainable models for social forestry plantations to meet the food, fuel, fodder requirements of rural poor and tribals
- Evaluation of Forest Development Agencies (FDAs)
- Monitoring of Works under Forest Development Agencies
- Consultancy Projects related to JFM

Total Budget: Rs. 369.80 Lakhs

(ii) Soil and Water Conservation Including Integrated Water-Shed Management

- Assessment of impact of deforestation on soil and water loss from forests
- Development strategies for soil and water conservation in forest areas
- Development package of practices for integrated watershed management

Total Budget: Rs. 150.55 Lakhs

(iii) Planting Stock Improvement

- Development of clonal technologies for mass production of superior quality planting stock and to develop methods for clonal identification using DNA finger printing and other biotechniques

- Genetic improvement of important timber and non timber forest tree species

- Clonal testing and identification

- Establishment of National Bureau of Forest genetic Resources

- Improvement in seed storability of recalcitrant forest tree species

- Research on seed production in clonal / seedling seed orchards

- Research on mass production of healthy superior quality planting stock

Total Budget: Rs. 3307.80 Lakhs

(iv) **Sustainable Forest Management**

- Development of biopesticides for control of important forest diseases and insect pests

- Development of techniques for monitoring of build up diseases and insect pests in natural forests and plantations and their eco-friendly control measures

- Certification of Forest Products particularly medicinal plants, non– timber forest products and quality planting material

- Developing Criteria & Indicators for certification of forest products

- Developing certification strategy of Sustainable Forest Management

Total Budget: Rs. 186.65 Lakhs

(v) **Biodiversity Assessment, Conservation and Development**

- Establishment of preservation plots

- Assessment of forest phytodiversity, threat status of wild plants and necessary action for their conservation

- Establishment of Forest Phytodiversity Network in India

- Research on Indigenous knowledge System

Total Budget: Rs. 616.79 Lakhs

(vi) **Natural Regeneration of Important Species**

- Assessment of current status of natural regeneration of important timber and non-timber forest tree species

- Development of strategies for improving natural regeneration of economically important forest plant species

Total Budget: Rs. 230.57 Lakhs

(vii)   **Control of Weeds and Invasive Species**

- Database creation at National and International level and capacity building to facilitate research and management of forest invasive species

- Development of regional strategies for control of forest invasive species through increased coordination and cooperation among the States Forest Departments and Regional Institutes of ICFRE

- Promote exchange and share information on forest invasive species at National & International level through Asia Pacific Forest Invasive Species Network (APFISN)

Total Budget: Rs. 69.80 Lakhs

(viii)   **Management of Wetlands and Mangrove Forests**

- Assessment of habitat features and phytodiversity of wetlands and mangrove forests

- Development of strategies for the conservation of biodiversity in wetland and mangrove forest ecosystems

Total Budget: Rs. 119.80 Lakhs

(ix)   **Environmental Impact Assessment *vis a vis* Development**

- Explore possibilities to undertake the EIA studies and formulation of EMP for housing societies, Industrial Area Development, Hydro and Thermal Power projects and other developmental projects. Consultancy service in Forestry and Social Environment.

- Training to the various user agencies on EIA

Total Budget: Rs. 369.45 Lakhs

(x)   **Impact of Climate Change and CO_2 Sequestration in Forest Canopies**

- Studies on impact of Climate change on Forest ecosystems and assessment of Carbon sequestration potential of various land use systems for climate Change mitigation.

- Validation and verification process of CDM Afforestation and Reforestation (A&R) projects by acquiring Designated Operational Entity (DOE) status of UNFCCC and Implementation of ISO 9001:2000 QMS.

- Implementation of a CDM A&R Project.

- Capacity building for promotion of CDM A&R Projects by conducting Trainings and workshops for all stake holders.

Total Budget: Rs. 106.65 Lakhs

(xi) **Environmental Amelioration Urban Forestry and Trees Outside Forests**

- Research on bioaesthetic value of wild plants

- Assessment of performance of wild plants under urban environment

- Research on shelterbelts.

Total Budget: Rs. 1308.62 Lakhs

(xii) **Bioremediation and Pollution Control**

- Research on evaluation of bioremediation potential of forest trees, shrubs, herbs, etc

- Development of mitigation strategies in forestry sector to reduce and store green house gases

Total Budget: Rs. 163.00 Lakhs

(xiii) **Ecorestoration of Degraded Forests**

- Ecorestoration of barren/saline/water logged lands

- Ecorestoration of mined forest areas

- Ecorestoration of deserts including sand dune stabilization

Total Budget: Rs. 296.17 Lakhs

(xiv) **Shifting Cultivation**

- Research on social aspects of the practices of shifting cultivation

- Development of alternative cultural practices for poverty alleviation in forest areas under shifting cultivation

<div align="center">**Total Budget: Rs. 59.80 Lakhs**</div>

(xv)   Forest Products Development

- Development of forest products, value addition and improved utilization of forest products

- Development of technologies for improved utilization of wood

- Development of eco-friendly wood preservatives

- Development of new value added wood products

<div align="center">**Total Budget: Rs. 1080.60 Lakhs**</div>

(xvi)   Chemistry of Non wood Forest Produces and Valued Addition

- Research on chemistry of noon wood forest products for value addition and improved utilization

- Development of eco-friendly techniques for pulp and paper production

- Production of specialty and quality paper from indigenous woods

<div align="center">**Total Budget: Rs. 429.50 Lakhs**</div>

(xvii)   Biofuel from Forests

- Research on wild plants having high potential as biofuel resources

- Research on production of biofuel from forest biomass

<div align="center">**Total Budget: Rs. 77.55 Lakhs**</div>

A.2   Research Grant Fund

For providing financial assistance to SAUs, Industry, NGOs, State Forest Departments and other User Groups to conduct research in identified areas of forestry

<div align="center">**Total Budget: Rs. 10,000.00 Lakhs**</div>

A.3   All India Coordinated Phytodiversity Project

Documentation of phytodiversity of the country in collaboration with SAUs, other Universities, NBRI, DBT, DST etc.

<div align="center">**Total Budget: Rs. 5,400.00 Lakhs**</div>

A.4 Establishment of National Bureau of Forestry Genetic Resources (NBFGR)

Total Budget: Rs. 10,020.00 Lakhs

B. ICAR

- Biodiversity data base of MPTS in various regions and their utilizations aspects should be developed for effective planning as well as their introduction into various programmes for enhancing productivity of farming systems.

- Research for making use of ethnic knowledge in grassland and forest ecosystems followed by applied research to obtain intellectual property rights that are capable of benefiting the local communities and the nation.

- Commercial Agroforestry should be encouraged in irrigated areas after identifying proper clones for different agro – climatic and edaphic regions.Rainfed Agroforestry models should be designed for complimenting the rainfed agriculture providing extra income to the farmer and soil conservation.

- Undertaking inventory, characterization and documentation of the available grasslands in the country with a view to add up and update the existing data base.

- Long term research on grassland ecology, invasive species in grassland and forest ecosystems and their control , protected area management through cut and carry options vs grazing management , reintroduction and rehabilitation of species etc. should be undertaken with proper funding.

- Food chain analysis of grassland and forest (that including agro – forest) ecosystems, Carbon sequestration patterns in promising forestry, Agroforestry and grassland systems for its evaluation as well as improvement.

- The management of Agroforestry and silvipastoral systems should revolve around clientele and regional needs with provision of land conservation. Modeling efforts should also focus on the same lines.

- Undertaking soil biology studies in forest and grassland ecosystem to understand their role in sustainability.

- Research on improvement of planting stock of important MP TS for their introduction in silvipasture and Agroforestry based development project Similarly, there should be more emphasis on developing vegetative propagation techniques for mass scale multiplication of elite clones.

- Developing genetic markers for identification of plus strains of promising forestry species as well the MPTS.

- Rehabilitation of disturbed habitats like mined areas and problem soils like saline lands with a variety of tree and grass combinations. More emphasis on short rotation nutritious fodder trees and shrubs for creating fodder resources outside reserve forest lands so that the pressure on forests for forage is lessened.

- Greater focus on scientific collection and handling of forest seeds. their conservation through proper seed storage options , development of ex situ seed orchards.

- More research on prevention and management of invasive species both domestic as well as alien.

- Designing and developing a sound analytical framework accommodating valuation of ecosystem services, both tangible and intangible, and their delivery across social groups .

- Networking of ICAR and ICFRE programmes and scientists where the working areas in forestry related activities are interfacing.

Total Budget: Rs. 1500.00 Lakhs

7.2 Environment Research, Education and Extension

7.2.1 Nature awareness areas and interpretation centers

This innovative and participatory environmental education program can be initiated at any city, town or taluka level place. It is intended to initiate a large mass environmental awareness program especially at school and college level, as well as, for people at large, through direct exposure to Nature in the individuals own natural environment. The scheme envisions setting up a Nature Awareness Area (NAA) with an Interpretation Center and a Nature Trail.

Total Budget: Rs. 150.00 Lakhs

7.2.2 Development of 'Nature Awareness Area' (NAA) for Urban Environments

The management of the NAA must center on permitting Nature to re-establish itself, by removing factors that have led to the development of a man-modified ecosystem. The strategy to manage the area as a small biodiversity demonstration unit

would have to be aimed at reverting the area to near-natural conditions. Sustainable use of such an area could become a focal factor that is demonstrated in the NAA.

Total Budget: Rs. 100.00 Lakhs

7.2.2.1 Selection of possible sites

Forested hill-slopes, grasslands and water-bodies such as wetlands, rivers or seacoasts with natural vegetation are ideal locations. The closer the area to the town, the more easily it could be utilized for day trips by school children. It would also act as an educational asset for field visits to document biodiversity for the UGC's core module course on environment for all undergraduate students as suggested by the Supreme Court. The Nature Awareness Area would include an Interpretation Center and a Nature Trail. The Interpretation Center would provide pictures, module and flow charts, with information that is required to be able to appreciate and identify plant and animal species that are present in the Nature Trail. Booklets to guide school teachers as to what to show the students could be made available. A local Nature Education Officer may be appointed to supervise and coordinate activities with local schools. School teachers could be given orientation courses by institutions. The NAA would bring about a sense of belonging and an attachment to the natural resources within the site.

Total Budget: Rs. 140.00 Lakhs

7.2.2.2 Ecological Management of the NAAs

The management of the NAA is dependent on the landscape ecology of the region.

1.   Size of the proposed areas

It is obvious that the larger the area, the greater would be the diversity of plants, insects, birds and mammals, that is could support. However, where a large area cannot be allocated for this purpose close to a town, even a smaller area can be effectively developed.

In a wetland ecosystem a small pond could harbor insects, fish, amphibia and a few local birds. A small forested patch would attract only 'garden' birds and would be more of a seasonal attraction, when its few trees are flowering and fruiting. A slightly larger patch would attract more specialized forest species such as frugivores, nectivores and insectivores. The contrast between, a part of the area that is left undisturbed, and one which is being utilized sustainably, and the external surrounding landscape that is

essentially degraded could form a major demonstration of logical forms of land use for the region.

2.   Special Site Requirements

(a) Forest Ecosystems: The ideal sites to establish 'Nature Awareness Areas' in forest ecosystems near towns is in nearby hilly areas. An existing temple grove could form an excellent location.

(b) Grassland Ecosystems: Where extensive overgrazing by sheep, goats and cattle has led to the deterioration of natural grasslands, appropriate range land management is essential to reform the natural ecosystem. Such eroded areas which are considered 'wasteland' can thus be restored and developed as 'Nature Awareness Areas' as well as where relevant to demonstrate methods of sustainable utilization.

(c) Aquatic Ecosystems: A 'Nature Awareness Area' in a wetland such as a percolation tank, or a stretch of secluded river outside town have several different habitat characteristics. The water body should be restocked with small local fist, which birds such as cormorants, darters, terns, kingfishers, and birds of prey such as marsh harriers and osprey can be feed on. It mush provide secluded roosts in the form of rocks and islands surrounded by water, so that the waterfowl can rest undisturbed.

(d) Coastal Areas: A variety of ecosystems along the western and eastern coasts can be used as demonstration areas. This includes coastal marshes, sandy breaches, rocky coasts and river deltas.

(e) Himalayan Ecosystems: The fragility of this ecosystem must form a major aspect of understanding land water and forest resources.

(f) Multi-landscape systems: Certain sites could incorporate a variety of landscape elements such as a combination of a forested path around a small water body or a grassland patch with a forest patch.

Total Budget: Rs. 350.00 Lakhs

7.2.3   The Interpretation Centres

The Interpretation Center should be an environmentally friendly structure based on local traditional architectural patterns of the region. It would thus establish the dependence of local people on available resources and demonstrate why they must be used sustainably. It is envisioned that the Interpretation Center should be at least 600 sq. ft. in size and lit by natural light as far as possible. The Interpretation Center should

ordinarily use the local language, for the displays. Most of the visual aids should be simple and direct and focus on local concerns.

Total Budget: Rs.245.00 Lakhs

7.2.4   The Nature Trail

The Nature Trail would have signage linked to the different species of plants and locally resident's faunal communities such as beehives, ant hills, reptiles and birds etc. Signage would provide information on the services and goods that the natural ecosystem provides if used sustainably. Nature Trails would orient visitors to the varied and diverse ecological features of each bio geographic region.

Total Budget: Rs. 200.00 Lakhs

7.3   Regulatory Reforms

The following specific actions would be taken:

- Institutionalize a holistic and integrated approach to the management of environmental and natural resources, explicitly identifying and integrating environmental concerns in relevant cross-sectoral policies, through review and consultation, in line with the National Environment Policy

- Identify emerging areas for new legislation, due to better scientific understanding, economic and social development, and development of multilateral environmental regimes, in line with the National Environment Policy.

- Review the body of existing legislation in order to develop synergies among relevant statutes and regulations, eliminate obsolescence, and amalgamate provisions with similar objectives, in line with the National Environment Policy. Further, encourage and facilitate review of legislation at the level of State and Local Governments with a view to ensuring their consistency with this policy

- Take steps to adopt and institutionalize techniques for environmental assessment of sector policies and programmes to address any potential adverse impacts, and enhance potential favourable impacts.

- Ensure accountability of the concerned levels of Government (Centre, State, Local) in undertaking the necessary legislative changes in a defined time-frame, with due regard to the Objectives and Principles of National Environment Policy, in particular, ensuring the livelihoods and well-being of the poor by ensuring improved access to the necessary environmental resources.

Total Budget: Rs. 50.00 Lakhs

7.4   Process Related Reforms

In addition, the following actions will be taken:

- In order to ensure faster decision making with greater transparency, and access to information, use of information technology based tools will be promoted, together with necessary capacity-building, under all action plans.

- In order to realize greater decentralization, State level agencies may be given greater responsibility for environmental regulation and management. Such empowerment must, however, be premised on increased transparency, accountability, scientific and managerial capacity, and independence in regulatory decision making and enforcement action. Accordingly, States would be encouraged to set up Environment Protection Authorities on this basis

- Mechanisms and processes would be set up to identify entities of "Incomparable Value" in different regions. It would be ensured that all regulatory mechanisms are legally empowered to follow the principles of good Governance

Total Budget: Rs. 50.00 Lakhs

7.5   Economic Principle in Environmental Decision Making

The following actions will be taken:

- Strengthen, including through capacity building, the initiatives, taken by the Central Statistical Organization in the area of natural resource accounting, with a view to its adoption in the system of national income accounts. Further strengthen in all respects, the system of collection, collation and analysis of all significant and relevant environmental monitoring data.

- Develop and promote the use of standardized environmental accounting practices and norms in preparation of statutory financial statements for large industrial enterprises, in order to encourage greater environmental responsibility in investment decision-making, management practices, and public scrutiny.

- Encourage financial institutions to adopt appropriate appraisal practices, so that environmental risks are adequately considered in the financing of projects.

- Facilitate the integration of environmental values into cost-benefit analysis, to encourage more efficient allocation of resources while making public investment decisions.

- Prepare and implement an action plan on the use of economic instruments for environmental regulation in specified contexts, including those relating to unsustainable production and consumption

- Consider creation of a National Environment Restoration Fund from the net proceeds of economic instruments, user fees for access to specified natural resources, and voluntary contributions. The Fund may be used for restoration of environmental resources, including clean-up of toxic and hazardous waste legacies.

7.6 Other Proposals and Action Plans

- Periodically identify and prioritize areas for research.

- Establish a research programme in priority areas within the Government, with expected outputs clearly specified.

- Encourage research in priority areas outside the Government, with necessary financial and institutional support.

- Avail of multilateral and bilateral cooperation programs, for capacity building for environmental management, particularly in relation to commitments under multilateral instruments.

- Participate in mechanisms and arrangements under multilateral agreements for enhancing flows of resources for sustainable development.

- Provide assistance to other developing countries, in particular for scientific and technical capacity building for environmental management.

- The following provisions are, accordingly made for review, updating, and renewal of the National Environment Policy

- Undertake consultations every three years with groups of diverse stakeholders, i.e. researchers and experts, community based organizations, industry associations, and voluntary organizations, and update the National Environment Policy.

- In the third of the three-year reviews, undertake a more comprehensive examination of the scientific and policy understanding of environmental issues, redefine the Objectives and Principles, and recast the Strategic Themes for Action. Anew National Environment Policy should be the outcome.

Total Budget: Rs. 1500.00 Lakhs

D   Training And Capacity Building

A.   The new composite scheme may be called as **"Capacity Building in the Forestry Sector"**.

B.   The components of the new composite scheme are:

I.   Indira Gandhi National Forest Academy, Dehradun – **existing**

II.   The Directorate of Forest Education may be renamed as 'Regional Forest Academies' – **existing**

III.   In-service training

(a)   Training of IFS officers- **existing**

(b)   Training of officers/personnel of other Services – **proposed**

IV   Domestic funding for foreign training of forestry personnel – **proposed**

V   Capacity building of other stakeholders – **proposed**

Proposed components of the scheme

I   Indira Gandhi National Forest Academy, (IGNFA) with mandate to

- Conduct initial professional training for the IFS probationers – **existing**

- Skills up-gradation courses for the promoted IFS officers – **existing**

- Organizing in-service refresher training courses for the IFS officers of various seniorities-Advance Forest Management (AFM) courses – **existing**

- Organizing seminars/workshops on various themes for forest officers and sponsored courses for officers of other services – **existing**

- Knowledge management for the forestry sector – **existing**

An amount of **Rs. 1913.91 lakhs** would be required for completing the various programmes under this component.

II   Regional Forest Academies (RFAs) with mandate to

- Conduct professional induction courses for the direct recruit SFS officers and the FROs recruited by the State Governments, in the SFS and Ranger Colleges under the directorate-**existing**

- Conduct in-service refresher courses for the forestry personnel (SFS officers, FROs and the frontline staff) of the SFDs for boosting the capacity building efforts of the States and sponsored courses for the personnel of other services-**existing**

- Organizing seminars/training workshops for various levels of forestry personnel.-**existing**

- Refresher courses for the promoted SFS officers-**existing**

- Upgradation of training capabilities (training materials, training of trainers, training methodology etc.) and infrastructure facilities for training of frontline staff (taking one State Training Institute in each region of the country as Nodal Training Institute.)-**proposed**

An amount of **Rs. 2426.74 lakhs** would be required for completing the various programmes under this component.

III   In-service Training

a)   Training of IFS officers

- To sponsor short-term (one to three week) refresher courses – **existing**

- Training workshops/seminars in the premier training and academic institutions/organizations in the country – **existing**

- To sponsor a few IFS officers for long-term training courses and institutions approved by the Government of India (*in institutions like Indian Institute of Public Administration, National Defence College, Indian Institutes of Management, Management Development Institute, The Energy and Resources Institute etc.*) – **existing**

  An amount of **Rs. 1526.24 lakhs** would be required for completing the various programmes under this component.

b)   Training of Officers/Personnel of Other Services – Rationale for organizing in-service training for personnel of other services has been explained earlier. Personnel of Police, Revenue, Customs, Agriculture, Horticulture, Soil Conservation, Animal Husbandry, Tribal/Rural Development, Judiciary, Public Health Engineering etc., have an interface with forestry sector. Sensitization of these departments through in-service training of their personnel will be covered under this component. It is proposed to include awareness programmes in the form of short-term trainings, study tours, seminars and workshops in the institutions under the government as well as in the private sector. The

trainings can be organized at two levels one for the senior officers (group A/class I) at IGNFA/LBSNAA/WII/Customs Academy or any other reputed training institute and the other one for the class II/class III state level officers at the State ATIs/Forest Training Institutes (Regional) and institutions under ICFRE etc. Adequate budgetary provision has been proposed for organizing/sponsoring courses for this category of personnel. For participation in these courses, a provision has been kept for meeting expenses on TA/DA in the budget proposals. An amount of **Rs. 1770.47 lakhs** would be required for completing the various programmes under this component.

IV   Domestic Funding for Foreign Training of the Forestry Personnel

Present-day foresters have to deal with non-technical issues e.g. inter-sectoral policy and programme linkages. Also, the forestry personnel need to keep themselves abreast of the technological advances in the fast changing world to address the changing requirements of the developing societies as well as the various global, regional national and local environmental concerns. It is important that officers from IFS and SFS are provided opportunities to learn and to present their views at international events related to forestry sector. Presently there is no scheme for providing opportunities to forest officers working in the States and under the Central Staffing Scheme of MoEF for IFS officers/ autonomous forestry institution of the MoEF, for undergoing courses/ participating in study tours/workshops in foreign institutions organizations. A provision has been made in the scheme for foreign training of IFS and SFS Officers and also for providing opportunities to them (including the FROs) for participating in international seminars, workshops and study tours abroad on emerging issues and challenges in forestry sector. An amount of **Rs. 7631.37 lakhs** would be required for completing the various activities under this component.

V   Capacity Building of Other Stakeholders

Forest Management in India is in a transitory stage moving from traditionally centralized forest management to participatory forest management. In traditional system of control, regulations and policing the forests have alienated the people from developing a sense of belonging to the forests. There is a need to sensitize other stakeholders for conservation of these natural resources. It is proposed to sponsor a number of specially designed short-term courses, study tours, workshops and seminars on various aspects of forest and environmental conservation for different stakeholders which may include NGOs, students in educational institutions, nature clubs/eco-clubs, Panchayats, elected public representatives, personnel from banking institutions, social activists, press and media persons etc. However, due to financial constraints it may be not be possible to

reach all the target groups. An amount of **Rs. 1220 lakhs** would be required for the various activities under this component.

21   The 'Task Force' discussed the need for strengthening of the Forestry Research and Training Division in the MoEF and in other training institutions of the MoEF for successful implementation of the additional components. Till the time new additional posts are created, it was decided to keep some provision in the scheme for outsourcing of services. Further, for better coordination and pooling of resource persons and infrastructure among the existing forestry training institutions, the 'Task Force' recommends that the MoEF may consider bringing all the institutions in the field under one umbrella. This may be considered while formulating proposals for the composite scheme.

VI   Outsourcing the Resource Persons/Consultants for Managing the Components III, IV & V (2% of the expenditure) Rs. 243 lakhs

VII   Contingency Fund/Critical Gaps (to Meet the Unforeseen Expenditure, 2% of the Total Expenditure) Rs. 330 lakhs

The total requirement of funds for the proposed scheme (only for the training component) would be Rs. 17061.73 lakhs

Financial Implications under the Scheme for the XI Plan period
(2007-08 to 2011- 12)

<div align="right">(Rupees in lakhs)</div>

(The proposals here have been restricted to only training component and do not include provisions for other activities such as capital works, medical expenses, domestic travel for faculty, foreign travel expenses etc. The non-plan budget also has not been shown in the proposals. 10% annual escalation has been shown for the plan period in the budget proposals)

Annexure I

I.   Indira Gandhi National Forest Academy

<div align="right">(Expenses /year)</div>

(a.)   Initial Professional Training of the IFS Probationers   135.00 lakhs

(b.)   Professional Skills Up-gradation Courses (PSUC)   2.50 lakhs

(c.)   I Conduct of In-service Advanced Forest Management   120.00 lakhs
       Courses (AFMC)

(d.)   Senior Foresters Workshops (25/30 years)
       (Two for a group of 50 (appox.) participants each)   6.00 lakhs

(e.)   Knowledge Management for the Forestry Sector   50.00 lakhs

<div align="right">***Grand Total for five years = 1913.91 lakhs***</div>

	Components	Financial Requirements					Total
		(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
1.	Initial professional training of the IFS (P)	135.00	148.50	163.35	179.68	197.64	824.17
2.	PSUC	2.50	2.75	3.02	3.32	3.65	15.24
3.	AFM Courses	120.00	132.00	145.20	159.72	175.69	732.61
4.	Workshops (SFWs)	6.00	6.60	7.26	7.99	879	36.64
5.	KMS	50.00	55.00	60.50	66.55.	73.20	305.25
	Total	313.50	344.85	379.33	417.26	458.97	1913.91

II   Regional Forest Academies

(a.)   Induction Courses for SFS officers and FROs   30.00 lakhs

(b.)   (Two-week Refresher Courses for SFS officers & FROs and
        150 Courses for Frontline Staff)   300.00 lakhs

(c.)   Six-week Courses for Promoted SFS officers   10.00 lakhs

(d.)   Up-gradation of State Forest Training Institute (Regional Level)   40.00 lakhs

(e.)   Sponsoring officers (SFS & FROs) for Long-term Courses
        recognized by the GOI – 05 officers/year
        (@ Rs. 03.50 lakh/person)   17.50 lakhs

Sl. No.	Components	Financial Requirements					Total
		(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
1.	Induction Courses for SFS and FROs	30.00	33.00	36.30	39.93	43.92	183.15
2.	Short-term Courses for SFS & FROs and Frontline Staff	300.00	330.00	363.00	399.30	439.23	1831.53
3.	Six-week Induction Courses for Promoted SFS officers	10.00	11.00	12.10	13.31	14.64	61.05
4.	Up-gradation of State Training Institutes (Regional level)	40.00	44.00	48.40	53.24	58.56	244.20
	Sponsoring officers (SFS & FROs) for long-term courses	17.50	19.25	21.17	23.28	25.60	106.81
	Total	397.50	437.25	480.97	529.06	581.95	2426.74

III(a) In-service Training of IFS Officers *(within India)*

a. Short-term refresher courses

Forty *one-week* courses
(20 courses @ 2.5 lakhs/course (50 lakhs), 20 courses @ 3.63 lakhs/course (A) (72.6 lakhs),

Ten two-*week* courses
(05 courses @ 4.75 lakhs/course (A) (23.5 lakhs), 05 @ 3 lakhs/course (G) (15 lakhs)

161.00 lakhs

b. Thematic training workshops   20 @ 2.70 lakhs/workshop

54.00 lakhs

c. Sponsoring officers for Long-term Courses recognized by the GOI –
10 officers/year (@ Rs. 03.50 lakhs/person)

35.00 lakhs

Sl. No.	Components	Financial Requirements					Total
		(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
1.	In-service courses	161.00	177.10	194.81	214.29	235.71	982.91
2.	Thematic Workshops	54.00	59.40	65.34	71.87	79.05	329.66
3.	Sponsoring officers for long term courses	35.00	38.5	42.35	46.58	51.24	213.67
	Total	250.00	275.00	302.50	332.74	366.00	1526.24

III(b) In-service Courses for Personnel of Other Services

III b(1) Senior personnel

1) **One week courses @ 30 participants**
   - 25 courses in Central / State Government/ Autonomous Institutions, @ (average) Rs. 3.10 lakhs
   - TA for the participants @ Rs 15,000 = Rs. 4.50 lakhs
   - Total per course 3.10 lakhs + 4.50 lakhs = 7.60 lakhs X 25 courses = 190 lakhs

2) **Two/Three-day workshops @ 2.5 lakhs X** 20 Workshops = Rs. 50 lakhs

Sl. No.	Component	Work shops	Financial Requirements					Total
			(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
1.	One-week Courses	25	190.00	209.00	229.90	252.89	278.179	**1159.969**
2.	Two/Three-day Workshop	20	50.00	55.00	60.50	66.55	73.20	**305.25**
	Total	**45**	**240.00**	**264.00**	**290.40**	**319.44**	**351.379**	**1465.219**

III (b) (2) Class II/III personnel

Sl. No.	Component	Duration	No. of courses	Financial Requirements					Total
				(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
1.	One-week Courses for Class II/III officers	One week	20	50.00	55.00	60.50	66.55	73.20	305.25

Grand Total (III (a) + III(B) I + III (b) II) = 1526.24 + 1465.22 + 305.25 = 3296.71

IV. Domestic funding for Foreign Training of Forestry Personnel

(a)   **Short term courses** – 80 officers/year @ (average) Rs. 12.50 lakh = 1000 lakhs (For ACF/DCF /CF/CCFs)

(b)   **Long term courses –** 10 officers/year @ (average) Rs 20 lakh = 200 lakhs

I   Sponsoring officers (IFS, SFS, FROs) for participating in the international workshops/seminars/meeting/study tours @Rs.2 lakhs (approx.) for 25 officers = 50 lakhs.

Component	Financial Requirements					Total
	(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
Long-term and Short-term Courses	1200.00	1320.00	1452.00	1597.20	1756.92	7326.10
Sponsoring forestry personnel for participating in International Workshops	50.00	55.00	60.50	66.55	73.20	305.25
Total	1250.00	1375.00	1512.50	1663.75	1830.12	7631.37

V   Capacity building of other stakeholders

- Other stakeholders – *(Civil society organizations including NGOs, public representatives, social activists, educational institutions, nature-clubs/eco-club, panchayats, press & media persons etc.)* – field visits, workshops, seminars, short-training courses etc.

a. Integrated Outdoor Bound Management Programmes (workshops, seminars, training courses/exposure visits) – 40/year @ 2.5 lakh/event - Rs. 100 lakh

b. Study Visits for creating Awareness – visit to best practices/study visits 100/per year @ 1.00 lakh/event Rs. 100 lakhs

Programme	Financial Requirements					Total
	(2007-08)	**(2008-09)**	**(2009-10)**	**(2010-11)**	**(2011-12)**	
Integrated outdoor bound management Programmes	100.00	110.00	121.00	133.00	146.00	610.00
Study Visits for creating awareness	100.00	110.00	121.00	133.00	146.00	610.00
Total	200.00	220.00	242.00	266.00	292.00	1220.00

Total: Rs.16488.73 lakhs

Proposed budget allocation for the Eleventh Five Year Plan

(Rupees in lakhs)

S. No.	Component	Year-wise allocation					Total
		(2007-08)	(2008-09)	(2009-10)	(2010-11)	(2011-12)	
1	IGNFA	313.50	344.85	379.33	417.26	458.97	1913.91
2	RFAs	397.50	437.25	480.97	529.06	581.95	2426.74
3	In-service Training						
(a)	Training of IFS officers	250.00	275.00	302.50	332.74	366.00	1526.24
(b)	Courses for Senior Personnel of Other Services	240.00	264.00	290.40	319.44	351.379	1465.219
I	Class II/III Personnel of Other Services	50.00	55.00	60.50	66.55	73.20	305.25
4	Foreign Training of Forestry Personnel	1250.00	1375.00	1512.50	1663.75	1830.12	7631.37
5	Training of Other Stakeholders	200.00	220.00	242.00	266.00	292.00	1220.00
	Sub Total	2701.00	2971.10	3268.21	3594.80	3953.62	16488.73
6	Outsourcing of Services						243.00
7.	Contingencies/ Critical Gaps						330.00
8.	Grand Total						17061.73 Or 17062

Institutions for Organizing/Sponsoring Courses for the Personnel of Other Services

S. No.	Name of the Institute
1.	Indian Council of Forestry Research & Education, Dehradun and its institutes
2.	Indian Plywood Industries and Training Institute, Bangalore
3.	Wildlife Institute of India, Dehradun
4.	Forest Survey of India, Dehradun
5.	Indian Institute of Forest Management, Bhopal
6.	Centre for Environmental Education, Ahmedabad
7.	Indira Gandhi National Forest Academy, Dehradun
8.	National Academy of Customs, Excise and Narcotics (NACEN), Faridabad
9.	Tata Energy Research Institute, Delhi
10.	Institute of Rural Management, Anand
11.	Indian Institute of Public Administration, Delhi
12.	National Police Academy, Hyderabad
13.	Lal Bahadur Shastri National Academy of Administration, Mussoorie (LBSNAA)

List is not exhaustive and will be updated as and when required

D. Wildlife Research, Training and Education

(i) Wildlife Training and Academics

Building capacity to manage wilderness resources through effective training programmes for various target groups and developing human resources through Master degree programme in Wildlife Science are the major mandates of the Institute. In order to rapidly build capacity it is proposed to conduct customized training programme for various target groups (forest and wildlife managers; para military and enforcement agencies; custom and revenue officials etc.) of varying duration at headquarters as well as in field locations in national parks and wildlife sanctuaries.

It is also necessary to sensitize the judiciary, politicians, senior administrators, armed forces about various facets of wildlife conservation through short-term training programmes. Currently, the Institute is offering a Master degree programme in Wildlife Science every alternate year with a limited intake of 10 students. In response to the growing demand for trained manpower it is proposed to offer this course every year; increase the number of seats; diversify this course into an integrated six-year course leading to a doctorate degree and introduce greater flexibility in both curriculum design and delivery of the course. To implement the proposals indicated above in, an enhanced allocation of Rs. 1250 lakhs is proposed.

(ii) Research Programme

The Institute has recently developed a *'Research Priority Matrix'* based on a landscape approach. A review of research priority has indicated several *'gap'* areas. New thrust areas have also been identified in consultation with the stakeholders. In order to meaningfully address the wildlife research needs of the country, the Institute's research agenda has to be substantially enhanced. There is a need to conduct *'status surveys'* of key species especially those which have become endangered and are involved in wildlife trade. e-Knowledge portals have also to be developed for rapid and effective dissemination of data and information on wild species status, distribution and threats and on the species and the products involved in wildlife trade. Long term research on key species in identified landscapes have to be initiated/ continued using modern tools and technology (remote sensing, GIS, GPS, satellite telemetry etc). To implement the proposal indicated above, an allocation of Rs. 1500 lakhs has been proposed.

(iii) National Wildlife Library and Documentation Centre

It is proposed to set up a National Wildlife Library and Documentation Centre in the XI Plan period. This would entail upgradation and further modernization of the

existing library facilities. Efforts will be made to establish digital libraries through subscription of e-journals. It is proposed to provide cubicles with computer facilities inside the library to be used by visiting academics and senior researchers. A range of *'value added'* services will be offered to various users for which manpower and financial resources in the library and documentation centre will have to be augmented. To implement the proposals indicated above, an allocation of Rs. 450 lakhs is proposed.

(iv)   Computer & GIS Centre

The importance of state-of-the-art computer facilities in a training and research institution cannot be over-emphasized. From VIII Plan onwards, the Institute has made considerable investment in setting up of a modern computer & GIS facility. This facility has to be continuously upgraded to keep abreast with latest technology advancements. The huge quantity of data gathered during the All India Tiger Population Estimation needs to be properly stored and retrieved using a modern Information Storage System using sophisticated computer hardware and software systems. It is also proposed to extend the existing local area network to a wi-fi system across the sprawling Institute's campus covering various hostels, guest houses and faculty residences. To implement the proposals indicated above, an allocation of Rs. 450 lakhs is proposed.

(v)   Strengthening Wildlife Forensic Facility

During the X Plan period the Institute has set up a modern wildlife forensic facility in response to the growing need for identifying the species and their parts/ products involved in wildlife trade. Apart for analyzing the samples received on the basis of morphometry techniques for which the Institute has developed basic protocols and infrastructure, there is a need to strengthen the wildlife forensic capability by establishing a state-of-the-art DNA facility for developing DNA profiles of key species and using modern techniques for analyses of specimens received in wildlife offence cases from various enforcement agencies. It is proposed to set up a Central Wildlife Forensic Facility (CWFF) at the Institute during the XI Plan period along with four Regional Wildlife Forensic Laboratories in Regional Wildlife Warden offices in Delhi, Kolkata, Mumbai and Chennai. The CWFF will mainly be the R&D centre to develop and standardize various techniques and protocols for identifying plant and animal parts and products involved in wildlife trade. In order to meet the safety, security and sanitation issues relating to wildlife forensic analyses, it is proposed to construct a separate building to house the forensic facility. To implement the proposals indicated above, an allocation of Rs. 1000 lakhs is proposed.

(vi)   Strengthening Wildlife Research Laboratories

During the IX and X Plan periods, the Institute had set up research laboratories to service the research and training activities. There is a need to further upgrade these facilities and to develop modern analytical capabilities for dealing with soil, water, plant and animal samples. The Wildlife Health and Wildlife Genetics laboratories set up in the X Plan need to appropriately strengthened. To implement the proposals indicated above, an allocation of Rs. 450 lakhs is proposed.

(vii)   Establishment Expenses

In order to meet the salary and wages and other benefits Institute's permanent and contractual staff, travel and office expenses etc. an allocation of Rs. 1600 lakhs is proposed.

(viii)   Strengthening of Academic and Other Infrastructure

In order to fulfill the Institute's growing mandate of strengthening wildlife conservation, there is a need to strengthen the academic infrastructure in form of research laboratory buildings, hostels for researchers and students and international student/ trainees. Similarly, faculty houses, staff quarters, community centre etc. have also to be added in the campus. The repair and maintenance cost of buildings, internal roads, air conditioning units, power generators etc have to be met. To implement the proposals indicated above, an allocation of Rs. 2200 lakhs is proposed.

Broad Budget Break-up of Activities proposed in the XI Plan

1.   Wildlife Training & Academics

S.No.	Activity	Amount (in lakhs)
1	Conduct of 9 months PG Diploma Course	300
2	Conduct of 3 months Certificate Course	150
3	Conduct of 2 years M.Sc. Course in Wildlife Science	150
4	Conduct of Customized Training Programmes	250
5	Activities of Specialized Cells and Activities related to Wildlife Conventions/ Treaties (CBD/ CMS/ CITES/ CMS/ IWC etc.)	400
Total		1250

2.   Research Programme

S.No.	Activity	Amount (in lakhs)
1	Ongoing Wildlife Research Projects	750
2	New Wildlife Research Projects	600
3	e-Knowledge Portal	150
Total		1500

3.   Establishment of National Wildlife Library & Documentation Centre

S.No.	Heads	Amount (in lakhs)
1	Procurement of Books	100
2	Subscription of Journals	150
3	Subscription of Electronic Resources	165
4	Upgradation of Bar Code Technology	50
5	Procurement of Hardware and Software	30
6	Training of Library Professionals	5
Total		500

4.   Strengthening of Computer/GIS Centre

S.No.	Heads	Amount (in lakhs)
1	Upgradation/Procurement of Computer Systems & Peripherals	250
2	Software License Renewal/Purchase/Service Support	175
3	Network/ Wi-Fi enhancement	25
4	Subscription/Upgradation of Internet Leased line connectivity	35
5	Skill enhancement of computer staff including participation in workshops/seminars	15
Total		500

5.   Strengthening of Wildlife Forensic Facility

S.No.	Activity	Amount (in lakhs)
1	Ongoing Wildlife Forensic Research and Development Activities	162
2	Construction of new Wildlife Forensic Laboratory Building	140
3	Procurement of Equipment and Analytical Tools	698
Total		1000.00

6. Strengthening of Wildlife Research Laboratories

S.No.	Activity	Amount (in lakhs)
1	Procurement of Analytical Equipments & Tools	300
2	Procurement of Glassware, Chemicals, etc.	100
3	Equipment Maintenance and Support	50
Total		450.00

E.   Forestry Education

Physical and Financial Targets during the XI Five Year Plan

(i)   Grant-in-Aid to the Universities

The ICFRE, pursuant to its mission objectives, provides grants to develop technical capabilities and strengthen infrastructure for forestry faculties in the Universities imparting Forestry Education at the Graduation and Post-Graduation levels. ICFRE has developed suitable norms for providing Grant-in-Aid to these universities. 26 Universities including F.R.I. Deemed University are recipient of the Grant-in-Aid, as of now. With the popularization of these professional courses in the Universities, greater support would be needed by these Universities in making infrastructure to run these courses for meeting the subject driven deemed for the professionally qualified manpower in the sector.   A provision of Rs.4800 lakhs is proposed for the XI Five Year Plan in Grant-in-Aid to Universities.

Financial Targets

(Rs. In Lakh)

2007-08	2008-09	2009-10	2010-11	2011-12	Total
600.00	800.00	1000.00	1200.00	1200.00	4800.00

(ii)   H.R.D. Programmes

The Scientists joining ICFRE at Scientist –B level come from different streams such as chemistry, zoology, Bio-technology, genetics etc. To introduce these newly recruited scientists to the basic forestry, the Directorate of Education in ICFRE organizes training on "Basic Forestry" for them. Further knowledge of forestry & new technical issues emerging in the field of forestry for our Scientists working in the Institutes also require to be updated from time to time.. These courses would enable them to appreciate areas of forestry research and from practical point of view and provide them adequate orientation towards field related problems.

Besides, an advance course on "Research Methodologies and Managements" would be organized for senior scientists, by out-sourcing it to premier Institutes of Research and Management such as IARI/ ASCI etc. This will provide them an insight to all the aspects of research management including project management, socio anthropological & marketing research etc. and would enable them to undertake forestry research on the principles of sound scientific principles. The course on Research methodology would provide knowledge on statistical tools and techniques as applied to forestry research, experimental design, testing of hypothetic Analysis, of variance etc.

The ICFRE being the apex body of Government of India, dealing in the field of Forestry Research and Education. It employs nearly 2300 personnel. The ministerial staff not only deals with establishments related matters but also handles accounts, procurement of stores & inventory, contracts and other financial transactions related to consultancy services etc. As such it is necessary to hone up their skills and knowledge related to rules and regulations, standing instructions from the Government, drafting and vetting of agreements, contracts etc. It is proposed that staff at various level in group B & C categories shall be provided training through recognized institutes in office procedures, rules/ regulations and other related matters, once in five years so that they get opportunities to continuously upgrade their skills.

The need to build capacity of Officers and Scientists in conformity with global levels is felt to deal with contemporary issues efficiently. This shall be achieved by foreign training courses for Officers and Scientists. It will enhance capacity to keep pace with new technological advancements and help achieve objectives of ICFRE. Three foreign training programmes (30 persons) are proposed annually at a total cost of Rs. 500 lakh for the XI Five Year Plan period.

Physical and Financial Targets

(Rs. In Lakh)

Sl. No.	Training	No. of Training Courses	Amount per year	Amount for 5-years
1	Basic Forestry	4	16.00	80.00
2.	Research Methodology	4	32.00	160.00
3.	Refreshers Courses for Group B & C	4	14.00	70.00
3.	Foreign Training	3 (30 persons)	100.00	500.00
Total			162.00	810.00

F. Forestry Extension

Physical and Financial Targets during XI Five Year Plan.

(Rs in Lakh)

Sl. No	Items of Work	2007-08	2008-09	2009-10	2010-11	2011-12	Total
1.	Mass Media Campaign	160.00	160.00	160.00	160.00	160.00	800.00
2.	Establishment of VVKs	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	5,000.00
3.	Stake holders Meeting for Transfer of Technologies Workshops, Seminars	160.00	160.00	160.00	160.00	160.00	800.00
4.	Publicity Van & Extension Equipment	110.00	110.00	220.00	40.00	40.00	520.00
	Total	1,430.00	1,430.00	1,540.00	1,360.00	1,360.00	7,120.00

SUMMARY OF RECOMMENDATIONS

A.   GENERAL

- Each important scheme/programme requires input of research as it encounters problems during its course of implementation. It is, therefore, essential that every sizable scheme/programme has an inbuilt component of research. This would facilitate mobilization of more resources for carrying out project related research.

- Apex environment and forestry research bodies like ICFRE ought to make use of strengths and capabilities of the SAUs, private sector and NGOs to pursue national research agenda. In other words, apex organizations like ICFRE should be technically and financially capable to farm out research to partner entities like SAUs, industry and NGOs. A Research Grant Fund (RGF) may be instituted for the purpose.

- Forestry and environment research by its very nature is multi-disciplinary and multi- sectoral. The research initiatives, therefore, in the sector need to be coordinated at the conception, formulation and implementation stage at the highest level. This would require exchange of adequate and appropriate information amongst all the research stakeholders, and ultimately lead to integration and dovetailing of the objectives of their strengths and capabilities. All India Forestry/Environment Coordinated Research Programmes on themes of multisectoral interest coordinated by ICFRE are intended to be launched.

- The research programmes and schemes should be flexible as well as rolling in nature. Based on regular evaluation and monitoring of progress, there should be provision of intermediate course correction of as also for continuance or strengthening or termination of the schemes.

- Bottom up approach in research is the need of the hour with essential provision for proper input from local community projecting its research requirements. This will make research programmes people centric, and usable and adaptable by the community.

- It is well understood now that research pertaining to natural resources should be carried out at ecosystem level. This holistic research approach is essential for understating the sum total effect of individual elements of the ecosystem and for replication of research results. The researches of environment and forest sector

should not be done in isolation but in a holistic manner taking into account the influences and interaction of other natural elements and resources.

- System of quinquennial review (QR) of the research projects should be introduced which should be undertaken by a committee of outside experts in respect of each research institute, as also in respect of important research projects/programmes of the ICFRE/CPCB/individual institutes. An expert committee may be constituted to critically examine the findings of the QR, and make suitable recommendations.

B.   FORESTRY AND WILDLIFE RESEARCH

- Forestry research is required to be in tune with the national priorities. It, therefore, requires reorientation to be of use and utility to the farmers and rural communities. Forestry research needs to reorient itself to fit into the national priorities, e.g., poverty alleviation, literacy and drinking water supply. This would mean focus on farmers and communities to enable them produce more from their landholdings, and consequently earn more. The research would, thus, need to be focused on integrating planting of trees and other non-traditional herbs and shrubs with the traditional agricultural crops with overall aim of increasing useful biomass production.

- Apex environment and forestry research bodies like ICFRE ought to make use of strengths and capabilities of the SAUs, private sector and NGOs to pursue national research agenda. In other words, apex organizations like ICFRE should be technically and financially capable to farm out research to partner entities like SAUs, industry and NGOs. A Research Grant Fund (RGF) may be instituted for the purpose.

- Environmental services generated by forests including watershed protection, biodiversity conservation and carbon sequestration need to be quantified and appropriately valued. Appropriate research needs to be commissioned for quantification and valuation of the forests. Research also needs to be initiated to develop a recognized system and set of processes and procedures for proper valuation of the services from forests to enable proper accounting of such services in the national economy. Valuation exercise must encompass the spectrum of forest types, soils, topography and other related parameters, and different combinations thereof.

- There is need to develop legislative framework to regulate the availability of good quality planting material in the market on the lines of Seed Act of the agriculture sector. The legislative framework would need to be supplemented by research on

development of cost effective protocols and technologies for mass propagation of planting stock.

- Each important scheme/programme requires input of research as it encounters problems during its course of implementation. It is, therefore, essential that every sizable scheme/programme has an inbuilt component of research. This would facilitate mobilization of more resources for carrying out project related research.

- Realizing the future prospects of value of biodiversity, it is essential that the Phytodiversity of the country be properly documented in a structured format with predefined information parameters. ICFRE should launch an All India Coordinated Phytodiversity Network Project for the purpose.

- To take care of the issues relating to import, export, trade and exchange of forest genetic materials, it is proposed to establish a National Bureau of Forest Genetic Resources (NBFGR) on the lines of NBPGR.

- Forestry and environment research by its very nature is multi-disciplinary and multi- sectoral. The research initiatives, therefore, in the sector need to be coordinated at the conception, formulation and implementation stage at the highest level. This would require exchange of adequate and appropriate information amongst all the research stakeholders, and ultimately lead to integration and dovetailing of the objectives of their strengths and capabilities. All India Forestry/Environment Coordinated Research Programmes on themes of multisectoral interest coordinated by ICFRE are intended to be launched.

- The research programmes and schemes should be flexible as well as rolling in nature. Based on regular evaluation and monitoring of progress, there should be provision of intermediate course correction of as also for continuance or strengthening or termination of the schemes.

- Bottom up approach in research is the need of the hour with essential provision for proper input from local community projecting its research requirements. This will make research programmes people centric, and usable and adaptable by the community.

- It is well understood now that research pertaining to natural resources should be carried out at ecosystem level. This holistic research approach is essential for understating the sum total effect of individual elements of the ecosystem and for replication of research results. The researches of environment and forest sector should not be done in isolation but in a holistic manner taking into account the influences and interaction of other natural elements and resources.

- Forestry research needs to move from the bounden of traditional silviculture to the realm of community welfare by focusing more on subjects, practices and problems that directly affect the economic well being of the local community. This would mean initiating and giving impetus by application of forestry science, to the research related to increasing productivity of private and community landholdings, removing or rationalizing barriers to the marketing and utilization of tree/forest produce, and developing management models of JFM based on the experience gained.

- There is need to channelize forestry research into development of simple technological packages that could easily be adopted by the farming community for supplementing its income. The packages could relate to establishment of nursery for raising quality planting stock, incorporating tree component with agricultural crops, soil improvement, value addition to NTFP, legislative and regulatory measures to promote tree planting on private lands etc.

- Present policy and legislative prescriptions need to be reviewed, analyzed, researched and adjusted to suit the changing developmental perspectives and scientific knowledge. This analysis can also be used to develop synergies between different statutes and to remove obsolescence, as also to decide upon the degree of decentralization of the particular statute. Research studies may also be launched to streamline the processes and procedures for statutory forestry clearances.

- Indian Council of Forestry Research and Education (ICFRE) and its institutes should also focus on basic research, and on research relating to national or regional priorities and problems which cannot be handled by State Forest Research Institutions (SFRIs), such as genetics and tree breeding, wood science and technology, forest hydrology, chemistry of forest products and their utilization, bio-pesticides, global warming, biodiversity conservation and management, forest sociology including participatory management, and forest economics. Strong linkage should be ensured between SFRIs, ICFRE institutes and agricultural universities undertaking forestry research in the same State. Networking of scientists working in these research organizations on common problems needs to be ensured.

- Long-term research on grassland ecology, fire, flood, invasive species, forest regeneration, wildlife diseases, inter-relationships and inter-dependence of species, groups and habitats, multidisciplinary integrated research encompassing scientific and socioeconomic aspects related to protected area management, reintroduction, rehabilitation, captive breeding of species, etc. should be undertaken in different eco-regions with proper funding by the government and

with provision of facilities by the Forest Department. Research for making use of ethnic knowledge in wildlife conservation and management, and applied research to obtain intellectual property rights capable of benefiting the local communities and the country, should receive special attention.

- There is a need to evolve proper standards for transportation of planting material, to reduce mortality during transit. A concept of cold chain needs to be developed and implemented to prevent loss during transit. Besides, proper packing, handling, storage and transit facilities also need to be developed and standardized.

- Ecological relations of species with their environment should be documented, and ecological keystone species in major forest types should also be identified.

- Key agents in biogeochemical cycles and energy flow chains should be identified, and quantification of the rates of nutrient and energy transfers should be ascertained.

- Genetic markers for identification of plus strains of important tree species for forestry and utilitarian purposes should be developed.

- Soil processes in forest ecosystems, particularly aboveground - belowground interactions including role of mycorrhizae in forest regeneration and rehabilitation should be studied, and indicators of soil quality be identified, and documented.

- Carbon sequestration of degraded forests using forestry practices should be improved, and carbon sequestration by major forest types be evaluated.

- The role of coarse woody debris in forest regeneration/restoration should be determined.

- Pollutant sensitivity of major tree species and the response of forest to carbon dioxide and nitrogen enrichment should be determined. Also, the impacts of toxins and pollutants in perturbing biogeochemical cycles be studied.

- Tree species for urban forest in different agro-climates should be identified.

- Biodiversity database for major forest types should be developed and the uses of this biodiversity be documented.

- The effect of changes in ecosystem structure and functioning in response to global biophysical and sociological impacts on the delivery of ecosystem services, both tangible and non-tangible, should be quantified, valued and documented.

- The linkage of ecosystem services to human well-being should be determined, and the level of well-being dependency on ecosystem services for different forest types under different socio-economic conditions be evaluated.

- Robust analytical framework and methodological foundations for valuation of ecosystem services and their delivery across social groups should be developed.

- Indian Council of Forestry Research and Education should assess the local research needs of States, industry, local communities, farmers, and other user groups, and prioritize the same.

- Government of India and the Forest Departments should encourage universities and organizations to take up research proactively, particularly the applied research. The topics/areas requiring baseline data collection and research should be identified, researchers be supported, and the findings of applied research be appropriately incorporated in the working/management plans.

- Permission for conducting research by agencies other than the Forest Department should be given without arbitrariness and as quickly as possible. Norms for permitting such research may be developed to make the process transparent.

- A quinquennial review (QR) of the research projects should be undertaken by a committee of outside experts in respect of each research institute. An expert committee may be constituted to critically examine the finding of QR, and make suitable recommendations.

- The outlay on forest research needs to be very substantially enhanced.

- Research for making use of ethnic knowledge in grassland and forest ecosystems followed by applied research to obtain intellectual property rights that are capable of benefiting the local communities and the nation.

- Identification of proper clones for different agro-climatic and edaphic regions for commercial agroforestry should be carried out. Agroforestry models for rainfed areas should be developed.

- Inventory, and characterization of the available grasslands in the country should be documented.

- Long term research on grassland ecology, invasive species in grassland and forest ecosystems and their control with respect to protected area management should be carried out.

- Food chain analysis of grassland and forest (including agroforestry) ecosystems needs to be studied and documented.

- Carbon sequestration patterns in promising forestry, agroforestry and grassland systems should be studied and quantified.

- Research on improvement of planting stock of important MPTS for their introduction in silvopastoral models of agroforestry with emphasis on developing vegetative propagation techniques for mass scale multiplication of elite clones needs to be commissioned.

- Rehabilitation of disturbed habitats like mined areas ands problem soils like saline lands with a variety of tree and grass combinations.

- More emphasis on short rotation nutritious fodder trees and shrubs for creating a fodder resource outside reserve forest lands so that the pressure on forests for forage is lessened.

- Greater focus on scientific collection and handling of forest seeds, their conservation through proper seed storage options, development of ex situ seed orchards.

- More research on prevention and management of invasive species both domestic as well as alien.

- Designing and developing a sound analytical framework accommodating valuation of ecosystem services, both tangible and intangible, and their delivery across social groups.

- Networking of ICAR and ICFRE programmes and scientists where the working areas in forestry related activities are interfacing.

- Creation of nodal data base facilitating centers for processing and dispensing need based past and present forestry related information like research findings, etc. This shall be useful in avoiding duplication of research effort, fixing regional, national and global research & developmental priorities and to further formulate effective strategies.

- Recognizing the long economic cycle of forestry species and in order to provide long term continuum in research and development efforts, there is need for initiating All India Coordinated Forestry Research Projects (AICFRPs) on prioritized research areas. This will help in effective transfer of adaptable research while strengthening the institutional capacities.

- ICFRE should play the role of lead agency to plan and monitor research and educational activities in core areas of forestry.

- Centres of excellence in identified fields of research should be established and strengthened in selected institutes.

- There is a need to develop crop specific progeny blocks in the State Agricultural Universities and ICAR institutes. It should be made mandatory that the private nurseries should be provided scion material from the SAUs and ICAR Institutes.

- Model nurseries need to be established by SAU's with funding under NHM, in order to make them the source of nucleus planting material and also the source of identified quality planting material, on a large scale.

- A small proportion of the exotic varieties imported into the country need to be deposited by the importers at crop specific research institutes for developing a gene bank for enrichment of germplasm.

- To assess the status of the planting material, there is need for regular interface between the State Agricultural Universities and the State Horticulture Departments.

- There is a need to develop crop specific standards starting from selection of poly bag, up to the stage of propagation. The standards should be applicable throughout the country.

- A mechanism need to be evolved and made mandatory for procuring planting material only from identified sources to avail financial assistance from the Government Department.

- The Nursery associations need to be involved in the certification process and also procurement of planting material, for new varieties.

- The information on requirement and movement of planting material need to be exchanged between the indenting agencies and the Horticulture Departments of the State from where the material is sourced.

- Inter State movement of planting material need to be regulated through the State mechanism to ensure traceability of source of origin.

- Tissue culture units already established need to be exploited to the full potential.

C. FORESTRY EDUCATION

- ICFRE should be declared as an apex body to standardize and certify quality education in the field of forestry in consultation with UGC, ICAR etc.

- Syllabus across universities should be made uniform with adequate emphasis on field skills. Syllabus review should develop backward linkages with job requirements.

- Specialized courses should be offered in all forestry programmes in collaboration with other institutions/organizations/industries.

- Inter-linkages amongst the universities, institutions and industries should be improved by an annual meet of faculty of all concerned universities, representatives from related institutions, industries, SFDs, UGC, ICAR and ICFRE.

- Forestry should be allowed as an optional subject in various competitive examinations (particularly civil services).

- All universities and institutes offering courses in forestry should have active Placement Cells.

- Link forestry education with forestry research to provide latest technical inputs and advances.

- A post of National Training Coordinator needs to be created to facilitate assessment of the training requirements.

- Private, Government and Non-Government organizations should recruit forestry professionals for pursuing forestry activities.

- Some percentage of posts in state forest services and rangers should be reserved for graduates in forestry.

- Research fellowships should be provided by ICFRE on the pattern of ICAR.

- There should be synergy between UG/PG forestry curricula followed by Universities and IFS/SFS/Rangers training programmes for better integration of the education standards at different levels.

- Uniform UG course curricula at national level has been developed by the ICAR . ICFRE should encourage all the forestry educational institutes to adopt this to bring uniformity in knowledge base of the forestry graduates.

- Ample opportunities for training of faculty in new emerging areas at national and international institutes for the advancement of education and research in forestry should be created.

- There should be very strong linkages between universities and different forest based industries so as to create opportunities for industrial training/internship of the students as well as employment avenues. Identify sectors/institutes for the placement of students for practical training/internship (5-6 months).

- Appropriate mechanisms for exchange of faculty among institutions imparting forestry education should be developed.

D. FORESTRY EXTENSION

- Van Vigyan Kendras (VVKs) on the analogy of Krishi Vigyan Kendras (KVKs) for operationalization and transfer of technology should be established.

- Mini mission projects in forestry (on the analogy of horticulture mission) for developing focused strategies of research, development and extension in specialized areas of forestry like non-wood forest products, timber engineering, wood composites, agroforestry, plantation forestry etc should be launched.

- The task of conservation cannot be undertaken without partnership between various sectors of the society. Therefore, a holistic partnership package involving various levels of the society should be encouraged/developed.

- Involvement and commitment of all stakeholders, especially landholders, in forest conservation and management, towards the development of national program on priority species should be encouraged and supported.

- Regular interaction between the forest conservation and Forestry Research Institute should be encouraged for sharing experiences.

- Krishi Vigyan Kendras (KVKs) which are now present in every district of India should be geared up for providing right information/material to the forestry community for afforestation work.

- Publication of brochures/ bulletins should be made in local/regional languages.

- Documentary films/street plays and other educational mass communication programmes should be developed/ conducted by the state governments.

E. ENVIRONMENT RESEARCH

- Systematic research to evaluate the impacts of pollution and climate change on freshwater resources needs to be commissioned to evaluate the impacts of climate change on glaciers and river flows. Research based integrated approaches need to be developed for management of river basins taking into account the upstream and downstream seasonal inflows and withdrawals, land and water interface, pollution loads, and natural regenerating capacities of the rivers.

- Research is also required to study and mitigate the impacts of river valley projects, power plants and industries on riverine and estuarine flora and fauna.

- The present policy and legislative prescriptions need to be analyzed, researched and adjusted to be in tune with the changing developmental perspectives and scientific knowledge. Such analysis will also be used to develop synergies between different statutes and to remove obsolescence, as also to decide upon the degree of decentralization of the particular statute.

- Research studies may also be launched to streamline the processes and procedures for statutory environmental clearances. Also, Coastal Regulation Zone (CRZ) Notification needs to be reviewed and analyzed with a view to making the underlying approach holistic to provide protection to the composite coastal ecological system.

- Research studies need to be commissioned to ascertain risks posed by LMOs to the ecological resources with a view to defining safe processes and procedures for introduction of LMOs.

- Scientific substantiation and validation of traditional land use practices need to be done on priority followed by effective demonstration and extension projects with the overall aim of arresting degradation of soils and improving productivity of desert ecosystems. Research needs to be initiated to develop workable multi-stakeholder partnership for adoption of science-based, traditional and sustainable land use practices with a view to optimizing production. Research based modules for increasing green cover in desert ecosystems incorporating the traditional knowledge need to be developed.

- Research studies on mountain ecosystems are required to be commissioned to develop best practices norms for infrastructure development, housing, other developmental activities, and for participation of local community in ecotourism activities.

- Policy research needs to be initiated to effect statutory reforms to incentivize the use of renewable energy technologies, decentralization of energy generation and distribution, and use of bio-diesel to gradually replace fossil fuel. Research also needs to be accelerated to develop technology for reducing transmission losses, and bringing down cost of solar photovoltaic cells. Research studies need to be initiated to indicate regulatory shortcomings and to recommend efficient pricing of fossil fuel based energy. Research and development is also required for development of low cost technologies for sewage treatment. Research based models of sewage treatment, and solid waste disposal to be financed and managed by local community should be developed.

F.   ENVIRONMENT EDUCATION AND TRAINING

- Preparation of an overall training plan based on the periodic assessment of the training need in all sub–sectors at all levels to support regulations during the five tear plan period (for all scientific and technical fields related to forestry and wildlife management, monitoring of stack emissions, ambient air quality, wastewater, hazardous wastes, other toxic emissions, assessment of pollution load, development of action plans, environmental regulations formulation of guideline, health risk assessment policy statements and laws). The existing capacities of all the individuals in different functional areas at different levels of the organization - like use of equipments, monitoring, data and information generation, field assessment, information dissemination, development of action plans, policy formulation -- should be assessed periodically in line with the policy goals.

- The training plan should include definite objectives, output and target groups for all the sub-sectors

- Develop evaluation system for all training programmes conducted by all institutes in terms of quality, outputs obtained. Develop framework for post training evaluation and quality assurance of training programmes. Develop indicators for assessing impact of training on skill building and enhancement.

- Need resources for augmentation of high skill personnel in CPCB, SPCBs.

- Develop institutional network and a formal protocol to engage with the research/educational institutions, scientific community, laboratories, public agencies to source credible science and information and field experience to support regulatory action. Also develop an active plan for implementation to strengthen the technical capabilities of institutions and organizations selected for training. Develop annual plans to make the targets achievable.

- **A** web based platform needs to be created for networking of various institutions for increasing the knowledge and skill base of all institutes and for dissemination of information and science. Encourage distance learning. Assess the need for information and communication technology.

- Initiate curriculum development, guidance material to reflect the emerging science and regulatory best practices.

- CPCB should create guidelines for training of regulators and trainers involved in pollution control and management and health risk assessment.

- Special programmes should be created for high skill training of senior and field staff and trainers needed for advanced sophisticated monitoring techniques and analysis.

- Development of training programmes to strengthen the capacity of the *panchayats* and JFM societies to monitor and manage forestry resources and facilitate data generation on use and regeneration of forest and biodiversity resources. ICFRE and other related institutions must strengthen their system and create training modules and programmes to enable this. Managerial and field inputs should be integrated. Create a time bound plan which ensures wide coverage of these local bodies across the country.

- Develop training modules and programmes customized to meet the training needs of the urban local bodies and also the *panchayats* that are expected to play an increasing role in implementation of the environmental laws and regulations for pollution control and EIA assessment. Managerial and field inputs should be integrated. Create a time bound plan which ensures wide coverage of these local bodies across the country.

- Create a well-structured scientific advisory for all sub sectors to guide the formulations of the training programmes.

G.   TRAINING AND CAPACITY BUILDING

- Consolidate training initiatives of the Central Government and expand the same to cover all stakeholders. Present scattered initiatives may be transformed into a structured composite scheme of the MoEF.

- Management oriented research topics should flow from IGNFA/DFE in consultation with various stakeholders including the government. IGNFA should establish a Research Cell to achieve this objective.

- Research may focus on realistic issues like HRD, Crime Investigation etc.

- The Sub Group may consider modalities of identification of issues, approval mechanism and networking framework to involve stakeholders.

- Create linkages between training programmes and regulatory development process to ensure that training is consistent with the regulatory action.

- Build skills for research, monitoring, data generation, regulatory impact assessment, compliance assurance, public consultation etc related tasks.

- Assess the ways to work with other concerned scientific agencies and other stakeholders within and outside the government sector to expand and build

capacity for training of the staff and the trainers. Develop institutional network and a formal protocol to engage with the research/educational institutes, scientific community, civil society groups, laboratories, etc to source credible science and information and field experience to support regulatory action.

- Assessment of curriculum development, guidance materials for regulatory development, use of traditional method of training and also newer methods involving information and communication technology, distance learning etc. Also link training with information management. Create benchmark for quality assessment.

- Bringing out a regular newsletter to keep the filed foresters up to date with the latest developments.

- Availability of information from the research and documentation center upon payment by field officers. Such payments will ensure financial viability of the center.

- Identification of nodal persons in each state to liaison with the Centre e.g., DFO Research / State Silviculturist).

- Flow of funding for research on project basis to states (DFO Research/State Siviculurist) through ICFRE.

- Exchange programme between ICFRE and state research institutions.

- Exchange of information on initiatives through seminars and workshops cutting across Ministeries.

- Formulating joint projects and working together on issues of common interests.

- Jointly setting priorities for implementation and research in the sector.

- Setting up an empowered joint consultative mechanism to ensure greater inter ministry co-operation and information sharing.

- Focused funding on prioritized areas to institutions outside government set up.

- Engage such folk taxonomists, ecologists and scientists in a dialogue that will feed into decision making at the policy level.

- Establish a network of such scientists etc., so that the work being carried out by them and their research finding are disseminated across the government institutions. This will ensure that their work feeds into and builds up on the work done by the government institutes.

- Organize training programmes under the supervision of these scientists so that a larger audience can benefit from their experience.

- Offer trainings and other capacity building measures specifically targeted to these scientists outside the government.

- Offer newsletter and other publications of government institutions to institutions outside the government at subsidized costs.

H. INFORMATION MANAGEMENT

- Data on socio-economic parameters in addition to physical data.

- Development of standard modules at each level for processing and easy analysis.

- Structuring of information flow at different levels needs to be worked out in consultation with NIC.

- Organizing the existing information available with the SFDs and other departments / organizations.

- Building the capacity of the staff of the SFDs upto range level in data collection and compilation including handling of GPS to collect spatial data and enter into Computers.

- Also build capacity of the local community for monitoring NTFP harvest and collecting data.

- Equipping around 800 forest divisions and 4000 ranges in the country with Computers and Handheld GPS by the end of XIth Five Year Plan period.

- Requirement of developing an Intra Government Portal for data sharing.

- FSI to be developed as a Nodal Center for all forestry related data and linked with SFDs with help of NIC.

- National organizations like FSI which are responsible for collection, compilation and analysis of primary data on various parameters of forest resource needs to be strengthened.

- ICFRE is also to suitably equipped for collection of research/ non-spatial data.

- Develop proper mechanism for flow of information from National organizations to state and vice versa.

- Suitable policy for easy and transparent access to information and data to other users.

Constitution of the Working Group on Research, education, training, capacity building and information management for the Environment & Forests Sector for the eleventh Five-Year Plan (2007-2012)

1	Secretary, Ministry of Environment & Forest, New Delhi	Chairman
2	Principal Adviser (E&F), Planning Commission	Member
3	Secretary, Deptt. of Biotechology	Member
4	Secretary, Deptt. of Science & Technology	Member
5	Director General Forests & Special Secretary, MOEF	Member
6	Director General, ICFRI, Dehradun	Member-Secretary
7	Dr. S S Negi, Director, Forest Research Institute, Dehradun	Member-Convener
8	Dr. D Pandey Director, Forest Survey of India, Dehradun	Member
9	Director-General, ICAR	Member
10	Director General, CSIR, New Delhi	Member
11	Chairman, UGC, New Delhi	Member
12	Vice Chancellor, YS Parmar University, Solan (HP)	Member
13	Director, National Bureau of Plant Genetic Resources	Member
14	Dr. P.S. Roy, Dy. Director, NRSA, Hydrabad	Member
15	Prof. C.R.Babu, ICEMDE, Delhi University	Member
16	Dr.Ulhas Karanth, Wildlife Conservation Society India, Banglore	Member
17	Shri Kartikeya Sarabhai, Director, CEE, Ahmedabad	Member
18	Shri B K P Sinha, Director Amity School of Natural Resources	Member
19	Dr. K.A. Singh, Director, Fodder Research Inst. Jhansi	Member
20	Dr. P Neema, Dy Sir & Head, APC Div NEERI	Member
21	Representative of Centre for Science and Environment, N.Delhi	Member
22	Director, IPIRTI, Bangalore	Member
23	Representative of the Energy & Resources Institute, N.Delhi	Member
24	Dr. P. J. Dilip Kumar, PCCF Karnataka	Member
25	Advisor ((EE), MOEF)	Member

26	Joint Advisor (E&F), Planning Commission	Member
27	Director (Forestry), Planning Commission	Member
28	Director, WII, Dehradun	Member
29	Dr. Lalit Pande, Almora	Member
30	Dr. S R Shetye, Dona Paula, Goa	Member
31	Dr. Sharad Lele, Banglore	Member
32	Dr. C S Rathore, Bhopal	Member
33	Dr. Erach Bharucha, Bharati Vidhyapeeth, Pune	Member
34	Dr. Jaishree Sharma, NCERT, New Delhi	Member
35	Dr. K.S. Swaminath, CCF Karnatka Forest Deptt.	Member
36	Dr. K.D. Singh ex-FAO Sr. Forestry Officer, ATREE, Delhi	Member
37	Director, IIFM, Bhopal	Member
38	Director, IGNFA, Dehradun	Member

Terms of Reference of Working Group will be as follows:

1. To make a critical review of the achievements in the field of environment and forestry research & education with special reference to the programmes undertaken in the sectors in tenth five plan. This will include evaluation of the outcomes of the programmes.

2. To evaluate adequacy and recommend strategy and approach for management of research, education & training with reference to target groups, specific areas and infrastructural development, in the field of Forestry & Wildlife, Environment and Animal Welfare. This may also include the problems of private and public sector activities for research back up.

3. Examine possibilities of uploading all environmental information accessible to the public under the Right to Information Act on a public web site.

4. Review proposals for establishment of data and information base for understanding, assessment, planning and monitoring of the sectors at local, state and national level on various spatial and temporal scales. This will also include establishment of a national network for the forest biodiversity as well as other environmental information.

5. Recommend a strategy for implementing the recommendation of the National Curriculum Framework Review 2005 that the knowledge on environmental

parameters generated through student projects on environment be used to create a publicly accessible database on Indian environment

6. Recommend a strategy for greater involvement of folk taxonomists, ecologists and scientists outside the Government institutions in forestry, wildlife and environment research.

7. Recommend guiding principles for deciding the research priorities based on the global commitments on conservation and nation needs.

8. Suggest measures for ensuring effectives coordination the field of forestry research in the State Sector with ICAR/ICFRE system.

9. Examine the existing system of forest education in the states/ country and scope of linkages between management and conservation research. This will include the existing forestry education paradigm in the universities, management institutions and its utility in career planning.

10. Suggest measures for effective coordination between the scientific Ministries / Departments of the Govt. of India who are also dealing with environment & forestry related activities.

F. No. 225/DRI/2006

Dated 25 September 2006

OFFICE MEMORANDUM

The Planning Commission vide its office order number M-3033/1/2006-E&F Dated 21.08. 2006 has constituted a Working Group on Research, Education, Training, Capacity Building and Information Management for the Environment and Forest Sector for the Eleventh Five Year Plan (2007-2012) under the chairmanship of Secretary, Ministry of Environment and Forests.

Keeping in view the enormity of the exercise and diversity of issues involved, the Chairman has desired that to assist the Working Group in preparation of its report, it is essential to allocate specific subjects for thorough deliberations thereon to four Sub Groups. The subjects assigned to the Sub Groups are as under:

1. Sub Group I   : 'Forestry Research, Education and Extension'
2. Sub Group II   : 'Environment Research, Education and Extension'
3. Sub Group III : 'Training and Capacity Building'
4. Sub Group IV : 'Information Management'

Constitution of the Sub Groups along with TORs assigned to each Sub Group are as follows:

Sub Group on Forestry Research, Education and Extension

Dr. S. S. Negi, Director, Forest Research Institute, Dehradun	Chairman
Dr. K. A. Singh, Director, Fodder Research Institute, Jhansi	Member
Director, National Bureau of Plant Genetic Resources	Member
Vice Chancellor, Y. S. Parmar University, Solan (HP) or his Representative	Member
Director, IPIRTI, Bangalore	Member
Representative of Director General ICFRE	Member
Representative of Director General ICAR	Member

Representative of Director General CSIR	Member
Representative of CII	Special Invitee
Dr. A. K. Hooda, Group Coordinator Research FRI, Dehradun	Special Invitee
Shri Ajay Kumar Lal, Dean, FRI Deemed University, Dehradun	Special Invitee

Terms of Reference

1. Make a critical review of the achievements in the field of forestry research, extension and education with special reference to the programmes undertaken in the sectors in the Tenth Five Year Plan. This will include evaluation of the outcomes of the programmes.

2. Evaluate adequacy and recommend strategy and approach for management of research, with reference to target groups, specific areas and infrastructural development, in the field of Forestry and Wildlife, and Animal Welfare. This may also include the problems of private and public sector activities for research back up.

3. Recommend guiding principles for deciding the research priorities based on the global commitments on conservation and national needs

4. Examine the existing system of forest education in the States and country as a whole, and the scope and possibility of linkages between management and conservation research. This will include the existing forestry education system in the universities, management institutions and its utility in career planning.

Sub Group on Environment Research, Education and Extension

Director, Indian Institute of Forest Management, Bhopal	Chairman
Shri B. K. P. Sinha, Director Amity School of Natural Resources	Member
Prof. C. R.Babu, ICEMDE, Delhi University	Member
Shri Kartikeya Sarabhai, Director, CEE, Ahmedabad	Member
Dr. Erach Bharucha, Bharati Vidhyapeeth, Pune	Member
Dr. Jaishree Sharma, NCERT, New Delhi	Member
Dr. P. Neema, Deputy Director and Head, APC Division NEERI	Member
Representative of Director General, ICFRE, Dehradun	Member
Dr. Kanchan Chopra, Institute of Economic Growth , New Delhi	Special Invitee

Dr. N. S. Bisht Head RSM Division FRI Dehradun   Special Invitee

Dr. R. Mehta, Advisor, MoEF   Special Invitee

Terms of Reference

1. Make a critical review of the achievements in the field of environment research, education and environment with special reference to the programmes undertaken in the sectors in Tenth Five Year Plan. This will include evaluation of the outcomes of the programmes.

2. Recommend a strategy for implementing the recommendations of the National Curriculum Framework Review 2005 that the knowledge on environmental parameters generated through student projects on environment could be used to create a publicly accessible database on Indian environment

3. Recommend guiding principles for deciding the research priorities based on the global commitments on environmental conservation and national needs.

Sub Group on Training and Capacity Building

Director, IGNFA, Dehradun   Chairman

Director, WII, Dehradun or his Representative   Member

Dr.Ulhas Karanth, Wildlife Conservation Society India, Bangalore   Member

Dr. K. S. Swaminath, CCF Karnataka Forest Department   Member

Representative of The Energy and Resources Institute, New Delhi   Member

Ms. Anumita Roychowdhary, Centre for Science and Environment,   Member

Representative of Director General ICFRE   Special Invitee

Shri A. K. Goyal, DIG (RT) MoEF   Special Invitee

Terms of Reference

1. Examine the existing system of forestry training in the States and the country as a whole and the scope and possibility of linkages between management and conservation research.

2. Suggest measures for ensuring effectives coordination in the field of forestry research in the States with ICAR/ICFRE system.

3. Suggest measures for effective coordination between the scientific Ministries/ Departments of the Government of India who are also dealing with environment and forestry related activities.

4. Recommend a strategy for greater involvement of folk taxonomists, ecologists and scientists outside the Government institutions in forestry, wildlife and environment research.

Sub Group on Information Management

Dr. D. Pandey Director General, Forest Survey of India, Dehradun   Chairman

Dr. K. D. Singh ex-FAO Sr. Forestry Officer, ATREE, Delhi   Member

Dr. P. S. Roy, Deputy Director, NRSA, Hyderabad   Member

Dr. Lalit Pande, Almora   Member

Dr. S. R. Shetye, NIO, Dona Paula, Goa   Member

Dr. Sharad Lele, Bangalore   Member

Dr. C. S. Rathore, IIFM, Bhopal   Member

Shri Kiran Karmic, President, NASSCOM ,New Delhi   Special Invitee

Representative of Director General ICFRE   Special Invitee

Shri Sanjay Gehlout, Senior Technical Director, NIC, MoEF   Special Invitee

Terms of Reference

1. Examine possibilities of uploading all environmental information accessible to the public under the Right to Information Act on a public website.

2. Review proposals for establishment of data and information base for understanding, assessment, planning and monitoring of the environment and forest sector at local, State and national level on various spatial and temporal scales. This will also include establishment of a national network for the forest biodiversity as well as other environmental information.

Each Sub Group is expected to deliberate on the assigned subject thoroughly with respect to the corresponding TORs and submit its report to the Chairman of the Working Group in due course. Meeting of the Working Group has been scheduled for 27.10.2006 at 1100 hrs in Paryavaran Bhavan under the Chairmanship of Secretary, Ministry of Environment and Forests. The Sub Groups are requested to initiate deliberations at the earliest, and are

advised to present salient features of their deliberations in the full Meeting of Working Group on 27.10.2006.

This issues with the approval of the Chairman, Working Group.

(Dr. S. S. Negi)
Director, Forest Research Institute and Member Convener
Dehradun

To

All members and Special Invitees of the Working Group

ABBREVIATIONS

A&R	Afforestation & Reforestation
APFSIAN	Asia Pacific Forest Invasive Species Network
CDM	Clean Development mechanism
DOE	Designated Operational entity
EIA	Environmental Impact assessment
EMP	Environmental management Plan
FAO	Food & Agricultural Organisation
FDA	Forest development
FSI	Forest Survey of India
FYP	Five year Plan
GIS	Geographic Information System
GPS	Global Positioning system
ICAR	Indian Council of Agricultural research
ICFRE	Indian Council of Forestry Research & Education
IGNFA	Indira Gandhi National Forest Academy
IIFM	Indian Institute of Forest Management
IPIRTI	Indian Plywood Industries Research & Training Institute
IT	Information Technology
JFM	Joint Forest Mangement
KVK	Krishi Vikas Kendra
MoEF	Ministry of Environment & Forests
NAEB	National Afforestation & Eco-Restoration Board
NFDMC	National Forest Data Management Centre
NGO	Non Government Organisation
NTFP	Non Timber Forest Product

PISFR	Preinvestment Survey of Forest Resources
SAU	State Agricultural University
SFD	State Forest Department
SFRI	State Forest Research Institute
TFI	Training and Forest Inventory
TOF	Tree Outside Forest
UGC	University Grant Commission
UNDP	United Nations Development Programme
UT	Union Territory
VVK	Van Vigyan Kendra
WII	Wildlife Institute of India