
सत्यमेव जयते
NATIONAL WORKING PLAN CODE - 2023
प्रकृतिः रक्षति रक्षिता
Nature Protects if She is Protected
Ministry of Environment, Forest & Climate Change
Government of India
New Delhi

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NATIONAL WORKING PLAN CODE, 2023

(for Sustainable Management of Forests and Biodiversity in India)

June 2023

Ministry of Environment, Forest and Climate Change
Government of India
New Delhi

मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
और
श्रम एवं रोजगार
भारत सरकार

सत्यमेव जयते

MINISTER
ENVIRONMENT, FOREST AND CLIMATE CHANGE
AND
LABOUR & EMPLOYMENT
GOVERNMENT OF INDIA

स्वच्छ भारत
एक कदम स्वच्छता की ओर

आज़ादी का अमृत महोत्सव

भूपेन्द्र यादव
BHUPENDER YADAV

FOREWORD

India is one of the few countries in the world that has a scientific system of forest management. The working plan is the main instrument through which the scientific management of Forests is being achieved in India. National Working Plan Code which was first adopted in 2004 with a subsequent amendment in 2014 brought uniformity and acted as the guiding principle for the preparation of the working plan for scientific management of different forest divisions of our country.

The forests in India are being managed for a multitude of reasons like maintaining environmental stability, conserving natural heritage, checking soil erosion and denudation of catchment areas, checking the extension of dunes, increasing tree and forest cover with people involvement, increasing the productivity of forests etc. Scientific forest management in India and the world is consistently evolving with new approaches, new technologies & innovations and it has become imperative to evolve ourselves to meet the essentials of forest management and the requirements of people who depended on it.

At this juncture, I am happy to share that to manage the forests scientifically according to the evolving needs and involving the principles of sustainable management, the Ministry of Environment, Forest & Climate change has come up with the "National Working Plan Code-2023" to deal with various challenges posed against the forests of India and its scientific management based on National Forest Policy.

"The National Working Plan Code-2023" has been prepared to incorporate the internationally accepted and evolving principles of sustainable forest management and will continue to bring uniformity into scientific forest management in India and integrate multiple functions of forests in the country with the application of modern tools and techniques.

The National Working Plan Code- 2023 includes the "Indian Forest Management Standard", a unique document which provides standards for all principles of sustainable forest management practised in the country in measurable terms. The standard has solutions for the complex issues and challenges posed by the diverse forest management in the country. The Indian Forest Management Standard will also act as an evaluation of the management effectiveness of the working plan prescriptions in the forest area of our country.

I congratulate DGF&SS and his team in the Ministry for the preparation of this important document. I am confident that this code will act as a guiding principle for the forest officers in preparation for the working plan for different forest divisions in the country.

With Best Wishes.

Date: 01.06.2023

(Bhupender Yadav)

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पर्यावरण, वन एवं जलवायु परिवर्तन
उपभोक्ता मामले, खाद्य और सार्वजनिक वितरण
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MINISTER OF STATE
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सत्यमेव जयते

आहारशुद्धौ सत्त्वशुद्धिः

एक कदम स्वच्छता की ओर

अश्विनी कुमार चौबे
Ashwini Kumar Choubey

प्रस्तावना

भारत में विविध प्रकार के वन हैं। इनमें सदाबहार वन, अर्ध-सदाबहार वन, नम पर्णपाती वन, शुष्क पर्णपाती वन, अल्पाइन वन, कांटेदार वन, मैंग्रोव वन आदि शामिल हैं। भले ही इन विभिन्न वनों का वैज्ञानिक प्रबंधन एक दूसरे से भिन्न हो, वनों के प्रबंधन के सिद्धांत और उद्देश्य समान रहते हैं। वन पारिस्थितिकी तंत्र जटिल है, इसलिए वनों का प्रबंधन भी उसी के अनुसार विकसित होना चाहिए।

''द नेशनल वर्किंग प्लान कोड-2023'' जिसे पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय द्वारा लाया गया है, हमारी आवश्यकताओं के अनुकूल वन प्रबंधन के अंतरराष्ट्रीय स्तर पर स्वीकृत सिद्धांतों में जटिल वन पारिस्थितिक तंत्र के प्रबंधन के लिए समाधान लाता है। नया कोड तुलनात्मक रूप से एक संक्षिप्त दस्तावेज है, जो वनों के वैज्ञानिक प्रबंधन के लिए कार्य योजना तैयार करने के लिए व्यापक सिद्धांतों को निर्धारित करता है।

"भारतीय वन प्रबंधन मानक" जो कि वर्किंग प्लान का एक अभिन्न अंग है, भारत में प्राकृतिक वनों के संधारणीय प्रबंधन के लिए मानदंडों और संकेतकों के एक राष्ट्रीय सेट के रूप में विकसित किया गया है। मानदंडों और संकेतकों के अलावा, इस मानक के माध्यम से संधारणीय वन प्रबंधन के सिद्धांतों को प्राप्त करने के समग्र उद्देश्य से सत्यापनकर्ता, इच्छित स्थिति और आवधिकता का भी उल्लेख किया गया है। यह मानक हमारे देश में वनों की सभी प्रबंधन परिपाटियों के लिए एक निगरानी तंत्र के रूप में कार्य करेगा जिससे वन प्रबंधन के उद्देश्यों को प्राप्त किया जा सके।

मैं पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय की पूरी टीम को राष्ट्रीय कार्य योजना कोड-2023 तैयार करने के लिए बधाई देता हूं। मुझे पूर्ण विश्वास है कि देश के सभी वन अधिकारी वनों के वैज्ञानिक प्रबंधन के लिए और इस पर निर्भर लोगों और समुदायों को सशक्त बनाने के लिए नए कोड के सिद्धांतों का उपयोग कर बेहतर आगामी कार्य योजना बनाएंगें।

(अश्विनी कुमार चौबे)

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लीना नन्दन
LEENA NANDAN

सत्यमेव जयते

सचिव
भारत सरकार
पर्यावरण, वन और जलवायु परिवर्तन
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST
& CLIMATE CHANGE

FOREWORD

It is a matter of great pride that the "National Working Plan Code – 2023" is being released by the Ministry of Environment, Forest and Climate change. This code gives uniform principles for scientific forest management in the country. The principles have been drawn from the internationally established, as well as from the currently evolving systems and criteria, along with indicators for sustainable forest management.

Forests in India are vulnerable to constantly increasing pressures and it is essential to find solutions for the upkeep of this complex natural ecosystem. The National Working Plan Code deals in detail with the essentials of forest management planning, incorporating the principles of sustainable management of forests which includes : Maintenance/increase in the extent and condition of forest and tree cover; maintenance, conservation and enhancement of biodiversity including wildlife; maintenance and enhancement of forest health and vitality; conservation and management of soil and water resources; maintenance and enhancement of forest resource productivity; optimization of forest resource productivity; maintenance and enhancement of social, economic, cultural and spiritual benefits; and providing the appropriate policy, legal and institutional framework.

The Code also includes the aspects of preparation of the working plan, submission of the plan, approval, midterm review, monitoring, assessment and reporting of the implementation of the working plan, formats for Preliminary working plan report, format for the working plan, all of which would assist forest officers in the efficient implementation of these activities in future.

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The "Indian Forest Management Standard" which is a part of this Code, is a carefully drafted document that takes into account the diverse forest ecosystem in our country, while trying to bring in uniformity in management. The standard is a basis for monitoring, with guidelines for sustainable forest management in terms of a broad framework comprising criteria, indicators and verifiers, that overall recognizes the environmental, economic and social objectives of maintaining forests. The State Forest Departments can adopt these indicators and verifiers according to their specific conditions and local needs.

I am confident that the National Working Plan Code – 2023 will be implemented in letter and spirit by forest officers across the country. The goal is scientific management of our forests, and innovative solutions to the problems faced by forests, as also for empowering the people who are dependent on the forest for their livelihood. I congratulate the entire team of the Ministry of Environment, Forest and Climate Change, for their pain-staking efforts towards bringing out this Code, and also for their future endeavours.

(Leena Nandan)

Dated: June 1, 2023.

चन्द्र प्रकाश गोयल
CHANDRA PRAKASH GOYAL

सत्यमेव जयते

वन महानिदेशक एवं विशेष सचिव
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
DIRECTOR GENERAL OF FOREST & SPL. SECY.
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT FOREST AND
CLIMATE CHANGE

FOREWORD

It is indeed a pleasure that the Ministry of Environment, Forest & Climate change is bringing out the National Working Plan Code - 2023 for scientific management of forests which is a revision of the Working Plan Code of 2014. Historically, India is one of the few countries in the world where scientific forest management is being practised. Forests are valuable resources which need to be protected for their economic, ecological, scientific & cultural values and also for the ecosystem services like water, medicine, carbon sequestration etc.

In the past, scientific forest management was focused more on timber production as per the prescriptions of the working plans. However, the scope of scientific forest management has been broadened during the last 3-4 decades to include other aspects of management including biodiversity conservation, participatory management, eco-tourism, ecosystem services, carbon sequestration etc. The working plans for the forest divisions are the main instrument to attain the objectives of forest management and the principles of forest management need to evolve as per the current needs and requirements of the country.

The new code lays down the principles for the preparation of working plans and procedures for its approval. For the first time, the new code has suggested state forest departments engage in continuous data collection and its updation in a centralized database. The new code has also suggested guidance for state-level consultative committees and Integrated Regional Offices for examination and approval of Preliminary working plan reports and working plans.

The National Working Plan Code – 2023 will be a primary referral document to all forest officers for scientific forest management in our country incorporating the principles of sustainable forest management. I congratulate Chairperson, Members and special invitees of the National Working Plan Code Revision Committee for the commendable job done in drafting the new code.

30.05.2023
(Chandra Prakash Goyal)

Place: New Delhi
Date: 30th May, 2023

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ABBREVIATIONS

ABS	Access and Benefit Sharing
AGB	Above Ground Biomass
AIGF	Assistant Inspector General of Forest
ANR	Assisted Natural Regeneration
APL	Above Poverty Line
BA	Basal Area per Ha
BCFT	British Commonwealth Forest Terminology
BD Act	Biological Diversity Act, 2002
BGB	Below Ground Biomass
BMCs	Biodiversity Management Committees
BPL	Below Poverty Line
BSI	Botanical Survey of India, Kolkata
CBD	Convention on Biological Diversity
CV	Coefficient of Variation
CW	Crown Width
CWLW	Chief Wildlife Warden
DBH	Diameter at Breast Height
DBT	Double Bark Thickness
DCO	Directorate of Census Operations
DFO	District/Divisional Forest Officer
DIGF	Deputy Inspector General of Forest
DOM	Dead Organic Matter
FAO	The Food and Agriculture Organization, Rome
FCA	Forest Conservation Act, 1980
FFVs	Forest Fringe Villages
FOD	Field Operation Division
FRA	Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
FRI	Forest Research Institute, Dehradun
FSI	Forest Survey of India, Dehradun
FSU	First Stage Units
GIS	Geographical Information System
GPS	Global Positioning System
GVE	General Volume Equations
ICFRE	Indian Council of Forestry Research and Education, Dehradun
IFA	Indian Forest Act, 1927
IGF	Inspector General of Forest
IIFM	Indian Institute of Forest Management, Bhopal
IRO	Integrated Regional Office
IUCN	International Union for Conservation of Nature
LPG	Liquefied Petroleum Gas

LVE	Local Volume Equation
MADP	Medicinal, Aromatic, and Dye Plants
MAP	Medicinal and Aromatic Plants
MoEF&CC	Ministry of Environment, Forest and Climate Change
NPP	Net Primary Productivity
NSO	National Statistical Office
NTCA	National Tiger Conservation Authority
NTFP	Non-Timber Forest Produce
NWPC	National Working Plan Code
PCCF (HoFF)	Principal Chief Conservator of Forests & Head of Forest Force
PDF	Plot Description Form
PESA	Panchayats Extension to Scheduled Areas Act, 1996
PF	Protected Forest
PWPR	Preliminary Working Plan Report
RF	Reserved Forest
RFA	Recorded Forest Area
SCC	Standing Consultative Committee
SFDs	State Forest Departments
SRS	Simple Random Sampling
SSU	Second Stage Units
ToF	Trees Outside Forests
TSU	Third Stage Sampling Units
UFS	Urban Frame Survey
WC	Working Circles
WGS	World Geodetic System
WII	Wildlife Institute of India, Dehradun
WP	Working Plan
WPO	Working Plan Officer
ZSI	Zoological Survey of India, Kolkata

PREAMBLE

Whereas, the National Forest Policy envisages that no forests shall be worked without the Government approved management plan in the prescribed format;

Whereas, the National Forest Policy further envisages that the Central Government should issue necessary guidelines to the State Governments in this regard and monitor compliance;

Whereas, it is necessary to evaluate the status of a forest and other biodiversity resources of a forest division, assess the impact of past management practices, forecast future pressures on natural forests and plan for sustainable management of the forests based on sound silvicultural principles;

Whereas, it is essential to plan for area-specific prescriptions for the forests towards continuity of management of a particular forest crop in a forest division;

Whereas, it is realised that there is a need to bring uniformity in the forest management planning process in the country;

Whereas, it is realised that there is an interrelationship between forest land use and water yield of a catchment, both in quality and quantity. Realising the trade-off between water quality and quantity from any forested catchment, it is affirmed that forest may be manipulated through appropriate silvicultural interventions to maximise the water yield from the catchment while ensuring water quality within permissible limits;

Whereas, it is recognised that forests are affected not only by the ways they are being managed but also by what is happening in the surrounding landscape. It is therefore imperative that there shall be cross learnings amongst the management plans developed for wildlife, biodiversity, wetlands, coastal zones, agriculture, industry, regional and rural development activities;

Whereas, it is affirmed that promotion and monitoring of Trees Outside Forest (ToF) is essential for a sustainable supply of wood, enhancing the income of the farmers/tree growers and increasing the green cover for climate resilient development;

Whereas, it is realised that forests play a vital role in the mitigation of climate change as a natural carbon sink. At the same time, they may also be a source of emissions if managed unmindfully. There is a need to create a robust inventory of data on current carbon stock, the rate of carbon sequestration in different forest types, and climate change mitigation. At the same time, climate resilient management strategies with requisite adaptations are necessary.

Whereas, it is affirmed that societal needs and aspirations are to be incorporated into the sustainable management of the forests. The international conventions on Biodiversity Conservation, Climate Change and Combating Desertification to which India is a Party, are also to be considered.

Whereas, mindful of the fact that natural forests are primarily managed for conservation objectives, it is necessary that the role of forests in providing goods and services are looked upon

with equal emphasis, if not more, for ensuring that pressures on forests on account of unregulated removal are minimised. This requires enhancing the production function of the forests. Valuation of various goods and ecological services provided by the forests is necessary for attracting payments by the sectors receiving benefits of the goods and services and channelizing the same;

Whereas, Rule 10 of the Forest (Conservation) Rules 2022 has provided the procedure for seeking the approval of the working plan from the central government;

Therefore, in light of the above, now the National Working Plan Code 2023 is hereby formulated for preparation of working plans, their approval and monitoring. The preparation of Working Plan initiated after 1st July 2023 shall comply with National Working Plan Code (NWPC) 2023.

CHAPTER 1

GENERAL

1.1 Introduction

i) Working Plan is the main instrument of forest management planning in India since the dawn of scientific forest management. Evaluation of the status of forest crop and its biodiversity, assessment of the past systems of management and prescribing future treatments as per the management objectives are the essential components of working plans.

ii) The principles of working of forests were first drafted in 1837 by Mr. U. V. Munro, the then Superintendent of Forests in Travancore. Later in 1856, Dr. Dietrich Brandis propounded the fundamental principle that the first-class trees (trees over a prescribed diameter) to be felled in a year should be restricted to the growing stock of the second-class trees that will eventually replace them in that year. Based on this principle of yield control, he prepared the first forest management plan using strip sampling for the Pegu Yoma Forests of Myanmar in the year 1860.

iii) In 1884, Sir Wilhelm D Schlich, Inspector General of Forests, initiated a scientific approach towards the preparation of Working Plans. In 1891, W.E.D'arcy brought out a treatise "Preparation of Forest Working-Plans in India".

iv) In 1906, the Superintendent of Working Plans, Forest Research Institute, Dehradun was entrusted with checking of working plans prepared across the country. The research undertaken by FRI on silvicultural of important tree species and regeneration techniques led to science-based prescriptions of the working plans

v) With the enactment of Government of India Act 1935, the management of forests was transferred to the Provincial governments. After independence in 1947, the State forest departments brought substantial areas under scientific forest management by adopting state specific processes for the preparation of the WP as there was no uniform code for the preparation and approval of working plan in the country.

vi) The principal aim of the National Forest Policy, 1988 is ensuring environmental stability and maintenance of ecological balance. The management of forests for derivation of direct economic benefit must be subordinated to this principal aim. The policy also mandates management of forests with approved WP.

vii) The Hon'ble Supreme Court of India in its order dated 12-12-1996 in the case titled T.N. Godavarman Thirumalpad Vs Union of India and others ordered that the felling of trees in all forests is to remain suspended except in accordance with the Working Plans of the State Governments, as approved by the Central Government thereby emphasise the primacy of working plan in the sustainable management of forests. The Ministry of Environment and Forests (MoEF), Govt. of India adopted the National Working Plan Code – 2004 with a standardised procedure for preparation and approval of working plans for management of forests in the Country.

viii) In 2014, the National Working Plan Code was amended. Grid based sampling design was also introduced in the changing scenario of forest resource management with more

emphasis on the use of technological advancements. National Working Plan Code 2014 provided a framework for meeting the requirements of the objectives of the National Forest Policy and other international conventions/agreements by simultaneous implementation of the Indian Forest Act (IFA), 1927, Wildlife (Protection) Act, 1972, the Forest Conservation Act,(FCA) 1980, the Panchayats (Extension to the Scheduled Areas) Act,1996 (PESA), the Biological Diversity Act, 2002, and Scheduled tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 (FRA).

ix) Now, this Code among other things endeavours to harmonise the management prescriptions of other area-based management such as national parks, wildlife sanctuaries, wildlife corridors, mangroves, eco-sensitive zones/areas, coastal regulation zones, wetlands and areas rich in biodiversity while finalising the management prescriptions in the working plans. The code also proposes continuous forest inventory and the use of national data base for the storage of data on forest inventory collected by the SFDs.

x) The code further prescribes a manual for the preparation of the working plan as **Annexure-I** and Indian Forest Management Standard as **Annexure-II**

1.2 Scope

i) All forests are to be managed under the prescriptions of a working plan/scheme. Working plans under this code are to be prepared generally for a period of 10 years for a territorial forest division. A provision for mid-term review of progress in implementation of Working Plans and scope for its extension for a further period of five (5) years has also been provided on case to case basis. It has been asserted that while considering management prescriptions in a WP a reference must be drawn to all the long-term management plans of adjoining areas (e.g. Wildlife Protected Areas, Eco-Sensitive Zones, Coastal Zones, Wetlands of Significance; and Biodiversity Heritage sites, wild animal corridors etc.) so as to bring in synergy in management endeavours.

ii) This Working Plan Code can also be made use for developing management Plans/working schemes for forests with the forest corporations, other government departments/District, Regional and Village Councils or under community or private ownerships, by the managers of such forests. These working schemes are generally prepared for 5 years and should not exceed 10 years.

iii) During the revision of a working plan, there shall be no annual working scheme for a forest division.

iv) For the forest division with forest area less than 1000 ha, management plans/working schemes may be prepared for a time period of 10 years.

CHAPTER 2

ESSENTIALS OF FOREST MANAGEMENT PLANNING

The forests are primarily managed for maintaining environmental stability, conserving natural heritage by preserving the natural forests, checking soil erosion and denudation of the catchments, checking the extension of sand dunes, increasing the forest/tree cover through afforestation programmes with active involvement of the people, meeting the requirements of the rural and tribal populations, increasing the productivity of forests to meet essential national needs and encouraging efficient utilisation of forest produce on the principles of sustainable forest management as provided in Indian Forest Management Standard (**Annexure-II**)

The essentials of sustainable management of forests are derived from the rich heritage of scientific forest management in India and internationally evolving system of criteria and indicators for sustainable forest management. These include 1) maintenance/increase in the extent and condition of forest and tree cover 2) maintenance, conservation and enhancement of biodiversity including wildlife 3) maintenance and enhancement of forest health and vitality together with establishment of regeneration 4) conservation and management of soil and water resources 5) maintenance and enhancement of forest resource productivity 6) optimization of forest resource utilization 7) maintenance and enhancement of social, economic, cultural and spiritual benefits and 8) providing appropriate policy, legal and institutional framework.

2.1 Extent and Condition of Forests and tree cover: Forest boundaries in India are legally defined and activities to be done within the forests are regulated. The diversions of forests for non-forest use are governed by the Forest (Conservation) Act 1980. The increase in green cover includes tree cover inside forests and the trees outside the forests. The changes in the legal status and the extent of forest area reflect whether the forest tree cover is maintained or increased or reduced. The change in the extent and the status of the forests are indicated by the following:

2.1.1 Area of forests under different legal status (Reserved Forests/Protected Forests/ Un-classed Forests / Village Forests and any other forests): Forests in India are legally classified as reserved forests, protected forests, village forests and un-classed forests under IFA 1927 with State specific amendments and State specific Forest Acts and the orders of Hon'ble SC dated 12-12-1996 in the case titled T.N. Godavarman Thirumalpad Vs Union of India and others. There are other categories of forests as well and a compilation of the legal categories of the forests and their change, if any, over a period of time reflects on the maintenance and extent of forests of a forest division.

2.1.2 Area of different forest types: Forest type is a unit of vegetation which possess characteristics in physiognomy and structure sufficiently pronounced to permit the differentiation from other such units. Description of natural forests into distinct forest types and their extent provide a scientific basis for their management. The assessment in the change in the extent of overtime is a reflection of alteration in productivity, and the status of the forest crop which will assist in the choice of silvicultural principles to be followed for suitable management practices.

2.1.3 Change in the category of forest cover: The FSI categorises the forest cover based on canopy density into very dense, moderately dense, open and scrub. Change in forest cover over a period of time reflects the actual changes of forest on the ground. The positive changes could be, among other things, attributed to better forest protection and related

conservation measures, including compensatory afforestation, whereas negative changes could be attributed to change of land use on account of developmental projects, excessive degradation due to anthropogenic pressures, harvesting of short rotation crop etc.

2.1.4 Area of different working circles: The forest is divided into different management zones as working circles based on the object of management. The working circles indicate the application of different set of silvicultural prescriptions and management practices in that area. A change in the area of working circle is often a reflection of change in the object of management and/or change in the status of vegetation.

2.1.5 Area of the Trees Outside Forests (ToF) : ToF contributes significantly to increase in the forest and tree cover of a forest division. Periodic monitoring of the change in area of ToF reflects the overall change in the forest and tree cover of the forest division.

2.1.6 Details of area of forests diverted under FCA: Diversion of forest lands allowed under the Forest (Conservation) Act envisage certain mandatory conditions for mitigating the impacts of such diversions. An analysis of the compliance of these conditions and progress in notification of the- Compensatory Afforestation areas as RF/PF is therefore, important.

2.1.7 Details of forest land where rights are given under the FRA: The FRA recognises specified forest rights in favour of forest dwelling scheduled tribes and other traditional forest dwellers and their communities. The nature and extent of individual forest rights recognised under FRA, the nature and extent/quantum of forest resources on which the community forest rights, and community forest resource rights have been recognised and the management practices prevalent to be indicated.

2.1.8 Details of forest land under encroachments: Forest encroachment often leads to change in land use and has an impact on the integrity of the forest. Encroachments could also lead to honeycombing of the forest leading to habitat fragmentation and adversely affecting wildlife.

2.1.9 Demarcation of boundaries: Area of forests with clear demarcation of boundary with boundary pillars, trenches and other measures enable protection of forest areas and analysis of all the measures taken up for protection of forest areas.

2.1.10 Details of any other factors affecting the existence of forests such as shifting cultivation, illegal mining etc.

2.2 Maintenance, Conservation and enhancement of forest biodiversity

The forests offer diverse habitats for plants, animals and microorganisms. Forest biodiversity encompasses not only the trees but also the multitude of plants, animals and microorganisms that inhabits the forest ecosystem and their genetic diversity. Higher the diversity, higher is the climate resilience and better livelihood opportunities for the forest-dependent communities. At the same time, loss of biodiversity makes it difficult for the ecosystem to recover from disturbances adversely affecting the forest dependent communities. Analysis of the impact of climate change and other factors including existing forest management may provide insight into suitable adaptive and corrective measures for conservation and biodiversity development. Different approaches are adopted in India for biodiversity conservation such as area-based conservation measures by establishing protected areas, species recovery programmes of threatened species and in-situ and ex-situ conservation programmes etc. These are indicated by the following:

2.2.1 Adjoining Protected Areas: Details of adjoining protected areas under Wildlife Protection Act, 1972 (National Parks/Wildlife Sanctuaries/Conservation Reserves/ Community Reserves/Tiger Reserves), Environment Protection Act, 1986 (Eco-sensitive zones/areas, Coastal Zone Regulation, Wetlands notified under Wetland Rules), Biological Diversity Act 2002 are important to be recorded as the status of these areas influences the status of forests and vice versa.

2.2.2 Species diversity: Diversity indices indicate the abundance and richness of species in a locality. Evaluation of these indices considering the management prescriptions provides insight into management options. Biodiversity richness is a proxy for the productivity and stability of a forest ecosystem.

2.2.3 Details of any species-specific conservation programmes: The presence of endemic, endangered species and actions taken up for their conservation, the progress and their impact.

2.2.4 Details of species prone to over exploitation: Some species, especially those that have a narrow ecological niche produce a smaller number of their individuals are more vulnerable to over exploitation than others. Identification of such species and their distribution and extent is helpful in devising the management interventions.

2.2.5 Details of unique/special habitats and high conservation value areas: Identification and mapping of these ecosystems which may include inviolate areas forms basis for special management interventions.

2.2.6 Details of diverse ecosystems such as grasslands, meadows, wetlands, mangroves, marine, deserts etc: Identification and mapping of these ecosystems and change over time forms the basis for sustainable management interventions.

2.2.7 Details of threats and challenges to vulnerable flora and fauna: Habitat fragmentation and unsustainable extraction and trade are serious threats that affect the population of flora and fauna. An analysis of various threats will help in formulating mitigation strategies.

2.3 Maintenance and Enhancement of Forest Health and Vitality

Natural forests are affected by various anthropogenic factors such as grazing, encroachment, forest fire, invasive alien species etc. Forests are also affected by natural phenomenon like flood, landslides, windstorms, pests and diseases etc. Presence or absence of regeneration is an indicator of good health of a forest. Inadequate regeneration necessitates an appropriate silvicultural intervention removing the factors that inhibit regeneration and its establishment. Forest vitality is the ability of the forest ecosystem to survive external disturbances and unfavourable conditions. Low vitality is normally caused by repetitive disturbances that allow very little time for the forests to recuperate. This needs attention of the manager for taking necessary steps. Following parameters help in understanding of health and vitality of forests and in deciding appropriate actions:

2.3.1 Status of regeneration of the principal species and its associates: The status of forest regeneration is estimated during the field survey. The regeneration status could be adequate, moderate or poor. In case the regeneration is inadequate or poor, then the factors that inhibit regeneration must be analysed and brought out clearly to enable suitable silvicultural/management interventions.

2.3.2 **Details of forest fire**: Forest fire is one of the agents that has a direct impact on the regeneration and vitality of the forest ecosystem. Uncontrolled fire has a deleterious effect on the regeneration. Repeated fire impacts the capacity of the forest to recover from its impact and thus reduces the vitality of the ecosystem. Fire frequency mapping and preparation of fire vulnerability maps help in effective forest fire management. The use of real time monitoring tools is a potential mechanism for effective fire management.

2.3.3 N**atural factors such as floods, landslides and windstorms etc:** Though natural calamities may not be prevented but their negative effects can be reduced. Documentation and assessment of all incidences of natural calamities and their impacts on forests, biodiversity and local communities can be useful for better planning and management.

2.3.4 **Area affected by and protected from grazing**: Uncontrolled livestock grazing in forest areas is detrimental to forest health and ecosystem vitality as it adversely impacts natural regeneration causes soil compaction and consequently diminishes the infiltration capacity of the soil. WPOs may ascertain livestock numbers from Animal Husbandry department and take the assistance of Grazing Settlement Officers to determine carrying capacity for grazing in forest areas.

2.3.5 **Area infested with invasive alien species**: Invasive alien species are a major threat to the forest ecosystem's vitality and its health in terms of biodiversity. They affect regeneration of principal species and their associates. Effective steps for eradication of invasive species are necessary for maintaining desired forest functions.

2.3.6 **Details of incidence of pests and diseases**: Pests and diseases affect the health and vitality of a forest ecosystem. Mapping of frequency of such events and the extent of area affected may help in devising effective strategies for prevention as well as control of such incidents. These strategies may include adoption of suitable silvicultural practices, use of healthy planting material, reducing risks that cause injuries to the forest crop thus making them susceptible to pest attacks and diseases.

2.3.7 **Details of Forest degradation due to pollution**: Incidence and extent of forest degradation due to pollution (soil, water, and in some cases air), and the mitigation measures taken and the impacts thereof may be recorded.

2.3.8 **Other drivers of forest degradation**: There are other drivers of forest degradation and deforestation and barriers to reforestation. Identification of these with inputs from stakeholders shall provide further insights for better management prescriptions.

2.4 Conservation and Management of Soil and Water Resources

The nature of soil and availability of water greatly influence the composition and quality of forests. Similarly, a good forest growth adds to the quality and abundance of soil and water. Given this complementary nature, the forest management prescriptions have to be so crafted as to minimise risks of degradation and maximize benefits of goods and services. For this, following information may be useful:

2.4.1 **Inventory of water bodies and sources:** The water bodies inside the forests not only improve the water regime but also provide diverse ecosystem for supporting biodiversity. Over exploitation of the ground water resources creates water-stress that necessitates

suitable management interventions. Mapping of all water resources in the forests including springs forms a basis for conservation and management intervention.

2.4.2 **Area treated under soil and water conservation measures**: The soil and water conservation measures reduce the surface flow, help infiltration and reduce the soil erosion. Planning for soil and water conservation structures greatly help in improving forest growth, however, in the low rainfall areas such structures have to be considered carefully as they may adversely affect water availability in downstream areas.

2.4.3 **Monitoring of ground water**: Periodical recording of water level in open wells during dry and wet seasons to determine the ground water level. It will help in the assessment of the impact of interventions taken in the catchment on the groundwater.

2.4.4 **Identification of areas vulnerable to erosion and prescription for treatment**: Identifying areas vulnerable to erosion and planting of local grasses in such areas are very effective for immediate control of soil erosion. Later on, plantation of suitable species may also be done.

2.4.5 **Mapping of riparian zones for special management prescriptions**: Riparian zones act as discharge zones and with appropriate vegetation help in lowering of water temperature, better dissolved oxygen, less turbidity and maintenance of channel shape. In areas with low rainfall, riverine plantations are likely to have a negative impact on the stream flow. Therefore, riverine plantation should be rainfall specific.

2.4.6 **Monitoring of streams, lakes, wetlands, ponds and other water bodies in forested catchments**: Eco-restoration, natural regeneration, tree/shrub/grass planting, soil and water conservation structures protect streams, lakes, wetlands, ponds and other water bodies and sea shores. The important forested catchments need to be monitored to assess the discharge and silt load. This data shall help in developing long term strategies for managements of streams and all water bodies.

2.5 Maintenance and Enhancement of Forest Resource Productivity

The net primary productivity (NPP) is the total energy accumulated by the plants during photosynthesis. The NPP of a forest is an indicator of how much it can produce in terms of timber, fodder, grass, Non-timber/wood Forest Produce (NTFP or NWFP) etc. However, productivity of not all of these produces can be maximised simultaneously. Therefore, there are trade-offs depending on the objective of management. The estimation of growing stock of timber is not the complete reflection of the productivity of a forest. Some forests by their open nature such as dry deciduous forests have low timber volume in terms of growing stock but compensate it by higher grass yield. The productivity of forests depends on the species composition, growing stock, increment and distribution of dia-class/age-class. Information on growing stock and its growth is necessary for efficient planning and management of the forests. The forest inventory, survey and mapping provide this important input. An assessment and the analysis of the following parameters indicate the status of the forests and the management interventions required:

2.5.1 **Estimation of growing stock**: Growing stock is the standing volume of a forest crop. In forest management parlance it is the existing wood resources and an estimation of carbon stock. Estimation of growing stock thus forms the basis for the forest management.

2.5.2 Estimation of current annual increment (CAI) and mean annual increment (MAI) of the forest crop: Increment of a forest crop is the rate of increase in growing stock per unit area. When taken annually, it is known as CAI and when taken as average over a long period of time, it is known as MAI. Higher increment also means higher carbon sequestration. The increment depends on locality factors such as site quality and composition, structure and stocking of the forest crop. Normal increment is one of the three conditions to be fulfilled to achieve a Normal (ideal) forest. Hence estimation of increment forms the basis in forest management.

2.5.3 Assessment of forest structure: The assessment of forest structure is generally done using age-class/diameter distribution. Maintenance of forest structure is essential for sustainable production of goods and services. The diameter is a proxy for age and the diameter distribution of the principal species, and their associates indicate the presence or absence of different age classes in a forest crop. Presence of all age-classes in even-aged forest and presence of all diameter classes in selection forest indicate the sustainability of a population and the benefits drawn from it.

2.5.4 Estimation of Basal Area (BA) and the number of stems per unit area: Basal area is a function of crop diameter and number of trees per unit area. Basal area along with the number of stems per unit area is a better indicator of a forest crop to sustainably provide the goods and services it renders.

2.5.5 Estimation of Carbon stock of the forests: An estimate of the carbon stock of the forests over a period of time indicates the carbon sequestration potential of the forests thereby the mitigation potential of the forests against climate change.

2.5.6 Area taken up for eco-restoration, rehabilitation and reclamation: The degradation of the forest leads to lower productivity. Analysis of measures taken up for mitigating the effects of the degradation, mining and shifting cultivation etc, especially through eco-restoration, rehabilitation and reclamation will be useful for effective management of forests.

2.5.7 Area taken up for improved productivity through afforestation: The productivity of a forest depends upon the genetic material of the trees also. It is difficult to manipulate the genetic makeup of a natural forests but can be done while raising plantation. The superior quality planting material is essential for increasing the productivity.

2.5.8 Area taken up for subsidiary silviculture operations: The timber, bamboo and NTFP productivity can be enhanced with suitable subsidiary silvicultural operations **(SSOs)** like thinning, tending, cleaning, pruning etc. In addition to these, SSOs to protect water resources and soils, to reduce disturbance and damage to wildlife habitats and ecosystems are also undertaken. Assessment of all SSOs undertaken and area covered indicate the efforts taken up for enhancing the productivity of the forests.

2.5.9 Analysis of Species composition: A forest with mixed species composition provides multiple goods. The object of management determines the species composition and an analysis of the tree diversity of a forest crop indicates the multiple goods a forest could provide.

2.6 Optimization of Forest Resource Utilization

Forests provide multiple goods for the use of the society in the form of timber, fodder, grass, fruits, nuts, gums, resin, tendu leaves, medicinal plants etc. The knowledge of the communities on the conservation, harvesting /collection practices, grading and storage helps in sustainable management of forest resources. Identification of the important forest produce, their demand and sustainable supply and the harvesting pattern will form basis for making sound management prescriptions. The following information may be useful in this regard:

2.6.1 Agriculture customs and requirement of the local people: An estimation of the requirement of the local people for small timber for agricultural and other local community uses on the basis of the socio-economic survey will indicate the dependence of the population on forests.

2.6.2 Listing of important NTFPs along with parts used and harvesting patterns: This listing is required to strengthen and diversify the local economy proportionate to the scale and intensity of management activities.

2.6.3 Extent of non-destructive / sustainable harvesting of resources: Bio resources are harvested and whole plants or different parts are used. If whole plants, underground plant parts or bark are used, this often leads to the death of the plant and is likely to have an adverse effect on its population than a plant whose leaf or seed or flower is used. An analysis of the part used, collection and harvesting practices will help to encourage practice of non-destructive / sustainable harvesting practices that lead to sustainability of NTFPs.

2.6.4 Demand and supply of timber and NTFPs: The socio-economic study and the local market survey will provide an assessment of the dependence of the local people on the forests for timber. This will also include the estimation of import and export of timber. This will enable the assessment of per capita consumption of timber by the people living near the forests.

2.6.5 Low impact harvesting: Assessment of any low impact harvesting technique being followed in the forest division. Harvesting and extraction of forest resources are undertaken in the manner so that merchantable waste is reduced, and damage to other products and services is avoided.

2.6.6 Recorded removal of timber, firewood, grasses, fodder, bamboos, NTFPs etc: Analysis of annual removal over a period of time indicates the trends in sustainability of production. This analysis may help in deciding corrective measures.

2.6.7 Valuation of the forest resources based on market prices: An estimation of the value of all the goods that are extracted from the forests based on the market value gives insight for making decisions for the optimisation of the use of the goods from the forests.

2.6.8 Forest enterprises: Wood based industries and other industries that use raw materials sourced from the forests are important stakeholders in the management of forests. Listing of forest based industries and enterprises in the forest division and outside forest division but sourcing raw material especially NTFPs from the division, not only indicate the forest based employment generation potential but also the contribution of the forests towards the local economy and indicates scope for new forest based enterprises.

2.6.9 **Access and Benefit sharing**: NTFPs are sourced from the forest areas for commercial use by the industry. Proper documentation of traded quantity and sharing of the benefits with the Bio-diversity Management Committees (BMCs) as per the provisions of Bio-diversity Act and ABS guidelines notified there under can help in the conservation and sustainable use of NTFPs on one hand and help communities get commensurate financial benefits.

2.7 Benefits to local people-social and cultural values.

An assessment of the following aspects may help in better understanding of the interface of forests in the social, cultural, economic and ecological aspects of the local people that will provide inputs for making management decisions:

2.7.1 **Details of employment generated**: A calendar of forest activities along with details of employment generated is useful in planning for manpower requirements. It also reflects direct employment generated from forest management activities. For the skill based operations, necessary training/skill up-gradation programmes can be planned for local people. This ensures availability of required work-force locally.

2.7.2 **Use of traditional Knowledge and listing of knowledge holders:** The local health practitioners of indigenous medicinal system are repositories of traditional knowledge which have a close linkage with the forests. This information may also be available in the Peoples' Biodiversity Register (PBR) prepared by the Biodiversity Management Committees. Their knowledge of the distribution of the species, their extent, their diverse use and availability etc shall form the basis for making sound management prescriptions.

2.7.3 **Sacred groves and other cultural values**: Sacred groves are great repositories of biodiversity and have great religious, cultural and conservation significance. Listing of these groves and the practices of their management may provide insight into special management interventions required for adjoining forests.

2.7.4 **Details of social customs on forests and forestry practices:** There are community specific social customs, customary laws on various forestry related activities like collection of NTFPs, their use etc. Identification of the same indicates the close cultural linkage of the communities with the forests which could contribute to making culturally conscious management prescriptions with the active participation of the local communities.

2.7.5 **Ecotourism sites and activities**: Ecotourism is responsible travel that involves interpretation and education about natural areas. Areas inside and adjoining designated forests, which have ecotourism potential to be identified and documented for effective implementation of ecotourism.

2.7.6 **Identification of rights and concessions of the local communities:** The communities living near the forest enjoy rights and concessions from the forests. Documentation of these rights and concessions, other than the rights recognised under FRA as recorded in para 2.1.7, as they have bearing on the management of forests.

2.7.7 **Ecosystem services and benefits**: Wherever possible a framework for identification, quantification and valuation of ecosystem services may be explored and documented.

2.8 Policy, Legal and Institutional Framework

National and State policies on forests, wildlife, water and environment govern the way forests are managed. The Indian Forest Act, 1927, the Forest Conservation Act, 1980, Wildlife (Protection) Act 1972, Environment (Protection) Act, 1986, Biological Diversity Act, 2002, Compensatory Afforestation Fund Act, 2016 and any other state specific law and rules made there under provide legal framework for the conservation and sustainable management of forests, wildlife and the biodiversity that the forests harbour. The Forest Rights Act 2006 and PESA Act also impact the management of the forests in India. An examination of these legal instruments and their implementation, various institutions involved with the forest management and research will indicate the impact of these instruments on forest management. For this aspect examination of the following details (and records thereof) are necessary**:**

2.8.1 **Listing of legal instruments governing the forest management**: This includes state/ locality specific rules, regulations.

2.8.2 **Role of panchayats or any locally elected bodies in the district and council areas in forest management**: Analysis of the village development plan and its focus on forests, wildlife and environment.

2.8.3 **Participatory forest management:** Participatory forest management is implemented on the principle of care-and-share. Listing of the committees constituted for the participatory forest management, extent of forest area under their management, status of preparation and implementation of their micro-plans, and effectiveness of these committees in management of forest is vital for furtherance of participatory forest management.

2.8.4 **Details of BMCs:** BMCs are constituted under the Bio-diversity Act to promote conservation, sustainable use and documentation of biological diversity including preservation of habitats, and chronicling of knowledge relating to biological diversity. The ABS Guidelines 2014 and further amendments specify the process for Access and Benefit sharing of bio-resources. Listing of BMCs, benefit sharing agreements, if any, data on the quantity of traded bio-resources especially NTFPs indicates the benefits derived by the communities from the forest resources.

2.8.5 **Forest, biodiversity and wildlife related offences**: Listing of year wise forest, biodiversity and wildlife related offences and details of conviction, if any, indicate the effectiveness of enforcement of law.

2.8.6 **Financial outlay**: Assessment of expenditure in the forest division on establishment and on developmental activities under different schemes indicates the potential financial outlay that helps the WPO to plan the financial forecast for the WP prescriptions.

2.8.7 **Human Resource**: Adequate and trained man power is essential for effective management of forests. Assessment on the vacancy of personnel against the sanctioned strength, percentage of women officials, requirement of additional human resources, if any, status of mandatory training of the staff as per the relevant State rules governing the same, details of in-service training programme organised etc.

2.8.8 **Gender aspects**: Women are involved in forest based income generation activities as they are the primary collectors of NTFPs and their primary processing. Women are likely

to have knowledge on forestry resources linked with food, health, fodder and firewood. However, their commensurate roles do not reflect in the forest management. Mapping of gender based roles and activities in forestry, assessing the contribution of the women in forestry activities, their role in forest management planning, training and capacity building for women organised by the forest department etc. are essential to understand gender mainstreaming in forest management.

2.8.9 **Labour welfare**: The welfare of the labours involved in forestry operations is of utmost importance. Listing of the different laws governing the labour welfare and analysis of adherence to the same indicate efforts taken for labour welfare.

2.8.10 **Environmental awareness and education**: Assessment of all efforts made to increase environmental awareness and education on forests, the benefits provided by the forests, along with list of the published material.

2.8.11 **Infrastructural support**: Adequate infrastructure in terms of office, residential accommodation of the staff, transportation facilities and communication facilities are necessary for effective forest management. Listing of the entire infrastructure available enables identification of gap, if any, and planning for reducing the gap.

2.8.12 **Research and development**: Research and academic institutes are important stakeholders. Research plots, preservation plots, seed orchards, seed stands/seed production areas etc established by forest department and research institutes are research infrastructures for forest management. Documentation of the efforts of the forest department for the production of quality planting material and focus on native endemic and threatened species, the details of research undertaken, application of results in the field and further identification of problems for research are essential for effective science based forest management.

2.8.13 **Existence of monitoring mechanism**: Monitoring and evaluation are essential tools for effective and adaptive forest management. Analysis of adherence to monitoring protocols like control forms, compartment history etc gives insight into the management of forests.