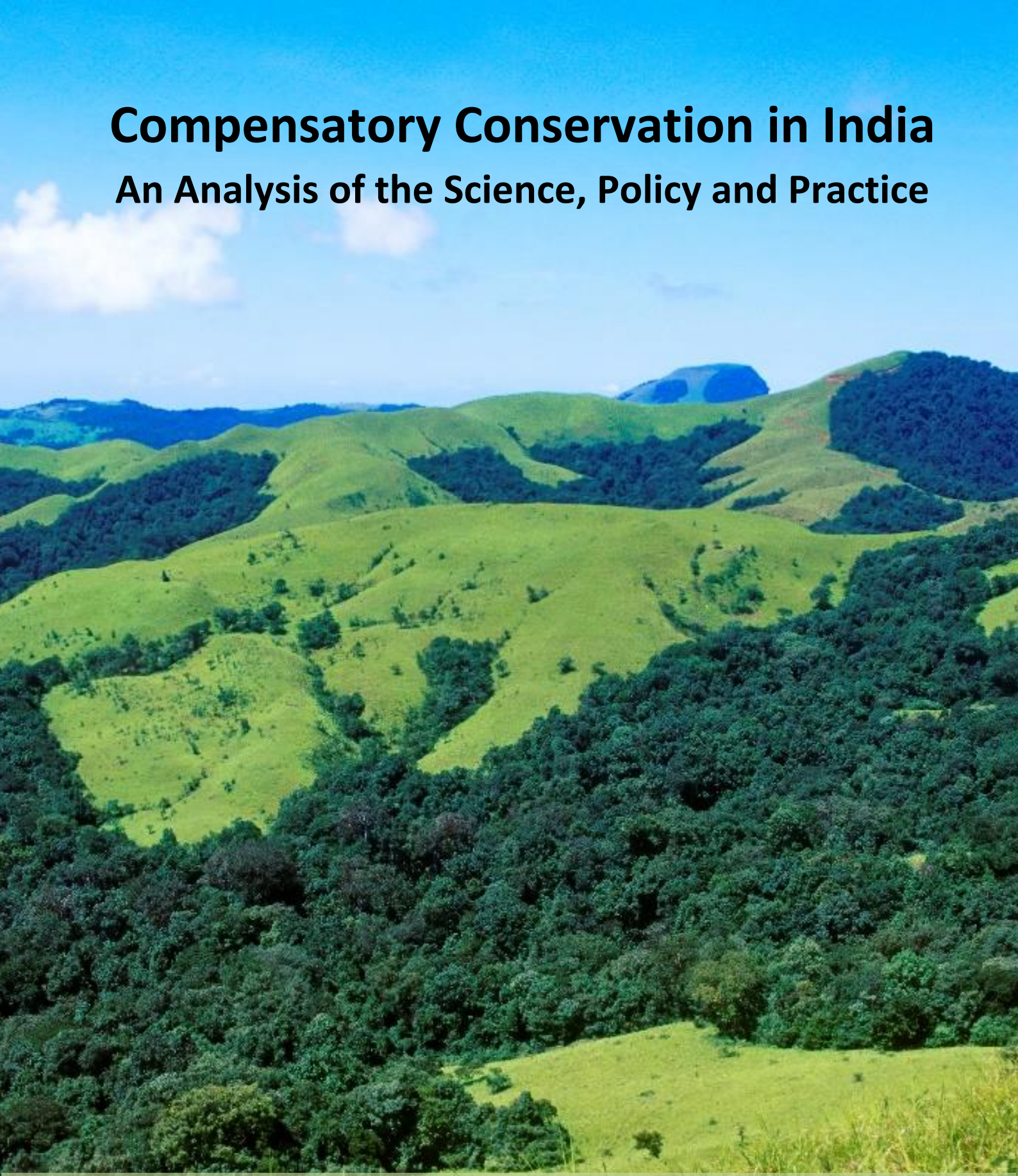
Compensatory Conservation in India

An Analysis of the Science, Policy and Practice



Report submitted to the Hon'ble Supreme Court
by the 7-Member Expert Committee
pursuant to the directions dated 25th March, 2021
in Special Leave Petition (Civil) No. 25047 Of 2018

Attribution:

Please cite the work as follows: Expert committee (2022). Compensatory Conservation in India: An Analysis of the Science, Policy and Practice, Report submitted to the Hon'ble Supreme Court by the 7-Member Expert Committee pursuant to the directions dated 25th March, 2021 in Special Leave Petition (Civil) No. 25047 Of 2018, New Delhi, India.

Cover photo:

Shekar Dattatri, Shola-Grassland ecosystem, Kudremukh National Park, Karnataka

Compensatory Conservation in India

An Analysis of the Science, Policy and Practice

Report submitted to the Hon'ble Supreme Court by the 7-Member Committee pursuant to the directions dated 25th March, 2021 in Special Leave Petition (Civil) No. 25047 Of 2018

5th January, 2022

The Hon'ble Supreme Court, in the Special Leave Petition (Civil) No. 25047 of 2018 constituted an expert committee vide its order dated 26th March 2021.

The Mandate of this expert committee is as follows:

a) Develop a set of scientific and policy guidelines that shall govern decision making with respect to cutting of trees for developmental projects.

b) These guidelines may specify the species of trees in categories based upon their environmental values considering the age and girth of the trees etc.

c) The guidelines may provide special treatment for geographical areas or eco-sensitive area, they may identify areas which need to be regulated and even identify a minimum threshold beyond which the guidelines will apply.

d) The guidelines shall prescribe a mechanism for assessment of both intrinsic and instrumental value of the trees, based not only on the value of timber, but also the ecosystem services rendered by the trees and its special relevance, if any, to the habitat of other living organisms, soil, flowing and underground water.

e) The guidelines shall also mandate rules regarding alternate routes/sites for roads/projects, and possibilities for using alternate modes of transport like railways or water-ways.

f) The guidelines shall also prescribe the mode of compensation financial and otherwise, the stage of depositing such compensation and the process that governs the computation and recovery. In this regard, the committee may consider the existing regulatory framework regarding calculation of Net Present Value (NPV) and may suggest necessary modification.

g) In addition, the guidelines shall also specify the manner and mechanism of compensatory afforestation to be carried out using the deposited compensation, consistent with the native ecosystem, habitat and species,

h) The Committee may consider the need for any permanent expert body and its proposed structural form.

i) Any other issue incidental to the aforesaid objectives.

The member of this committee are as follows:

a) Dr. M.K. Ranjitsinh Jhala, wildlife expert and former chairman of the Wildlife Trust of India – Chairman of the Committee;
b) Sri. Jigmet Takpa, Joint Secretary, Ministry of Environment and Climate change- member Secretary of the committee;
c) Sri. Arun Singh Rawat, DG, Indian Council for Forestry Research-Member;
d) Prof. Sandeep Tambe, (Indian Forest Service), currently working as Professor of Forestry at the Indian Institute of Forest Management, Bhopal-Member;
e) Dr. Gopal Singh Rawat, former Dean and Director, Wildlife Institute of India-Member;
f) Dr. Nilanjan Ghosh, Director, Observer Research Foundation, Kolkata, an expert in ecological economics-Member and
g) Sri. Pradip Krishen, Environmentalist-Member.

Contents

Introduction

"*There is a tremendous temptation for a government with forests under its control, to cut capital timber… The forests are too ripe a plum for a democratic chancellor of the exchequer… It is so easy to cut down trees, and so hard to replace them*." So wrote J.W. Best of the Imperial Forest Service of India in 1935 while making grave predictions about the future of Indian forests in a democratic setup, as forest conservation does not procure votes.

The conflict between conservation goals and developmental ambitions has been an innate component of the development paradigm and the concomitant developmental trajectory of the global South. Unbridled ambition to pursue mindless economic growth in the global South has led to lop-sided development that has exacerbated inequality on the one hand and the destruction of natural ecosystems on the other. Large-scale anthropogenic interventions and land-use change from forestlands to alternate purposes such as agriculture, linear infrastructure, urban settlements, industry, etc. have not only fragmented integrated natural ecosystems but have dented the ecological security of nations and the well-being of rural masses whose lives and livelihoods depend on forests. India is no exception.

India has one of the lowest *per capita* forest areas in the world—less than 0.08 hectares, compared with a world average of 0.64 ha. National forest reports that are published periodically depict an increasing forest cover for the country. While these reports create a 'feel good factor', it would be revealing to learn how much of this forest cover includes plantations of coconut, cashew, coffee, rubber, eucalyptus, poplar and fruit orchards. It is crucial to know if the canopy cover of native forest trees is really increasing.

In the mid-1980s, the diversion of a single hectare of forest land required approval by the environment minister of the country. Today, Integrated Regional Offices of the Ministry of Environment and Forests are empowered to grant diversion of upto 40 hectares of forest land at a time (except for diversions related to mining, hydropower or encroachment) but including all linear projects such as roads, railway lines, powerlines, etc. Today, the diversion of forest land is applied for and granted as a routine matter to facilitate the ease of 'doing business'. These diversions are often applied for piecemeal in order to stay within the limits, to obtain quick and easy approval and to evade the scrutiny that a larger project might attract and end up creating cancerous, ever-increasing fragmentation of forested biomes, whose adverse ecological impact is far greater than the actual area permitted for diversion.

Though there is empathy for nature and a belief in the sanctity of life and, in some communities, even veneration of trees, the conservation impetus in India does not emanate from the masses. The leadership provides the cues and the impetus, the lack of which provides opportunities for circumvention and subterfuge to evade environmental laws of the land and even to change these laws. There are also perceptions and traditions from the colonial past that hamper implementation of the conservation prerequisites of the present. The economic output of forests still takes precedence over its ecological value, though much less so now than in the past. 'Afforestation' has come to mean planting trees of economic value or of quick-growing exotic species that are relatively safe from impacts such as grazing and fire. Tree-planting campaigns are often based on flawed science: planting in grasslands and other open ecosystems, and even prioritizing invasive, exotic trees over native ones. India has the largest livestock population in the world that is largely dependent upon free grazing in forests and natural grasslands. Yet grasslands, amongst the most productive terrestrial ecosystems in the world and even more important in India for the dependence thereupon of the huge pastoral population of the country, continues to be the least understood and the most abused and overused biomes of the country. We have a forest policy, but no grassland policy for India. Grasslands become the first casualty of land diversion, for agriculture, encroachment and afforestation programmes.

The way in which afforestation is practiced in India often does not amount to or contribute to 'ecological restoration'. Exotic tree species and weeds are choking forests and grasslands and hampering the recruitment and regeneration of indigenous biota. Yet no biological control of invasive species has been arrived at through research. Next to clean air, potable water is increasingly the most valuable commodity on earth. Nearly all of our perennial streams have their origin and source in forest landscapes, many of them in national parks and sanctuaries. While a system of compensatory afforestation has been in place for the last several decades, we need to ask whether we have been able to recreate any of the natural biodiversity and ecosystem services that have been lost. Is afforestation with a few select, quick-growing species a substitute for the natural forests that have been felled for 'development'? What about the plight of forest dwellers who are dependent on these forests for their very sustenance and are impacted the most by forest diversion? Some decades ago, the tribal people of southern Jharkhand agitated against the supplanting of their native *sal* and other forest trees by the lucrative teak. They called teak a *sarkari* (government) tree and sought to cut down its plantations.

The sole responsibility for the management of designated forest areas which comprise almost a quarter of the land mass of the country, lies with forest personnel. The management needs of such vast and varied tracts are diverse. Specialisation and

training in diverse fields—extension forestry, restoration of degraded forests, participatory forest governance, forest hydrology, grassland management, forest conservation, protected areas management, research and others, are a prerequisite today. Despite being recommended by previous committees, specialisation is still not endeavoured.

Conservation is a compromise, "the art of the possible". There are almost always alternatives to destroying natural forests and wildlands. Even if the cost of an alternative is high, project proponents must be prepared to pay that higher price because the long-term ecological cost of forest-loss to the nation is even greater. Do national highways have to cut right through pristine forests and national parks, when a little detour can bypass them? And if they must, can they not go underground, as do much larger networks of the metro railways in our metropolitan cities? Our protected areas—small and fragile ecological islands—are the last havens of hope for the survival of our magnificent national natural heritage, which is no less precious than our other kinds of heritage.

Recognizing the dire straits of the nation's forests and trees and the need to assess not just their economic value but also their ecological importance, the environmental, water and food security of the country, the Hon'ble Supreme Court of India passed a landmark order on 26th March, 2021 in its Special Leave Petition (Civil) No. 25047 of 2018. It observed that Article 21 of the Constitution of India recognises the Fundamental Right to a clean and healthy environment and Article 48-A imposes upon the state the duty to protect and improve the environment and to safeguard the forests and wildlife of the country. This Order recognises that "many of the trees can be called 'historical trees' which have 'irreplaceable value' and compensatory afforestation cannot replace trees of this value." The Order goes on to say that "conservation and development need not be viewed as binaries but as complementary strategies that weave into one another. Conservation of nature must be viewed as a part of development and not as a factor stultifying development."

The mandate given to this Committee by the Hon'ble Supreme Court was challenging, as central to it lies complex decision-making in the sustainability domain which necessarily involves evaluating tradeoffs between the economic, social, and environmental dimensions. These decisions are complex because they straddle multiple disciplines and sectors of governance. The Committee has tried to reconcile these conflicting paradigms by opting for a long-term sustainable development approach over short-term reductionist thinking where infrastructure is created oblivious of issues relating to the human dimension, spatial equity and landscape integrity. Attaining sustainable development goals will entail recasting developmental policies to simultaneously deliver social inclusion, ecological security and economic prosperity. Decision-making across the conservation-development divide can be

difficult and the Committee has taken inspiration from the moral compass provided by Mahatma Gandhi that whenever in doubt, the decision-maker should contemplate the effect that his proposed action would have upon the poorest in society. The principle of *Antyodaya* or uplifting the weakest sections of society was expanded to include forests and biodiversity as well, as they too are voiceless and marginalized and their denizens are also citizens of India, struggling to survive in an increasingly anthropocentric world.

The mandate provided to this Committee by the Hon'ble Supreme Court covers not only the conservation of trees impacted by development and compensating for their loss, but also the identification of geographical areas that need special conservation attention, rules regarding linear infrastructure intruding into natural areas, a review of our Net Present Value (NPV) framework, the manner and mechanisms of forest clearance and compensatory afforestation, the need for a permanent expert body and other ancillary matters. Instead of taking up these topics on a piecemeal basis, the Committee has adopted a holistic approach wherein the science, policy and practice of the compensatory conservation regime of the country has been reviewed and recommendations provided.

While going about its business, the 7-member Committee adopted a scientific and broad-based approach to develop this Report. Field visits could not be undertaken due to restrictions imposed by the COVID-19 pandemic. Hence, the Committee banked on secondary information, online stakeholder consultations, internal deliberations and the domain expertise of the expert members. In the review of secondary literature, best practices globally and within the country were assessed, a performance review by the Controller and Auditor General of India (CAG) was banked upon, reports prepared by various think tanks and civil society were referred to and scholarly literature was accessed. Select references pertaining to various sub-themes are listed at the end of each Chapter.

Based on this methodology, a draft consultation note was prepared and shared with the state governments, union territories and integrated regional offices of the MoEFCC. This was followed by five regional consultations with these stakeholders—Central region on 30th June 2021, Western and Northern region on 6th July 2021, Southern region on 8th July 2021, Himalayan region on 13th July 2021, and Eastern and North Eastern region on 15th July 2021. A special consultation was organized with local tree authorities, state forest departments and the Forest Policy Division of the MoEFCC on 6th October 2021 to discuss the policy, laws and practices of protecting public trees. The MoEFCC was requested to grant time for the Committee to make its presentation and get feedback on its Report, but this consultation could not materialise. Thereafter, a request was made to the MoEFCC to give comments on a detailed executive summary of the Report, but these too were not forthcoming. The

Committee would have liked wider consultations and engagement with a diverse array of stakeholders before finalising its Report but this was not possible as procedurally, the draft report cannot be made public for obtaining feedback because it has first to be submitted to the Hon'ble Supreme Court who commissioned it.

Many subject matter experts were consulted and they wholesomely shared their expertise and experience, which strengthened the report in many ways. Shri B.M.S Rathore and Shri Chitranjan Tyagi contributed extensively to the chapter on ecological restoration, Shri Praveen Bhargav and Shri Shekar Dattatri provided insights into the forest clearances and ecological restoration chapters. Shri Mahendra Vyas gave particulars of court rulings and present practices, Dr. T. R. Shankar Raman and Dr. Divya Mudappa shared their expertise on restoration of rainforests in the Western Ghats. Shri Sanjay Kumar, Dr. Pratap Singh, Shri Ved Pal Singh and Dr. Bivash Pandav helped compile the list of areas of special conservation significance. Discussions with Dr. Kinsuk Mitra, former President of erstwhile Winrock International India, New Delhi and Dr. Somnath Hazra, Consulting Economist, International Institute of Environment and Development, UK, helped in drafting the recommendations of Chapter 5 on Net Present Value for Indian forests. Scientists from the Indian Council of Forestry Research and Education (ICFRE) contributed to the chapter on the valuation of trees. A number of scientists from the Wildlife Institute of India (WII) and other reputed institutes, experienced foresters and naturalists, contributed in the identification of important geographical areas which are listed in Appendix 2.1. Shri K. Parameshwar, *amicus curiae*, rendered invaluable advice on legal aspects as directed by the Hon'ble Supremet Court in its order. Special thanks are due to members of this committee Dr. Sandeep Tambe and Dr. G.S. Rawat for formatting this report and to Shri Pradip Krishen for editing it, all working overtime to meet the deadline. Mr. Ravi Kumar provided able secretarial support and hosted all the online meetings. The Committee is grateful to Mr. K.V.C Sekhar for typesetting the Report and making it print ready.

The Committee met on a weekly basis, non-stop over a period of nine months to prepare, deliberate and consult, and a total of 32 online meetings were organized. The Committee extensively consulted State/UT's Governments, State Tree Protection Authorities/Tree Preservation Authorities of the States, state CAMPA authorities, Integrated Regional offices of the MoEFCC, Forest Policy Division and various other experts. The date-wise details of the meetings convened and details of the experts consulted is provided in Appendix A. The Committee acknowledges its deep gratitude to all of them. This Report carries with it the burden of their hopes, expectations and optimism. While studies are commissioned with a quantum of enthusiasm and positivity, not many of the reports succeed in changing the *status quo*. Most of them end up being discarded and condemned to languish in files or, even if accepted, lie dormant for want of political will. We hope that this Report will find the support of

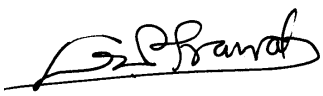
the Judiciary, the government and the public and contribute to securing the future of forests and forest-dwellers of the country.

M.K. Ranjitsinh
(Chairperson)

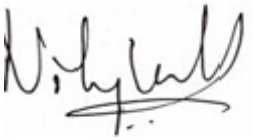
Jigmet Takpa
(Member Secretary)

Arun Singh Rawat
(Member)

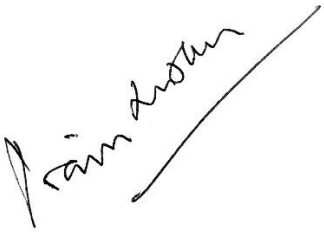
Sandeep Tambe
(Member)



Gopal Singh Rawat
(Member)



Nilanjan Ghosh
(Member)



Pradip Krishen
(Member)

Executive Summary

The Hon'ble Supreme Court *vide* its Order dated 25.03.2021 in the matter of SLP (C) no. 25047 of 2018 (Association for Protection of Democratic Rights Vs. State of West Bengal) constituted a seven-member Expert Committee under the chairmanship of Dr. M.K. Ranjitsinh and provided it with a 9-point mandate (a to i).

While going about its business, the 7-member Committee adopted a scientific and broad-based approach to develop this Report. Field visits could not be undertaken due to restrictions imposed by the COVID-19 pandemic. Hence, the Committee banked on secondary information, online stakeholder consultations, internal deliberations and the domain expertise of its expert members. The Committee convened online 32 times. In reviewing the secondary literature, best practices globally and within the country were assessed, a performance review by the Controller and Auditor General of India (CAG) was banked upon, reports prepared by various think tanks and civil society were referred to, and scholarly literature was accessed. Select references pertaining to various sub-themes are listed at the end of each Chapter. Based on this methodology, a draft consultation note was prepared and shared with the state governments, union territories and integrated regional offices of the Ministry of Environment, Forest and Climate Change (MoEFCC). This was followed by 5 regional consultations with these stakeholders. A special consultation was organized with local tree authorities, state forest departments and others. Many subject matter experts were consulted and they shared their expertise and experience with us, which strengthened the Report in many ways. The Committee would have liked wider consultations and engagement with a diverse array of stakeholders before finalising its Report but this was not possible as procedurally, the draft Report cannot be made public for obtaining feedback because it has first to be submitted to the Hon'ble Supreme Court who commissioned it.

This Report has been organized into 7 chapters covering this mandate, wherein each chapter provides a background, a review of current policies and practices including major gaps and shortcomings, recommendations and key references, along with supporting appendices.

Chapter 1 deals with scientific and policy guidelines for valuing public-owned trees on non-forest land (PTNFL) such as those along highways, roads, canals, parks and institutional areas (but excluding farm trees, agroforestry and others on privately-owned land). We found that while PTNFL are protected under various national and state laws, the main function provided to local authorities under these laws is to protect them from individuals and not from public projects that are emerging as the

biggest drivers of their destruction. When forests are diverted for development, the Forest Conservation Act, 1980, lays down a procedure of compensatory conservation. But when it comes to protecting PTNFL from development projects, there is a policy void. In the absence of a national policy, the doctrine of *fait accompli* usually comes into play, with tree-felling approvals rendered as a mere formality when projects have already been sanctioned and awarded. Also, in most of the states, there is a lack of a mitigation, valuation and compensation mechanism in place. Our recommendations are as follows:

- To be able to value trees using the benefit-based approach, we found a dearth of scientific studies in the Indian context. Hence, we provide a framework for valuing trees based on the cost-based approach of transplantation and substitution, using the trunk formula with the species, size, condition and location as input variables, as described in Appendix 1.3.
- For protecting PTNFL, there is a need for a national model Act that will codify the functions, powers and composition of a tree conservation authority at various levels, mainstream tree conservation aspects in developmental planning, articulate the mitigation hierarchy to govern decision-making, enable public participation, prevent abuse of trees, lay down the monitoring protocol and other ancillary aspects to be adopted by state governments in a time-bound manner, while taking into account their local context and practices related to the veneration of individual trees, tree species and the religious significance of tree stands.

In Chapter 2, we have identified important geographical areas and eco-sensitive sites of high conservation significance in the country and provided guidelines for their conservation, along with a minimum threshold beyond which land diversion and tree felling should not be allowed. Such areas are divisible into 2 categories: (a) existing and future Protected Areas (PAs) of the country notified under legislation and rules; (b) all other areas outside the PA network with high conservation significance and which are liable to be damaged or diverted in the process of infrastructure development, and which, despite their critical ecological value, have not been included in or designated as 'Protected Areas' due to the overt reluctance of governments to notify them as such, over the past 3 decades. We used the following criteria to identify such unprotected areas: (i) biologically significant areas that harbour endemic and highly threatened species and their habitats; (ii) heritage sites representing areas of special geological, cultural and religious significance; (iii) bio-corridors that provide crucial passageways for the movement and dispersal of important and threatened species to maintain genetic contiguity and ecological integrity; and (iv) eco-sensitive zones adjacent to existing PAs. An initial list of 294 such sites including all elephant corridors (84 in number identified by the Wildlife Trust of

India), is provided in Appendix 2.1. These areas (i to iv above) have been collectively termed 'Ecologically Critical Areas' or ECAs in this Report. More such areas may be added in the future and appropriate measures should be taken to demarcate, notify and protect such sites following the guidelines provided. The Committee noted that presently there is hardly any legal provision to protect such ECAs which need to be protected either by augmenting existing legislation or by framing a new one. Major recommendations under this chapter are:

- All ECAs identified by this Committee (Appendix 2.1) need to be assessed for their feasibility and demarcated on the ground by respective state governments/Union Territories and notified appropriately under the Environment Protection Act, 1986, to ensure their protection.
- State Forest Departments (SFDs) or State Biodiversity Boards (SBBs) may identify these areas and add on to them, using criteria suggested by this Committee. State Governments need to secure all bio-corridors of large mammals, especially for the seasonal movement of elephants and other large mammals, and important habitats of other critically endangered species.
- All ECAs need to be protected from undesirable and substandard physical infrastructure and pollution that may negatively affect the aesthetics, serenity and ecological security of these places and their surroundings.
- Whenever any part of a notified PA or identified bio-corridor is sought to be diverted/denotified, that diversion/denotification shall occur only after its endorsement by the Permanent Expert Body envisaged in this Report and after an area at least twice the size of the area to be diverted/denotified is added to the very same PA/area, by the same legal procedure by which the PA/area was set up, i.e., by notification under the concerned law/executive order, etc. If adjacent public lands are not available for this purpose, they will need to be acquired. Project approval would be a *quid pro quo* with approval to be given only after requisite land has first been notified and added to the area in question, as indicated above.
- The Committee recommends a zero threshold or 'no land diversion' for areas containing the nesting sites of highly threatened birds and the Type Localities of highly localized and gravely endangered species. Other thresholds for different categories are also recommended.

Chapter 3 provides a comprehensive review of the impacts of linear infratsructure intrusions into natural habitats and Protected Areas. Linear infrastructure–roads, railways and powerlines—are an integral part of socio-economic life and development. But do they have to divert forests and destroy the nation's natural heritage? Would such intrusions be allowed to go into or across our other kinds of

national heritage sites? These intrusions are made into forests and public lands of national ecological importance because they are the easiest and economically cheapest alternatives. Habitat fragmentation, disturbance and decimation—both qualitative and quantitative—are currently recognized as the greatest threats to the long-term survival of faunal species and the ecological security of pristine and important biomes. Recent studies point out that roads have overtaken hunting as the leading direct human cause of animal mortality on land. They also adversely impact the lifestyle of some indigenous people and help the ingress of invasive and exotic plants. Devious stratagems like seeking piecemeal permissions, construction of linear intrusions right up to the edges of Protected Areas to provide a '*fait accompli*', and others, are adopted to get clearances and permissions. The Committee recommends the Primacy of Prevention as a first priority, i.e., the avoidance of crucial areas by bypassing them, even if this entails incurring additional costs. If total avoidance is not possible, deviation of the route to at least spare the core area and other crucial parts of the area in question, should be the next alternative. The third option when the first two options are unavailable is to go underground, just as metro railways, powerlines and other linear intrusions do in metropolitan cities and even in some Protected Areas. It is pertinent to note in recent years that Delhi has constructed 48.6 km of metro railway lines underground, Chennai 24 km, Bengaluru 8.82 km and Ahmedabad 6.5 km, most of them through granite and other hard rock. In Mumbai, 33 km of metro lines have been taken underground and the proposed Bullet Train within the Mumbai Metropolitan Region will also be built underground including under Thane Creek and Flamingo City. Underground water tunnels have been built below Sanjay National Park in Mumbai. Powerlines have also been taken underground in the Khadir Sanctuary in Kutch. If roads cannot bypass these special designated areas, they can and must go through them underground and not on elevated passageways. The last alternative is that if linear intrusions have to go overground, ecological imperatives will take precedence over economic considerations and the long-term conservation interests of the area must remain paramount and prevail over construction norms provided for roadways, powerlines and other intrusions: *inter alia*, no upgrading or widening of existing roads; all powerlines to go underground; new roads to be single lane roads; crucial habitats to be completely avoided; speed limits and speed breakers to be installed; no movement on roads inside PAs at night; no stoppage and no infrastructure construction, and more.

In Chapter 4 we analyse the policy and practice of forest clearances and compensatory principles. Performance assessments by the Controller and Auditor General of India show that against the receivable non-forest land, only 27% was received and compensatory afforestation was done on only 7% of the area it ought to have covered. Only 14% of the land transferred to state forest departments was declared as reserve forest/protected forest. The present 'land for cash' policy is commodifying and

devaluing, even denigrating, nature and natural resources and resulting in a net loss of biodiversity on a permanent basis. We recommend the following:

- There is urgent need to strengthen and improve the decision-making context while diverting forests for development, by putting in place a codified mitigation hierarchy of avoidance of impacts, minimisation of inevitable impacts, on-site restoration, and biodiversity offsets.
- It is imperative to shift to a 'land for land' policy above a certain threshold value and to streamline this policy by setting up land banks and accredited offsets.
- Notification of non-forest land as 'forest' to be urgently expedited by the states
- The process of splitting projects to evade central scrutiny and approval must be stopped
- Compliance with final clearance conditions by user agencies needs to be strengthened very significantly
- The Compensatory Afforestation Act, 2016, is adversely impacting the additionality of compensatory conservation, as many states are now substituting their regular funding to the forestry sector with compensatory funds that are now available, thereby negating the very purpose of such additionality. This needs to be stopped and compensatory levies routed directly to the state fund rather than the state treasury, as is standard practice in Centrally Sponsored Schemes (CSS).

Chapter 5 provides an in-depth analysis of various methodological and conceptual issues in the estimation of Net Present Value (NPV) for diverting forests for development purposes and suggests substantial modifications in the methodology of estimation of NPV on the basis of state-of-the-art knowledge that has affected global thinking and practices, thereby bringing into prominence prevalent methods of valuing ecosystem services. It needs to be noted that the Hon'ble Supreme Court was instrumental in setting up the *Expert Committee on Net Present Value* under the chairpersonship of Prof. Kanchan Chopra which submitted its report in 2006. With estimates recommended by the Central Empowered Committee (CEC) presently in vogue, NPV estimates used presently for payment are already 15 years old and a revision is long overdue. The present Report critically analyses the Report of the Expert Committee on Net Present Value 2006, the estimates of the Central Empowered Committee (CEC) 2008 (which is presently in use), recommendations of the IIFM Report of 2014, and the proposed NPV revision with respect to WPI as recommended through an Office Memorandum of the MoEFCC. Existing methods of fixing NPV (as recommended by the CEC) suffer from 3 major problems: a) choice of ecosystem services; b) choice of methods; and c) lack of reflection of present market conditions. We finally make recommendations that broadly entail: a) consideration of a few ecosystem services without considering supporting services, as that can lead to

'double counting'; b) NPV should be site-specific; c) development of a standard template (computer and/or mobile application) where with some input values being entered to estimate values of a few ecosystem services, i.e., timber flow, carbon storage, fuelwood and fodder, NTFPs, water purification, soil conservation, water conservation, and air pollution control, the output values of NPV will be obtained. The specific methodological recommendations are:

- The rotation period for a forest may be chosen as 60 years, as that emerges as an indicative average considering the data for 14 major Forest Type Groups.
- A standardised template with fixed formulae should be created so that just by placing input data of some of the variables will provide the present value or PV. NPV gets estimated on the basis of these as one enters the input values as shown in the yellow cells of the tables in Appendix 5.1
- The excel template can be made into a computer programme or a mobile application
- Every state forest department should appoint a nodal officer dedicated to enter the input data in the excel sheet, that will then yield final NPV values
- A dedicated expert committee on NPV may be formed with a ToR on the nuances of NPV in terms of expanding the above list, updating the list and ecosystem services valuation, updating of methods and datasets. This body should also set the formula and help in updating the template.

Chapter 6 deals with graduating from afforestation to an ecological restoration regime. This chapter complements Chapter 4 and contributes to the mandate (g) that relates to compensatory afforestation and assesses the extent to which it is 'consistent with the native ecosystem, habitat and species'. This chapter provides basic terminology, principles of ecorestoration, a review of global and national policies and practices and strategies to graduate from compensatory 'afforestation' to compensatory 'restoration'. The science of ecological restoration indicates the need for differentiating impacted ecosystems as degraded, damaged and destroyed and then adopting site-specific approaches with suitable natural, assisted or reconstructive restoration approaches, with full involvement of the local community. A review points out that natural and assisted restoration may be more cost-effective in moderately damaged ecosystems, and in some cases, reconstructive restoration can even cause more harm than good. Also, in moderately damaged ecosystems, it is not necessary to plant more trees when nature is doing the job admirably by itself.

The national afforestation policy permits only reconstructive restoration by promoting intensive tree plantations (1,000 trees per hectare), which may appear attractive in the short term, but in practice is often biased towards fast-growing, non-native tree species that have very limited scope of fostering biodiversity and ecological security and may even cause ecological and economic harm as in the case of Kutch, where invasive mesquite (*Prosopis juliflora)* is shrouding the grasslands, the most productive biome on which depends the livelihoods of so many. The existing policy does not target the causes of degradation as a pre-condition and as a result, costly afforestation assets often meet the same fate as the original forests. Present policy has a heavy 'forest' bias, as a result of which non-forest ecosystems such as grasslands, savannahs, wetlands that have intrinsic ecosystem values and benefit local communities, are often converted into sterile monocultures. India is a signatory to the Global Restoration Initiative and Bonn Challenge, and the UN Decade of Ecological Restoration provides a golden opportunity to graduate from a costly, uniform, reconstructive afforestation to a more inclusive, cost-effective and ecologically sound ecorestoration regime. The key recommendations include:

- Our national compensatory conservation policy and practice need to graduate from 'afforestation' to 'ecological restoration' by changing policies, laws, guidelines and mindsets and by building capacity at all levels.
- The present uniform afforestation policy of 1,000 trees/hectare should be done away with. Instead, a whole range of ecological restoration approaches, namely, natural, assisted and restorative, need to be made permissible, based on the status of the ecosystem, i.e., degraded, damaged or destroyed.
- Other than plantations, ending the drivers of degradation in partnership with local communities is key to restoration so that the root cause is addressed. Compensatory conservation should include this component (ending the causes of degradation) as a permissible activity.
- The imperative to adequately and in a timely manner compensate forest-dependent communities affected by forest diversion and strengthen their participation in afforestation and even more so in ecological restoration.
- Avoid forest expansion in non-forest ecologies such as grasslands, savannahs, wetlands, etc. and rethink the current 'forest-centric' bias of our afforestation policy.
- Avoid planting exotics, invasives, commercial species and plant only local native species which belong to the particular ecosystem, the plantations being of mixed species of trees and not monocultures.
- Ecological restoration should be made an integral part of the training of foresters and in the writing of Working Plans and Management Plans. The National Working

Plan Code 2014 should be accordingly modified to replace the afforestation bias with an ecological restoration approach.

- Government should invest in developing capacity in modern ecological restoration practices with foresters, planners and scientists across a range of disciplines. The government needs to tap into the experience and expertise of restoration ecologists and practitioners from civil society and academic institutions and involve them in ecological restoration on a national scale.

The Committee strongly believes that graduating from compensatory afforestation to ecological restoration, if it is done in both letter and spirit, has the potential to be a game-changer and result in a transformative change of the country's degraded ecosystems—a transformation that is inclusive, lasting, ecologically sound and cost-effective.

Chapter 7 dwells on the need, composition and functions of the Permanent Expert Body. Implementation of constitutional provisions, laws and policies pertaining to the environment, biodiversity and our national natural heritage has been inadequate. It is overly dependent upon individuals and the political agenda of the party in power, because environment conservation is not an issue that would elicit significant voter support. Committees and bodies entrusted with the task of conserving forests and wildlife have become 'project approval agencies' and public opinion, including that of communities most affected, is rarely and very inadequately obtained. While national and state-level regulatory authorities and agencies for air pollution control, coastal zone management and other subjects of national importance have been established, including some due to judicial intervention, there is as yet no independent body to regulate and monitor the actions of governments and others in respect of conservation, diversion or destruction of forests and ecologically important areas, to advise in such matters and to oversee and ensure the implementation of constitutional provisions, laws and policies in this regard.

In its order of 2011 in the case of Lafarge Umiam Vs Union of India, the Hon'ble Supreme Court directed the establishment of a regulatory body to implement the National Forest Policy, the Forest Conservation and Environment Protection Acts. This directive has been reiterated in subsequent orders in the Godavarman case in 2014, but orders of the Court have not been honoured as yet. In its order of 25/3/2021, the Hon'ble Supreme Court mandated this Committee to consider the need for a '*permanent expert body and its proposed structural form'*. In pursuance of this directive as well as orders in the cases cited above, the Committee recommends that a national forest and wildlife habitat empowered committee be set by the Government of India, under the provisions of the Forest Conservation Act, 1980, titled the National Forest Conservation Authority (NFCA), headed by a retired Judge of the

Supreme Court and comprising a retired officer of the Indian Forest Service, two ecologists, a member of non-government agencies or an individual, an ecological economist or one who has successfully worked with local communities in saving and restoring natural biomes, all known for their knowledge and expertise in forest, grassland and wetland ecology, nature conservation, etc. in different regions of the country. MoEFCC will nominate a member secretary. The Authority will report to the Minister in charge of the MoEFCC.

The Authority will have regulatory, advisory and monitoring functions pertaining to the diversion of forests and natural ecosystems, and to restoration and conservation. It will monitor progress of compensatory afforestation/eco-restoration, compliance of the mitigation hierarchy and the status of ecologically critical areas proposed by this Committee and may add to the same. It would ensure implementation of the recommendations of this Committee with regard to the diversion of land or usage of these ecologically critical areas, of forestlands and of the destruction of trees above minimum thresholds, and may issue guidelines in this regard.

The Authority will exercise regulatory functions in approval of certain proposals under the Forest (Conservation) Act, 1980. Project proposals approved by respective State Boards for Wildlife and requiring approval of the National Board for Wildlife, or those that affect Ecologically Critical Areas (ECA) and others mentioned hereunder, shall first be put in the public domain to seek the opinion of the people, especially those who are directly affected, and also that of the Authority, who may for reasons to be recorded in writing, endorse, suggest modifications or reject the proposal, keeping in view the long-term conservation interests of the area concerned and public opinions voiced. Where Net Present Value (NPV) is to be deployed, the Authority shall review the methodology and instruments used for valuing forests and trees and ensure their regular review and revision. It shall ensure that current inappropriate policies and practices of afforestation are not deployed and that ecological restoration as envisaged under this Report is implemented. It will ensure that forest lands and natural ecosystems are diverted or damaged as little as possible and only as a last resort and not as an easy option. This would be particularly applicable in the case of areas of special ecological significance identified under this Report.

Where the *modus operandi* of 'land for land' is advocated under this Report, the Authority shall ensure that land to be restored is suitable and ecologically equivalent to the land diverted and is notified as 'forest' and handed to the forest department prior to allowing diversion of the concerned forest land or its usage, and mitigation requirements are provided for. In case of an attempt to accomplish a '*fait accompli*' described herein in order to obtain forest clearance, not only will permission be refused/rescinded, but penal provisions should be enforced and responsibilities fixed for the misdemeanour.

The Authority will oversee implementation of recommendations pertaining to linear infrastructure intrusions, including avoidance, going underground and keeping the primacy of the conservation interests of the area in question over norms of construction prescribed for the intrusion. It will ensure safeguarding of the interests of forest-dependent communities affected by forest diversion and that they are adequately compensated and actively involved as managers and stakeholders. The Authority would draft a model law for the conservation of trees on non-forest public lands, pursue its adoption and implementation.

Abbreviations

APCCF	Additional Principal Chief Conservator of Forests
APO	Annual Plan of Operation
BC	Biological Corridors
BSA	Biologically Significant Areas
BSI	Botanical Survey of India
CA	Compensatory Afforestation
CAF Act	Compensatory Afforestation Fund Act, 2016
CAF Rules	Rules notified under the Compensatory Afforestation Fund Act in 2018
CAG	Controller and Auditor General of India
CAMPA	Compensatory Afforestation Management and Planning Authority
CAVAT	Capital Asset Value for Amenity Trees
CEC	Central Empowered Committee
CER	Certified Emission Reduction
CPSU	Central Public Sector Unit
CSS	Centrally Sponsored Scheme
CTLA	Council for Tree and Landscape Appraisal
DFL	Degraded Forest Land
ECA	Ecologically Critical Areas
EPA	Entry Point Activity
EP Act	Environment Protection Act, 1986
ER	Ecological Restoration
ESZ	Eco-Sensitive Zone
FAC	Forest Advisory Committee
FCA	Forest Conservation) Act, 1980
FRA	Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
FTG	Forest Type Groups
GAISP	Green Accounting for Indian States Project
GIB	Great Indian Bustard
GIST	Green Indian States Trust
HS	Heritage Sites
IBA	Important Bird Area
ICFRE	Indian Council of Forestry Research and Education
IGA	Important Geographical Area
IIFM	Indian Institute of Forest Management
IRO	Integrated Regional Offices
JFM	Joint Forest Management

KBA	Key Biodiversity Area
LII	Linear Infrastructure Intrusion
LTC	Local Tree Committee
LTCA	Local Tree Conservation Authority
MA	Millennium Ecosystem Assessment
MH	Mitigation Hierarchy
MoEFCC	Ministry of Environment, Forest and Climate Change, Government of India
MoU	Memorandum of Understanding
NBSC	National Board for Wildlife - Standing Committee
NFL	Non-Forest Land
NG	Net Gain to Biodiversity
NH	National Highway
NHAI	National Highway Authority of India
NNL	No Net Loss to Biodiversity
NPV	Net present value of forests diverted for development purpose
NTCA	National Tiger Conservation Authority
NTFP	Non-Timber Forest Products
PA	Protected Area notified under the Wildlife Protection Act, 1972
PF	Protected Forests
PTNFL	Public Trees on Non-Forest Land
REC	Regional Empowered Committee
RET	Rare, Endangered and Threatened species
RF	Reserve Forests
SA	Scheduled Area
SBB	State Biodiversity Board
SCC	Social Cost of Carbon
SDG	Sustainable Development Goals
SFD	State Forest Department
STCA	State Tree Conservation Authority
TCF	Tree Conservation Fund
TEV	Total Economic Value
TTP	Tree Transplantation Policy
UN	United Nations
UT	Union Territory
VFC	Village Forest Committee
WII	Wildlife Institute of India
ZSI	Zoological Survey of India

List of Boxes

List of Figures

List of Tables

Chapter 1

Valuing Public Trees on Non-Forest Land

1.1 Mandate

The Hon'ble Supreme Court vide its order dated 25 March 2021 in the Special Leave Petition (Civil) 25047/2018 by the Association for Protection of Democratic Right and Anr versus The State of West Bengal and Ors constituted an Expert Committee under the chairmanship of Dr. M. K. Ranjitsinh, and provided it with a nine-point mandate. This note attempts to contribute to mandates (a), (b) and (d), namely:

a) *Develop a set of scientific and policy guidelines that shall govern decision-making with respect to cutting of trees for development projects*
b) *These guidelines may specify the species of trees in categories based upon their environmental values considering their age and girth of the trees etc.*
d) *These guidelines shall prescribe a mechanism for assessment of both intrinsic and instrumental value of the trees, based not only on the value of timber, but also the ecosystem services rendered by the trees and its special relevance, if any, to the habitat of other living organisms, soil, flowing and underground water.*

1.2 Definitions

a) **Government-owned forest trees:** Trees that occur in notified forests, deemed forests, revenue forests and the like, on government land.

b) **Community-owned trees:** Trees that occur in community-owned lands, village commons and the like.

c) **Privately-owned trees:** Trees in non-forest areas that occur on privately-owned lands such as farms, urban plots, land owned by firms, companies, etc.

d) **Public trees on non-forest land (PTNFL):** Trees in non-forest areas that stand on government land but outside government-owned forests, community-owned forests, farms or privately owned urban plots. Examples of PTNFL are trees grown on government land along highways, roads, canals, in parks and on institutional lands such as lands owned by cantonments, railways, defence, educational institutes, public sector units, etc.

The purpose of providing the above definitions is only to bring about clarity on how to identify PTNFL and to differentiate them from other categories of trees.

1.3 Objectives and Methods

Trees that are cut for development projects can broadly be categorised as being either government-owned forest trees, community-owned trees, privately-owned trees, or PTNFL. This chapter focuses on PTNFL in urban, peri-urban or rural areas with a four-fold objective, namely, to:

a) Highlight the contribution of PTNFL to human wellbeing.

b) Analyse the scope of existing policies and laws to protect PTNFL and assess policy gaps and barriers.

c) Undertake a quick review of how other countries value these amenity trees.

d) Formulate policy recommendations for protecting PTNFL and compensating for their loss when they are felled for development projects.

Before we proceed further it would be in place to provide a disclaimer that this note in no way tries to interfere with the policy liberalisation underway to deregulate farm forestry trees, agroforestry, and farm bamboo in order to encourage farmers to grow more trees and bamboo on their private lands. The scope of this chapter is limited to PTNFL which have not been provided adequate protection under the existing policy and legal framework.

The Committee reviewed secondary literature, held stakeholder consultations as well as internal deliberations. In surveying the secondary literature, global approaches to valuing trees were studied, existing laws to protect trees were reviewed, and scholarly studies compiled. Based on this methodology a draft consultation note was prepared and discussed internally among Committee members. This discussion note was then shared with state forest departments and local tree authorities. This was followed by an online consultation with these stakeholders on 6 October 2021, based on which the discussion note was fine-tuned and finalised.

1.4 Environmental Benefits Provided by Trees

India aspires to be a $5 trillion economy by 2025. The country is urbanising fast and it is estimated that half of India's population will be living in urban areas by 2050. But this urbanisation process is plagued with severe air and water pollution issues. Indian cities are amongst the most polluted in the world and reeling under the impact of a growing population, burgeoning vehicular traffic, industrialisation, and mounting

pressure on urban infrastructure services such as sanitation and solid waste management. Environmental deterioration poses a serious threat to public health, especially for vulnerable groups including the poor, children, and the elderly. In this context, trees are a nature-based solution to making our cities a little more liveable and less polluted.

Trees in urban, suburban, and rural environments offer ecological, recreational, and psychological benefits and for all these reasons need to be considered 'public goods'. They deliver a host of valuable ecosystem services such as mitigating pollution, improving air quality, providing oxygen, storing carbon, managing stormwater runoff, providing shade and enhancing aesthetic beauty in densely populated areas, thereby making a significant difference to human health and wellbeing. They play an important role in climate regulation and change by helping to mitigate extreme weather events such as floods and heatwaves. Trees also contribute to mitigating climate change by sequestering carbon, helping to protect soils, and by supporting biodiversity, acting as a refuge for avian and arboreal life forms. They help moderate urban climates, for example, by cooling the air, reducing dust and wind speeds and by providing shade, which may help reduce the cost of cooling buildings. Attractive, tree-filled landscapes improve the physical, emotional, and mental health of city-dwellers as they provide a setting for physical exercise, reduce exposure to ultraviolet radiation and help to relieve stress. Some of these benefits are intangible, such as a cool summer breeze or the relaxing sounds of birds and wildlife in the landscape.

As per the Global Tree Assessment, we now know that 30% of tree species are threatened with extinction and at least 142 tree species are recorded as having gone extinct in the wild.[1] Hence, urgent measures are needed to protect trees from losing their habitat, exploitation for timber and other products, the spread of invasive pests and diseases, and climate change.

1.5 Scope of Existing Policy and Tree Laws

PTNFL are protected under various state tree protection laws, the Indian Forest Act and state forest acts promulgated by state governments. Tree protection authorities have been constituted by urban and rural local bodies including municipal authorities, as also state forest departments, in Karnataka, Maharashtra, Goa, Delhi, etc. (**Appendix 1.1**). The mandate of these authorities is primarily to protect trees and oversee due procedure of their felling by individuals, i.e., by non-state actors. But the law does not protect PTNFL from situations when departmental projects earmark hundreds of trees for felling without compensatory mechanisms in place. Only a

[1] BGCI (2021)

handful of states have passed laws to protect PTNFL affected by development projects.

(a) **West Bengal:** Development projects, including government-owned initiatives, are obliged to undertake compensatory plantation of trees by making a plantation plan, getting it approved and then implementing it at their own expense. No building or construction plan, even if sanctioned under the relevant Act, is treated as valid if it is not found to be compatible with such a plantation plan.

(b) **Bihar:** All tree cutting at sites of development projects is completely banned; only translocation of trees is permitted.

(c) **Telangana:** The state assigns the responsibility for trees growing on urban public lands and along road margins to its urban local bodies. Explicit directions have been issued to the departments of roads, energy, telecommunications and others to ensure the protection of trees and tree branches while developing infrastructure.

(d) **Maharashtra:** By an amendment in 2021, heritage status was accorded to all trees in the state that are 50 years old or more. A tree census is to be carried out every five years, in which heritage trees will be counted. A State Tree Authority is to be constituted, besides the tree authority at the urban local body level. Permission from the State Tree Authority is required if more than 200 trees are to be felled for a project and below this threshold, permission is needed from the tree authority at the local level. The number of trees planted must be equal to the age (counted in years) of the tree being cut, i.e., to compensate for the felling of a 30-year-old tree, 30 saplings must be planted.

(e) **Delhi:** The Tree Transplantation Policy, 2020 (TTP) stipulates that a minimum of 80% of all trees affected by development projects must be transplanted, not cut. Delhi also has a negative list of trees that need not be transplanted or compensated for. Empanelled technical agencies have to be engaged by a user agency for planning and executing tree transplantation. For each PTNFL that is felled, Rs. 34,000 is charged from individuals and Rs. 57,000 from commercial or development projects in lieu of compensatory plantation. Fifty percent of this amount is refundable and returned after a period of three years. As compensation, 10 trees need to be planted, of which 5 will be planted by the government. Because of the scarcity of land especially in urban areas, the onus for providing land for plantation is placed on the user agency.

1.6 Gaps in Existing Policy and Legal Framework

A clear policy and legal void exists as far as protecting and valuing PTNFL are concerned. There is lack of adequate protection under existing state tree laws.[2]

1.6.1 Lack of protection under existing policy and legal framework

The protection of trees in forests is covered under the Forest Conservation Act (FCA), 1980. When these forests are diverted for development, a user agency is obliged to pay compensatory levies in advance. The FCA, 1980, also covers trees in forests on community-owned lands (for instance, in the North East Region) and in revenue forests. However, street trees, trees in green spaces like parks and gardens, roadside trees, canal-side trees that do not stand either on forest land or private land, are not protected under any central law. Though several states have promulgated tree protection laws that regulate the cutting of such trees, municipal tree authorities have the limited mandate of granting permissions for felling, rather than acting as custodians of a city's trees. Proposals are rarely rejected unless there is citizen protest or objections by NGOs. The entire legal procedure is geared towards facilitating the felling of private trees by individuals or organisations and issuing permits in order to do so. These laws are unfortunately not designed to deal with preventing or compensating for the felling of a large number of trees standing on public lands.

1.6.2 Lack of priority and authority for protection in state tree laws

A tree officer has neither the technical capacity nor the functional autonomy to deal with applications for felling trees, nor with the lopping or deliberate killing of 'unwanted' trees by girdling or any other methods. Usually a junior officer in the forest department, the tree officer is seldom vested with the authority to deny permission sought by other government departments or by influential private agencies. While the felling of trees on private lands is covered under these Acts, regulating the felling of PTNFL to make way for state-led development projects (like the FCA does for forest trees) is a policy void. Also, in terms of institutional arrangements, while a tree authority is constituted at the local level, there is a need for an apex body at the state level that can take expert decisions, formulate policy, undertake performance reviews, conduct regular monitoring, and ensure interdepartmental coordination, etc.

1.6.3 Doctrine of *fait accompli*

In the absence of a deliberate policy to protect PTNFL, the decision about whether or not to fell a tree is often governed by the doctrine of *fait accompli*. An executing agency generally applies for tree-felling permission only after a project (e.g., road

[2] Dutta (2019)

widening, flyover, metro, railways, etc.) has already been sanctioned, and a tender has been floated and awarded. At such a late stage, the only option before a tree officer is to negotiate compensatory measures, instead of deciding whether any trees ought to be cut in the first place. Hence, the approval process is rendered a mere formality. Consequently, these amenity trees tend to be looked upon as impediments to development and as liabilities or obstructions to be cleared rather than as assets to be protected and nurtured. Any objection by a tree officer runs the risk of delaying a project and the local tree authority being branded as 'anti-development'.

1.6.4 Lack of a mitigation, valuation, and compensatory mechanism

The above analysis highlights the vulnerability of PTNFL to being felled, lopped, or transplanted when they stand in the way of development projects. The existing legal framework does not take into account the intrinsic and instrumental value of trees as public assets, or their role in sustaining human wellbeing, sheltering urban biodiversity and in making our cities liveable. The cost of transplantation and/or compensatory plantation is generally not budgeted for in the project proposals of a development agency and hence is generally not implemented. The lamentable fact is that development authorities engage with tree officers only when felling becomes imminent.

There is pressing need to plug these policy and legal gaps by fostering guardian institutions for trees to ensure that their lives do not depend on the whims and fancies of development agencies. A comprehensive legal edifice could protect PTNFL, thereby ensuring that they continue to provide valuable ecosystem services. This is best achieved through public participation, where the local populace develops a sense of pride, ownership, and responsibility towards the trees in its vicinity and thereby plays guardian to these trees, keeping the local authorities informed on their health and upkeep. Residents' welfare associations should be roped in for this task and asked to remain vigilant and report incidents of tree abuse to the authorities.

1.7 Adapting Global Approaches to the Indian Context

It is generally acknowledged that trees have value. Whenever it is affordable and feasible, city-dwellers opt to stay near green belts, parks, or tree-lined lanes, and residents' welfare associations have been known to protest against the removal of trees in their locality. At the same time, ascribing a specific price to trees is by no means an easy task. There are scientific, technological, and ethical issues to contend with. Given that both the tangible and intangible services provided by PTNFL are non-market goods, monetary values assigned to trees are neither uniform nor standardised. So how should we assess the value of a tree?

Broadly, there are two ways of doing this—the benefit-based approach and the cost-based approach **(Appendix 1.2)**. In the benefit-based approach, the net present value (NPV) of all ecosystem services provided by a tree is assessed to determine its value. Hedonic pricing, the travel cost method, and contingent valuation method are some commonly used benefit-based economic approaches. Hedonic pricing is a form of the 'revealed preference' method of valuation and uses 'surrogate' markets to estimate the value of an environmental amenity—by asking questions such as: how much more are you willing to pay for a house facing the park? The travel cost method is used to estimate the value of sites that are used for recreation. It assumes that the value of a site or its recreational services is reflected in how much people are willing to pay to get to such a site. The third method—contingent valuation—is a survey-based technique for estimating the value of environmental preservation or the impact of externalities, such as pollution. However, these benefit-based approaches are not easy to apply at the micro-scale of individual trees unless the tree in question possesses some special cultural value. Similarly, the contingent valuation method is a non-market (or hypothetical market) method, which is both difficult and cumbersome to use. Also, valuation packages such as InVEST, WAVES, etc. do not provide estimates or figures at the level of an individual tree. While packages like i-Tree are available, they are used primarily for research and in showcasing the economic value of trees at different scales. The main problem with using these packages is that the data and information needed to value a tree species is not available currently in the Indian context. However, if we use a cost-based approach, then the cost of replacing a tree with another tree of the same species and size in the same location can be appraised.

Benefit-based approaches work best when they are used for large landscapes such as forests. It is is easier to estimate the NPV of their ecosystem services because standard values based on the forest type and canopy density are already available. It is important to remember that these rates are computed on the basis of 'per hectare of forest land diverted' and do not account for tree diversity or other site-specific parameters. With hundreds of tree species in the country that occur in different sizes, a benefit-based approach will not help us to arrive at the value of an individual *neem*, *peepul* or *jamun* tree. Nor does it help us to take into account the gradient of growth of an individual tree and its health status. What is the value of a full-grown *mahua* tree compared to one that is, let us say, only five-years old? By how much does the value of a tree decline if it is damaged or infested with pests or pathogens? Our present state of knowledge or scientific advancement has not reached a stage where we can assign a monetary value to trees based on the species, age, size, and health. As this knowledge is not available for hundreds of common tree species in India, we can discount the usefulness of using benefit-based approaches for valuing trees and prefer the cost-based approach for being more convenient. As and when the scientific literature develops in that direction, it is recommended that the NPV of ecosystem

services provided by individual trees be computed using specific parameters but the present state of knowledge is not comprehensive and specific enough for the purpose. In the current context, therefore, trees to be felled in forests are valued using benefit-based approach, while for trees on private lands are valued based on the cost-based approach. Hence, urban trees that are damaged or need to be felled are valued using either the transplantation cost method or the substitution cost method.[3]

1.7.1 Transplantation cost method

As its name suggests, this method is based on estimating the cost of transplanting a tree, including all stages of the operation—pre-conditioning, hardening, rootstock consolidation, refuge site preparation, transportation, transplanting at the refuge site and aftercare. The cost of supplemental care needed after transplantation, such as protection, maintenance, and irrigation, is added to the cost of removal and installation. A user agency has to bear the cost of transplantation and aftercare for at least five years. All trees of all sizes cannot be transplanted, and expensive experiments of this kind have often met with failure. Studies point out that only certain tree species can survive the transplantation 'shock'. Trees of a smaller girth and those that produce coppice shoots have a higher chance of survival.[4]

1.7.2 Substitution cost method

This method attempts to capture the scarcity value of the resource (or the loss if the tree is not available) and the cost of substituting the same. A 'trunk formula' is widely used for appraising the value of large, individual trees that cannot be transplanted (owing to their size, condition, or poor chances of survival). It takes into account the replacement cost of a sapling and then scales it up to the larger specimen by using a multiplying factor of the basal area. It considers the species, size, condition, and location of the tree in order to assess its value. Appraisal methods such as the Council for Tree and Landscape Appraisal (CTLA) and Capital Asset Value for Amenity Trees (CAVAT) are widely used by authorities (and appraisers) when publicly-owned trees are damaged or need to be removed for development.[5]

Tree value (based on trunk formula) = trunk area × unit price × species rating × condition rating × location rating… (1)

[3] Grande-Ortiz *et al.* (2012), Fountain and Crocker (no date)

[4] ICFRE (2020)

[5] Upson (2015)

The species, condition, and location ratings range from 0 to 1 and are based on standard guidance notes provided by the CTLA.[6]

Trunk area is the cross-section area of the tree trunk measured at breast height.

Unit price represents the full cost (estimated per unit of the cross-sectional area of the trunk, i.e., per square centimetre) of a newly planted sapling that is at least 1.80 metres tall. Its derivation has two components: the nursery gate price and the planting cost (transportation, planting, materials, manure, fertilisers, immediate care and management costs, but not aftercare). Specifically, the nursery gate price is the average cost per square centimetre of the stem area of the ten most commonly purchased species, based on a survey. An average cost is preferred to the cumbersome task of estimating the varying costs of individual species.

Species rating is an assigned value between 0 and 1 based on the 'species class'. Criteria used in determining 'species class' include aesthetics, socio-cultural linkages, regulation of micro-climate and habitat for wildlife.

Condition rating is an assigned value between 0 and 1 based on the condition of the tree which takes into account factors such as wounds, decay, storm damage, insect or disease damage, and form. For simplicity's sake, a tree is usually placed in one of five classes (1, 0.80, 0.60, 0.40, 0.20, 0) whose value is expressed as a decimal in the formula. When assigning a value for 'condition class', it needs to be kept in mind that very few trees are perfect specimens and several species have the ability to heal injuries, cuts or even partial necrosis.

Location class is based on the functional and aesthetic contribution that a tree makes to a site and the importance of the location in the context of the broader community. The location value lies between 0 and 1 and this too, is expressed as a decimal in the formula. Generally speaking, a tree of historical significance, at a sacred natural site or in a residential area for shade, will have a much higher location value than a tree growing under a power line or in some other odd place.

The object here is to capture both the instrumental and intrinsic values. For example, the trunk area, on the one hand, can indicate a high timber quotient that reflects its *instrumental value*, while on the other hand, it can also reflect its *intrinsic value* because a large trunk results in a better canopy, more carbon sequestration, and other ecosystem services like the provision of shade and refuge for various bird species and biodiversity. Similarly, species rating can also indicate both instrumental and intrinsic values. While its longevity, health, etc. may indicate the instrumental component, the

[6] Guidance is provided in this note from Purdue University.
http://dev.albertlandmanagement.com/wp-content/uploads/2019/11/Tree-Appraisal.pdf

rarity of the species will indicate its intrinsic value. Condition rating largely reflects the use-value or instrumental values. The location rating can be on the basis of the market price of the land (reflecting the instrumental value) or the cultural or spiritual significance of the tree.

To assist with the process of estimating substitution cost, pictorial guides (on the CTLA tool) have been developed with detailed instructions on using the trunk formula.[7] The guides include species class, condition class, and location class tables, complete with values for different tree species, as well as condition and location scenarios. Several examples are also provided. Also included are tables that list the ratings for the species, location, and condition.[8] However, since these formulae were developed primarily for use in developed countries in the temperate zone, the factors used might not be relevant to our Indian context. Hence, some parameters have been adapted for the Indian context for the purpose of this report (see **Appendix 1.3, Box 1.1**).

The trunk formula, being simple and elegant, is widely used for objective assessment of the replacement value of a tree. The CTLA tool (in the US) and the CAVAT tool[9] (in the UK) are consistently used for evaluating urban amenity trees and in providing benchmarks of a 'market' price. In the US, where urban tree valuation has the longest history, the trunk formula is an officially approved aid to planning decisions. Though these methods are recommended for calculating financial compensation for tree damage or diversion, they cannot be used for economic valuation because they estimate the cost of replacing a tree, without taking into account the ecosystem services it is providing.

Box 1.1: Assessing the value of trees using the substitution cost method

Let's say a neem tree (*Azadirachta indica*) is to be felled for a development project. It is located within a municipal corporation but away from the commercial hub and is overall in a healthy state. It is a medium-sized tree with a girth at breast height (GBH) of 88cm.

GBH of the tree = π x D = 88cm

Diameter of the tree = 88/π = 88x7/22 = 28cm

Trunk area = π x $D^2/4$ = 22/7 x 28 x 28/4 = 616 cm^2

Let's say the State Authority has notified the unit price which is the nursery gate price and the planting cost of commonly purchased species based on a survey as Rs 300/cm^2 (Rs 180 is the nursery gate price of a tall seedling of 1.8 meters (6 feet) height and

[7] https://www.albertlandmanagement.com/wp-content/uploads/2019/11/Tree-Appraisal.pdf. | https://www.extension.purdue.edu/extmedia/FNR/FNR-473-W.pdf

[8] Page 4–8, ibid

[9] https://www.ltoa.org.uk/documents-1/capital-asset-value-for-amenity-trees-cavat/139-cavat-full-method-user-guide-updated-september-2010/file

1cm^2 collar cross-section area, while Rs 120 is the cost of transportation, pit digging, manuring and planting). However, this cost does not include the cost of the tree guard and aftercare.

Hence unit price = Rs 300/cm^2

Species rating = 0.8 (Refer Appendix 1.3)

Condition rating = 1.0 (Refer Appendix 1.3)

Location rating = 0.9 (Refer Appendix 1.3)

Tree value = trunk area × unit price × species rating × condition rating × location rating

Tree value = 616 x 300 x 0.8 x 1.0 x 0.9 = Rs 1,33,056

This is how we arrive at the appraised value of the neem tree that the user agency has to pay to the local authority. Assuming that the cost of planting a tall seedling along with a tree guard, including aftercare for 5 years, is Rs 4,000 per plant. Thus this appraised tree value can be substituted by planting 33 tall seedlings by the local authorities with tree guards and aftercare for 5 years on suitable land that is provided by the user agency.

1.7.3 Land for planting or transplanting

The land needed for planting or transplanting also needs to be provided by the development agency, which should be suitable for tree planting as assessed by the local tree authority.

1.7.4 Global experiences from using these approaches

Due to the application of these approaches, authorities have started to look at trees as assets that provide civic amenities. It is seen that their value appreciates with time and that they are valuable and not easily or quickly off-set. Global experience shows that these approaches have been successfully used to defend trees from loss due to development, to secure adequate compensation and also to trigger alterations to infrastructure development plans by encouraging retention of mature urban trees.

1.8 Recommendations

The following policy recommendations need to be given statutory backing by amending the relevant State Acts by respective state governments. The central government should expedite this process by sharing a model Act which the states can adopt, as per their context, by amending their respective Acts in a time-bound manner.

1.8.1 Institutional arrangements

A State Tree Conservation Authority (STCA) should be constituted in each state and union territory, charged with the explicit duty of protecting and acting as a custodian of PTNFL in urban and rural areas. Also, a Local Tree Conservation Authority (LTCA) should be constituted in all urban and rural local bodies. State governments need to appoint tree conservation officers to man their LTCA and the STCA, and provide them with sufficient staff and resources to perform their duties effectively. At all sites where compensatory plantation or tree transplantation of 100 or more trees/saplings has taken place, local tree committees (at ward or assembly level) comprising citizen's groups, professionals and experts, shall be constituted by the concerned LTCA. These Local Tree Committees (LTC) will be responsible for carrying out regular monitoring of all projects involving compensatory plantation or tree transplantation of 100 or more trees/saplings in their local areas and to certify their survival rate at the end of one year (**Box 1.2**).

Box 1.2: Maharashtra: Providing special protection status to heritage trees

The Maharashtra government will make amendments to the Maharashtra (Urban Areas) Protection and Preservation of Trees Act of 1975, to introduce provisions for the protection of 'heritage trees'. The Maharashtra cabinet also green-lighted the formation of the Maharashtra State Tree Authority at the state level for overall policy and monitoring and Local Tree Authorities in local civic bodies and councils which will take all decisions regarding the protection of trees. Also for overall policy guidance and monitoring at state level.

Under the proposed amendment, a tree with an estimated age of 50 years or more shall be defined as a heritage tree. A heritage tree will get special protection. Crucially, the tree's age will determine the number of trees to be planted as part of the compensatory plantation – that is anyone cutting a heritage tree will need to plant trees in the same numbers as the cut tree's age. As per the amendment, the number of trees planted will be equal to the age of the heritage tree that is cut. For instance, if a 52-year-old tree is to be felled, then the party felling the tree will have to plant 52 trees in compensation, with each compensatory tree at least 6-8 feet in height at the time of planting. The organisation planting the compensation trees will also have to ensure the survival of the plantation for seven years and geo-tag the trees. Such plantations can be carried out either in the same plot or a common amenity plot.

Source: *The Indian Express, 12th June, 2021*

1.8.2 Mainstreaming compensatory tree conservation in development

Compensatory plantation and tree transplantation need to be embedded in the development proposal itself. Generally, this is not implemented and development authorities engage with Tree Officers only when felling has to be done. It becomes very difficult to stop a development project when it nears the implementation stage,

hence this needs to be done at the planning stage itself when dialogue or consultation can be held with the concerned tree authority to look for alternative solutions. In all instances where PTNFL are to be felled for development, prior approval of the STCA needs to be taken by the user agency (as is the practice in the case of diversion of forest land) during the project planning stage itself. The STCA needs to be taken into confidence during the project formulation stage and the *fait accompli* syndrome currently in vogue, where clearances are a mere formality, must be eschewed. If the costs of compensatory plantations are not factored into the cost of a project, a development agency may be unable to pay. Private players at times perform better in this aspect, as they have elbow room to manoeuvre and it is often government agencies and quasi-government agencies who are the biggest transgressors. Hence, penal provisions are also needed which should be five times the normal cost. If prior approval is not taken, and a *fait accompli* scenario is created, a penal compensatory levy of five times the compensatory levy shall be charged before approval is granted. For a repeat offense, the user agency should be blacklisted for a period of time.

1.8.3 Guidelines to govern decision making

While scrutinising proposals, the concerned TCA needs to adhere to the mitigation hierarchy of avoidance, reduction and offsetting. It should examine the proposal and look for alternatives with the first objective of avoiding the felling of trees altogether. If that is not possible, then reducing the total number of trees to be felled should be the next alternative. And only if this, too, is not found feasible, should felling and offsetting be permitted. While accepting that there are limitations to offsetting trees, culturally significant trees, sacred groves, etc. should not be felled.

There is a lack of knowledge to assess whether to opt for transplantation of existing trees or substituting them with a large number of tall saplings. Presently, science does not have ready answers to enable managers to decide which tree species and of what size can be successfully transplanted and in which season. In our love for trees and not wanting to see them being cut down, transplantation experiments are growing in the country. Many transplantation projects fail to live up to expectations with low survival rates. Any decision about whether the transplantation of full-grown trees is feasible or not needs to be taken under the advice and guidance of an expert committee constituted by the government. Already a few states such as Delhi and Uttar Pradesh have a Tree Transplantation Policy (TTP) in place where the user agency has to bear the cost of transplantation, engage empanelled technical agencies, provide land for transplantation and also aftercare (**Box 1.3**).

Box 1.3: Delhi government: Tree Transplantation Policy 2020

The Delhi government notified the tree transplantation policy (2020), under which at least 80% of trees affected by a construction project will have to be transplanted. The whole tree is dug up with the root intact and scientifically transplanted at another location instead of being felled. Construction agencies will also have to ensure that 80% of transplanted trees survive after being relocated. Invasive species such as vilayati kikar and subabul have been excluded from the list of species that will be transplanted. The compensatory plantation of 10 saplings for every tree cut for development projects shall also continue. The policy will not apply if 10 or less trees are felled. As the saplings may take years to replace the felled tree so transplantation is being done in addition.

A tree survey shall be carried out at the time of project feasibility assessment along with site identification to obtain the required information for preparing the tree transplantation proposal. National level agencies that have successfully carried out tree transplantation will be empanelled as technical agencies. The applicant shall select one of the technical agencies among the agencies empanelled for carrying out tree transplantation work. Survival rate and social audits will be carried out after a year to assess which trees were able to withstand the process. Tree activists are of the opinion that while the attempt to save large trees is laudable, however past experience of transplantation has not been positive and this could be an avoidable expense. Past tree transplantation efforts have been both costly and ineffective with records revealing a low survival rate.

Source: *The Times of India, 10th October, 2020*

1.8.4 Valuing public trees

Though this Committee favours a cost-based approach, it agrees that a benefit-based approach based on NPV criteria is a better way of assessing the value and making developers pay, as is proposed for land-use change. However, a paucity of studies providing information and data impedes its application in the Indian context. Therefore, the Committee recommends a large-scale national research project to conduct a species-specific tree ecosystem service valuation to arrive at their NPV, considering the same as functions of age, girth-at-breast height, etc. This may well be a long-term project given the number of species and the biogeographic diversity of the country.

While valuing public trees using the transplantation-cost method, a user agency would bear the cost of transplanting trees including pre-conditioning, hardening, rootstock consolidation, refuge site preparation, transportation, transplanting at a refuge site, and aftercare. The transplantation process involves the preparation of a 'site tree report', the appointment of a technical agency for transplantation, preparation and approval of a tree preservation plan, implementation of the tree preservation plan, handing over and maintenance of transplanted trees and finally, a social audit. For all

transplanted trees that do not survive, indigenous tree species of 4.5 meters (15 feet) height and at least 15 cm diameter need to be planted, at a ratio of 1:5, by the user agency.

While using the substitution-cost method, the appraisal method using the trunk formula can be used to assess the value of trees to be felled based on the four parameters of girth, species rating, condition rating and location rating, as indicated in **Appendix 1.3**. The nursery gate price and the planting cost need to be assessed by the STCA at least once every three years, and this uniform unit price be made applicable across the state. In no case shall this unit price be less than Rs 200 per cm^2. As the tree is standing on public land, it is the property of the state and hence standard practices prevalent in the state regarding the felling of trees, their disposal and crediting the proceeds to government revenue. shall apply in this case as well. The value of all trees to be felled thus needs to be appraised by the concerned STCA and informed to the user agency. Following this, the user agency shall transfer this tree compensatory levy (TCL) to the STCA before approval for felling is accorded. The STCA can fix a numerical threshold based on the number of trees to be felled, beyond which all felling proposals must be routed to it by the LTCA for approval. Below this threshold, the LTCA can dispose of a proposal at the local level itself. Regarding the value of government-owned land to be diverted for development on which the PTNFL is standing, existing state norms will be followed as land is a state subject.

Guidance needs to be provided on compensatory tree plantations, specially on the suitability of what gets planted and where. Unless we plant something that is ecologically suitable, it will be a waste of effort. From funds that accrue from compensatory levies, a Compensatory Tree Planting Scheme needs to be designed. This scheme shall provide guidance on selecting the right species of trees to be planted at the right locations, using technically sound planting techniques with adequate protection, aftercare and monitoring in partnership with local residents, as well as mandatory social audits conducted by Local Tree Committees (LTC).

1.8.5 Public participation and social audits

Local tree authorities must actively involve resident welfare associations in urban areas and local government at district, block and gram panchayat levels in rural areas, by designating them as joint custodians of public-owned trees in their respective areas, jointly with the concerned government authority. Public participation through social audits is the most effective manner to assess the success of plantation and transplantation projects. An LTC comprising citizen groups, professionals and experts shall be constituted for this purpose by the concerned TCA. These LTCs will be responsible for carrying out regular monitoring of all projects involving compensatory plantation or tree transplantation of 100 or more trees/saplings in their local areas

and to certify tree survival rates jointly with the concerned tree officer at the end of one year.

1.8.6 Preventing abuse of trees

Trees also need to be prevented from harm from electric wires, cables, advertisers and the public in general. Trees are often strangled with metal wires and cables. Nails, staples and rods are hammered into trunks and branches, causing deep wounds. Advertisement pamphlets are pasted over their trunks. During paving or concreting works, the entire space around the base of a tree is covered, thereby constricting tree growth and hindering the percolation of rainwater. Wherever the base of a tree has been concretised, it needs to be de-concretised. Concerned authorities need to be vigilant and launch campaigns to prevent the abuse of trees and also book offenders. These actions need to be prohibited and treated as punishable offenses inviting penalties under relevant Acts.

1.8.7 Funding and reporting

There shall be constituted a fund to be called the Tree Conservation Fund operated by the concerned TCA, where all revenue receipts and fines can be collected and used for tree plantation works. The Tree Conservation Fund (TCF) shall be audited annually and statements of accounts prepared. The STCA shall prepare an annual report detailing the activities taken up, approvals granted, replacement projects, compensatory projects and their performance, along with statements of account, and submit these to the state legislature every year. This annual report shall also be uploaded to a public website for proactive disclosure.

1.8.8 Monitoring and time-bound follow up

A Model Act that assimilates all the above recommendations needs to be framed within six months by an Expert Group composed of relevant experts and anchored by the MoEFCC. The Permanent Body will follow up and pursue the matter to ensure that the Model Act is framed in a time-bound manner and that relevant tree and forest laws are amended by state governments in accordance with this Model Act, while taking into account the local context including veneration of individual trees, tree species and the religious significance of stands of trees. In order to encourage farmers to grow more trees and bamboo in their farms, felling and transit permission for many species are no longer needed. These guidelines will in no way impact this policy liberalisation underway with regard to trees planted on private lands such as agroforestry or farm trees.

1.9 References

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Chapter 2

Guidelines for the special treatment of geographical / eco-sensitive areas of high conservation significance

2.1 Background

Protected areas (PAs) encompass only about 5% of India's geographical area. Despite the fact that plans for all our PAs were based on well-thought-out biogeographical criteria[10], several ecosystems and unique habitats remain unprotected and for this reason are vulnerable to encroachment, degradation or fragmentation. Consequently, many rare and endangered species, including 'habitat specialists', continue to face the threat of extinction. Several ecosystems and habitats that lie outside PAs have not yet been fully inventoried and biologists have been discovering new species of flora and fauna in such habitats. For example, between 2009 and 2014, hundreds of new species of plants and animals were added to science from the Eastern Himalayas alone[11]. In 2020, Indian taxonomists added as many as 267 taxa of flowering plants, pteridophytes, bryophytes, fungi, lichens, algae and microbes to the plethora of India's flora[12], many of them from unprotected areas. Studies have shown that a myriad of lesser vertebrates, especially herpetofauna, fish and nonvascular plants, inhabit unique ecosystems, mesic sites and inland wetlands which are otherwise overlooked in the course of infrastructure development. The recent rediscovery of an endemic Malabar Torrent toad (*Ansonia ornata*) from a private estate in the Western Ghats and the discovery of Smith's Litter Frog (*Leptobrachium smithi*) from Mayeng Hill Reserve Forest in Kamrup District of Assam, are shining examples. Forest clearance and polluted streams are responsible for decimating many populations of endemic herpetofauna. Several remote and hitherto undisturbed localities are now being given easy access for exploiting natural resources and development of physical infrastructure. Even steep mountain slopes, once regarded as reservoirs of native biodiversity, are now being rapidly transformed. Presently, there is hardly any legal or institutional mechanism to notify and conserve critical habitats, Type Localities of narrow endemics and other unique geographical localities.

[10] Rodgers and Panwar (1988)
[11] WWF (2015)
[12] Mao *et al.* (2021)

Taking cognizance of looming threats to such localities and recognizing the need for safeguarding specific geographical and eco-sensitive areas of conservation significance, the Hon'ble Supreme Court of India has directed this Committee to suggest special treatment in order to preserve them for posterity, as national treasures. With a burgeoning human population, the rise in living standards and the consequent increase in human impacts, exploitation of natural resources and diversion of public lands, the safeguarding of these treasures is progressively becoming more imperative and increasingly difficult.

2.2 Criteria for Identifying Geographical Areas and Eco-Sensitive Sites

After extensive deliberations, the Committee decided to classify areas of high conservation significance into the following two categories:

(a) Existing and future protected areas of the country, notified and established under legislation or rules, namely, National Parks, Wildlife Sanctuaries, Conservation Reserves and other areas declared under the Wildlife Protection Act, Biodiversity Act and others.

(b) A large number of areas of crucial importance from the viewpoint of flora, fauna, geology, cultural and religious significance, as refuges of endangered and endemic species, as corridors of connectivity to overcome ecological and physical isolation, as well as others which still remain outside our current PA network due to the overt reluctance of concerned governments over the past three decades and particularly in this century to include them under the protected areas system, in order to facilitate easy diversion of such areas and their usage, in keeping with the changing conservation ethos in governance.. This second category of important localities are collectively called here **Ecologically Critical Areas** (**ECAs**)**.**

Under prevailing circumstances, therefore, the only practical way to save these unique and precious heritage sites is to accord those identified now and subsequently a status similar to our extant PAs, whereby stringent regulations would apply to them if their diversion or destruction is required for developmental projects. The categorization and criteria for the selection of ECA (presently lying outside the existing PA network) are given below:

1. **Biologically Significant Areas (BSAs):** These areas include localities where critically endangered and endemic species exist or represent unique ecosystems, rare and relict habitats, key biodiversity areas (KBAs) and important bird areas (IBAs), including the breeding grounds of endangered species. Such areas may also include very small habitats (less than 5 ha in extent) that harbour populations of

'point endemics' i.e., endemic species that are known to have extremely narrow distribution ranges.

2. **Heritage Sites (HS) or sites of special geological, cultural and religious significance:** A large number of sites in the country exhibit unique geological, historical or cultural features that need to be recognized, documented and passed on to future generations for their intrinsic, cultural and other values. Such sites include sacred natural sites, sacred groves, and historical sites where traditional landuse practices have continued, e.g., *Law-Lyngdohs* (sacred groves) of Meghalaya*, Orans* (sites protected in the names of local deities in Rajasthan) and suchlike*.*
3. **Bio-corridors (BC)**: Areas that provide for the seasonal movement and migratory paths of animals. Particular cases in point here are the corridors of the Asian elephant, which need to maintain large annual home ranges. More than a hundred such corridors have been identified across the country for the movement of the Asian elephant by the Wildlife Trust of India (2017), of which **84** corridors lie outside the existing PA network. These corridors, along with a few other localities falling in this category, have been listed and included in this report (see **Appendix 2.1**).
4. **Eco-sensitive Zones (ESZs) and Buffer Zones of PAs:** ESZs notified under the Environment Protection Act (EP Act) 1986, aim to regulate certain anthropogenic activities (e.g., mining, power projects) around national parks and sanctuaries so as to minimize their negative impact on the overall integrity and safety of valued ecosystems. The Ministry of Environment, Forest and Climate Change (MoEFCC) has issued guidelines and listed a broad range of activities that are allowed, prohibited, regulated or promoted. This is an important checklist for conservation to be kept in mind while identifying threats inside ESZs. Wherever ESZs have not yet been designated, state governments are expected to designate a buffer zone of about 10 km radius around PAs.

This Committee circulated these criteria to all the state Forest Departments, various experts and conservation agencies, with a view to identify areas of high conservation significance in different states. The Committee also used personal knowledge, secondary literature and published information[13] [14] [15] [16] such as the list of important elephant corridors in India by the WTI and the State of the Environment reports of a few states. In addition, the Committee chose a few sites from the 2nd volume of 'Planning a Wildlife Protected Area Network in India'.[17] Such sites include areas of high

[13] Gadgil & Meher-Homji (1986)
[14] Islam & Rahmani (2009)
[15] Wickramanayake *et al.* (2002)
[16] INTACH (2016)
[17] Rodgers & Panwar (1988)

conservation significance which were initially proposed as PAs by these authors but have not been notified by the states till date. A preliminary list of 294 Ecologically Critical Areas (ECAs) in various states, along with the criteria used to list them and their conservation significance, is provided in **Appendix 2.1.** It is submitted that this is not an exhaustive list and additional areas can be added in the future, including by the Permanent Expert Body envisaged and proposed by this Report.

2.3 Guidelines for Special Treatment of Ecologically Critical Areas (ECA)

At present, there are hardly any legal provisions to protect ECAs including Biologically Significant Areas (Type Localities, Relict Sites, Unique or Special Habitats), Heritage sites of geological, cultural and historical significance, and Bio-corridors.

In order to ensure the protection of such geographical areas, the following guidelines are suggested:

2.3.1 All geographical areas of high conservation significance identified here (**Appendix 2.1**) should be taken up for status / feasibility assessment and demarcated on the ground by respective state governments / Union Territories and notified appropriately as PAs under the Wild Life (Projection) Act, 1972, or as 'Scheduled Areas (SAs)' under the Environmental Protection Act, 1986. State Forest Departments (SFDs) in consultation with their respective State Biodiversity Boards (SBBs) and other stakeholders must prepare ecologically compatible rules governing landuse (as developed in the case of ESZs) to ensure their long-term existence.

2.3.2 State Biodiversity Boards (SBBs) may notify and take special measures to demarcate and prepare detailed inventories of BSAs and site-specific conservation action plans, as indicated above (2.3.1) and for long-term monitoring.

2.3.3 In the event of any ECA falling within private or community-owned land, SFDs should initiate a dialogue with the owner(s) of the site in order to develop appropriate mechanisms for joint protection of such sites and, if needed, to provide support and training, including financial assistance for this purpose.

2.3.4 SBBs may approach the Botanical Survey of India (BSI) to map and delineate the Type Localities of Point Endemic Plants and habitats of Critically Endangered Plants, identify threats to such sites and initiate periodic population monitoring programmes. Similarly, the Zoological Survey of India (ZSI) can be approached to carry out similar studies for faunal species.

2.3.5 State Governments need to secure all bio-corridors of large mammals, especially for the seasonal movement of elephants and other large mammals, and critical habitats of other critically endangered endemic species such as the caracal, pangolin, swamp deer, Manipur sangai, Kashmir markhor, Kashmir stag or hangul, Tibetan antelope or chiru, wild yak, takin, Nilgiri tahr, Andman wild pig, great Indian bustard, lesser florican, black-necked crane, Andaman teal, Nicobar megapode, and suchlike. SFDs may submit proposals to the MoEFCC for financial assistance under existing schemes, as is also recommended in the National Wildlife Action Plan (2017–31).

2.3.6 The proposed Permanent Expert Body should be entrusted to make a detailed inventory in a GIS domain of all the ECA in order to prepare comprehensive landscape-level conservation plans, along with a clear delineation of zones for future compensatory restoration (Chapter 6 of this report), infrastructure development and other projects.

2.3.7 A number of terrestrial ECA, especially anthropogenic grasslands, e.g., the blackbuck refuge in Rohtas district, Bihar, require protection as well as occasional management interventions to restore or maintain their original biotic structure, with efforts such as removal of invasive alien species and invading woody vegetation. Inappropriate and unwarranted interventions such as tree-planting on grasslands is not only counterproductive, but positively harmful. SFDs may include such operations in the management plans of concerned Divisions and carry out appropriate interventions on a regular basis under the ongoing scheme of MoEFCC's 'Integrated Development of Wildlife Habitats'. In the case of IGAs falling within community-owned or private land, suitable arrangements should be made by Forest Departments with the owners of the land. It is strongly emphasized that tree-planting, if necessary, must only be of tree or shrubby species that are strictly indigenous to the area in question, as far as possible restoring the locally prevalent composition of indigenous plants and not a monoculture. Exotic species, even if they are fast growing, must not be planted.

2.3.8 Sources of several rivers and their catchments in the country face increasing anthropogenic pressures, resulting in the loss of their catchment capabilities and severe shortages of freshwater, both in quantum and inflow periodicity, for downstream communities. Some of these catchments have been identified here (**Appendix 2.1**). It is recommended that all states in the country should identify such critical watersheds and include them under the category of IGAs and manage them at par with ESZs.

2.3.9 Several sites of geological, cultural, religious and historical significance are also projected (often by tourism agencies) as important tourist destinations. It is seen that some of the more popular places are plagued with undesirable and substandard

physical infrastructure that negatively affects the aesthetics and serenity of these places, and some even threaten the ecological security of the area in question by activities like diversion of water, pollution and suchlike. For example, Kalo Dungar in Kutch and Naina Devi Bird Sanctuary near Nainital have been ruined by the erection of animal figurines and other statues. All such heritage sites require minimal physical infrastructure and aesthetically designed visitor facilities.

2.3.10 Compensatory notification of PAs in lieu of areas diverted/de-notified: Whenever a part of a notified PA or identified bio-corridor is sought to be diverted/de-notified, that diversion/ de-notification shall only occur after an area at least twice the size of the area to be diverted/de-notified is added to the very same PA/area, by the same procedure by which the impugned PA/area has been set up, i.e., by notification under the concerned law/executive order, etc. If adjacent public lands are not available for this purpose, they will have to be acquired.

2.4 Minimum threshold beyond which the guidelines will apply

It is recommended that the following thresholds will apply as guidelines for the diversion of the land/habitat:

2.4.1 Zero threshold: All designated national parks and ECAs containing the **nesting sites** of highly threatened birds (e.g., blacknecked crane, lesser florican, great Indian bustard, Nicobar megapode, etc.), sea turtles, highly endemic species of frogs, special geological structures that have been notified or identified, **Type localities** of narrow endemic plants which are Critically Endangered as per **IUCN's Red List,** will all fall under this category. Such sites cannot be substituted or created. No diversion of such sites can be accepted.

2.4.2 Up to 1 ha: Only one-time diversion of up to 1 (one) ha area will be permissible at sites that represent the natural vegetation or ecosystems akin to their geological past, characterized by the continuing presence of species of ancient lineages such as primitive vascular plants, living fossils, etc., Ramsar sites, coral reefs, and existing or potential natural heritage sites of natural (biological/geological) cultural significance such as sacred natural sites (e.g., sacred lakes, sacred groves) **provided their geographical area is more than 30 ha. Such diversions would be permissible only in extremely imperative cases, subject to following the principles of mitigation hierarchy as set out in this report (section 4.6.1).**

2.4.3 1-5 ha: ECAs representing bio-corridors (less than 5 kms wide), Eco-sensitive zones, unique or special habitats (provided their geographical areas are more than 100 ha) may allow diversion of land upto 5 ha, provided that such diversion is done at the fringe of the CEA and not within it.

2.4.4 Minimum threshold of trees that can be cut: The following thresholds are recommended:

i) Zero threshold: All endemic and critically endangered species of trees that have extremely poor natural regeneration and a known population of less than 100, e.g., *Amentotaxus assamica, Bauhinia foveolata*, *Elaeocarpus gaussenii, Hopea shingkeng,* etc.*,* and all Heritage Trees, which State Governments have notified or are in the process of being notified, will have total protection. Examples of Heritage Trees include the great Banyan tree of the Indian Botanical Garden at Shibpur (Kolkata), the ancient mulberry tree at Adi Shankaracharya temple (Joshimath), the giant deodar tree at Tolma village in Nanda Devi Biosphere Reserve, the original dassheri mango tree at Kakori (Lucknow), the sacred ber tree at the Golden Temple (Amritsar), etc.

ii) Up to 5 mature trees: Up to five mature individual trees belonging to all other endemic species may be cut, provided that their total population in the wild is ascertained to be more than 500 and whose natural regeneration is relatively easy. Under this category, all keystone species which provide numerous ecosystem services such as the banyan, peepul, pilkhan, rudraksh, maulsari, evergreen oaks, junipers and 'state trees' may be included.

iii) Up to 20 trees*:* Up to 20 mature trees of gregarious species which can regenerate easily, e.g., sal, teak, shisham, khair, chir pine, blue pine, etc. may be allowed to be cut provided that project proponents ensure the availability of 10 times more saplings of the same species for plantation in an area adjacent to the impact zone, in a similar habitat and subject to strict observance of a clear mitigation hierarchy.

iv) No ceiling: All exotic, fast-growing trees which can easily be propagated and which are easily available at various nurseries, e.g., *Eucalyptus* spp., silver oak, *Ailanthus*, *Haplophragma*, Australian acacias, *Robinia pseudoacacia*, etc. Project proponents may be allowed to cut any number of mature trees of these species provided that they undertake to plant the same number of native, multi-purpose species of the same eco-climatic region in the area designated for compensatory restoration.

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Chapter 3

Linear Infrastructure Intrusions and Alternatives

3.1 Introduction

The Hon'ble Supreme Court has provided a further mandate to this Committee in point (e): '*The guidelines shall also mandate rules regarding alternate routes/sites for roads/projects, and possibilities for using alternate modes of transport like railways or water-ways'.*

Roads, railways, powerlines and canals are the predominant forms of linear infrastructure intrusions into forests, PAs and other ecologically critical areas and are invariably in conflict with forest integrity, ecosystem security and wildlife conservation. Faunal and avifaunal species require contiguity of habitats and barriers that break them are greatly detrimental to the long-term conservation interests of species, their habitats and ecosystems.

It must be stated at the outset that it would not be practical to suggest the closure and removal of any railway lines already passing through PAs and crucial biodiversity areas, but rules can be drawn up to reduce their adverse impacts and guidelines provided for planning new railway lines in such areas in the future. As regards existing roads in PAs and similar crucial areas, in some rare instances alternatives must be resorted to, in other cases ameliorative steps need to be taken to reduce their adverse impacts. As regards waterways, they would normally not be suitable alternatives to roads inside PAs and similar areas, as their impact would be even greater on aquatic ecosystems and lifeforms and would inevitably lead to human settlements along new waterways. Waterways could perhaps be considered outside such areas, although the slow progression that waterways provide do not make them a pragmatic alternative to roads.

Complying with the given mandate, this Committee provides a succinct review of current policies and practices followed by recommendations regarding alternate routes and sites for all kinds of linear infrastructure intrusions.

3.2 Review of policies and practices

Linear infrastructure intrusions in forests and public lands of ecological importance are made because that is the easiest and cheapest way to proceed. No acquisition of

land or displacement of people and property is involved and a mere pittance is paid for the diversion and destruction of land that has great ecological value. For this practice to change, a change of mindset is required as well as acceptance of the fact that the nation's national heritage is at least as important as any other heritage, if not more so; that Protected Areas (PAs) and other ecologically important places are the last havens of hope for the survival of this precious heritage. Damage to our ecologically important areas must be avoided by alternative options, and if there are no viable options, the nation and government must be prepared to pay the extra cost to prevent their destruction and desiccation whilst making linear infrastructure intrusions through them. It must be accepted that the conservation of these PAs and their equivalent natural areas are permanent and paramount and if a national highway has to go through a national park, for instance, within the precincts of the park the highway should traverse the distance **underground**, or follow the conservation requirements and rules of that national park if perforce it has to go overground.

In earlier decades of the 20th century, hunting both legal and otherwise was presumed to be the main cause for the death and decline of larger faunal species. Gradually it came to be realized that habitat fragmentation and decimation, both qualitative and quantitative disturbance and ecological alterations were far more harmful and pervasive. A classic example is that despite the huge slaughter of wild animals that occurred in the country prior to 1947, their populations recovered very rapidly because the food chain, habitats, and ecology had not yet been drastically altered. Recent studies have shown that roads have overtaken hunting as the **leading direct human cause of vertebrate mortality on land.**[18] It is estimated that if the present rate of road kills continue, leopards in Rajaji National Park and the adjacent Haridwar Conservation Area are expected to become extinct in the next 50 years and the sloth bear and lion-tailed macaque will become gravely endangered elsewhere in the country.[19] Between 2017 and 2021, Telangana Forest Department has recorded 208 road kills, 58 of them of primates, on an 85 km stretch of a single highway in the Amrabad Tiger Reserve.[20] Over 200 elephants have been killed by railways,[21] mostly in PAs, in the past 25 years, including 58 between 2015 and 2018.[22] Over 150 flamingos have been killed by collisions with overhead powerlines in Gujarat,[23] and 1% of the sarus crane population of India is killed annually in similar manner.[24] Large, terrestrial birds have poor frontal vision and are highly susceptible to colliding into overhead powerlines. The greatest threat to the great Indian bustard (GIB)—the species most

[18] WII (2016)
[19] Grilo *et al.* (2021)
[20] Kalpavriksh, 'Protected Area Update', Vol.17. No.6 (2021)
[21] WII (2016)
[22] Ministry of Railways, in reply to Question no 16 in the Lok Sabha, 18th July 2018
[23] WII (2016)
[24] Sundar *et al.* (2005)

likely to go extinct in India in the near future with the world population estimated to be below 100—has been collisions with overhead powerlines. Male GIBs, which fly more than females do, are the most endangered. In Gujarat and Andhra Pradesh, just a handful of females survive, all the males having perished in powerline collisions. It is estimated that 18 GIBs are killed annually due to powerline collisions in the Thar Desert alone and nearly 100,000 different kinds of birds are killed each year from the same cause in this region.[25] Of all the diversions, decimation and damage caused to natural habitats and ecosystems by developmental projects, those caused by linear infrastructure intrusions—roads, railways and powerlines—are the most insidious, expansionist and permanent. 'Insidious' because they appear small and even unobtrusive, but their adverse impact is far greater than the area actually diverted. 'Expansionist' because roads, railways and powerlines periodically need to be upgraded, widened and maintained and induce 'ribbon development' along their length. 'Permanent' because once created, they cannot be shifted and the land restored to its previous status. Villages have been relocated out of crucial biomes, not linear infrastructure intrusions.

The effects of roads and their infrastructure on the populations of 234 mammal and bird species, adduced from 49 studies, revealed that population densities declined perceptibly in close proximity to infrastructures. The effect of roads and their infrastructure on bird populations extended over distances of upto 1 km, and of mammal populations upto 5 km.[26] Roads and railways also cause wildlife mortality, as mentioned earlier. Apart from habitat loss, roads and railways cause degradation and fragmentation of habitats into spatially isolated parts, which is a major cause for biodiversity loss, forest fires, pollution, garbage, sedimentation of aquatic ecosystems, and breaks in canopy connectivity which is essential for the movement of arboreal species, forcing them to travel on land where they are vulnerable and exposed to road kills as in the case of the lion-tailed macaque. Road openings and the movement of livestock thereon provide conduits for the spread of invasive species such as *Lantana camara* and other invasive species whose seeds become viable only after passing through the digestive tracts of livestock. Habitat segregation in turn can cause genetic effects and changes in the behaviour of animals and facilitate illegal hunting and smuggling and illegal extraction of timber and other forest produce. Habitat segregation also impacts local and indigenous tribes and communities, as has occurred with the Andaman Trunk Road on the Jarawa tribe and with the Great Nicobar East-West Road on the Shompen tribe. Powerlines that traverse such areas are usually high voltage lines that, apart from causing bird mortalities as mentioned before, require the clearance of linear swathes of vegetation 30 to 50 metres wide, which result in the

[25] Mohib Uddin *et al.* (2021)
[26] Benitez-Lopez *et al.* (2010)

spread of invasive alien species.[27, 28, 29] Roads contribute the most to surface erosion and landslide losses per unit of area disturbed, compared to any other kind of land use. Labourers, who stay during construction and remain thereafter for the maintenance of roads and railways, cause serious adverse impacts on ecosystems and habitats. In Hemis National Park, Ladakh, for example, a 20 km stretch of road has been under construction for over 10 years and labourers working on the road are now semi-permanent residents inside the Park. The same situation prevails in the eastern Himalaya and in several north-eastern states.[30]

A strategy that is often deployed is to construct linear infrastructure intrusions—frequently from both ends—right up to the borders of a PA, and then present a *fait accompli* to project clearance authorities, giving them no alternative but to grant approval because of the costs already incurred. A recent example is the construction of a four-lane NH 13 upto the edge of Kudremukh National Park in Karnataka. Clearances given in this manner are no better than *ex post facto* approvals and amount to the subversion of the letter and the essence of environmental clearances.

Linear infrastructures—roads, railways and powerlines—are a crucial, integral part of economic and social life and development. But they do not have to divert and destroy our national natural heritage, just as they would not be permitted to do the same to any national monument.

3.3 Recommendations

This Committee, therefore, makes the following recommendations:

3.3.1 Firstly, the Primacy of Prevention, through the realignment of linear infrastructure intrusions by skirting around PAs and other ecologically critical areas (ECA) including recognized wildlife corridors. This is in accordance with the directive of the National Wildlife Action Plan. If realignment and avoidance of the PA/ECA/corridors is not feasible, the same would have to be certified by the project proponent/secretary of the concerned ministry/chief secretary of the concerned state, providing detailed reasoning why such realignment and avoidance is not feasible. The extra cost involved of making any such realignment and avoidance must not be a reason. The proposal would then be considered by the Permanent Expert Body envisaged under mandate (h) provided in the Order of the Hon'ble Supreme

[27] Shankar Raman (2011)
[28] WII (2016)
[29] Goosem and Turton (2002)
[30] Shankar Raman (2011)

Court. The said expert body could then approve, reject or modify the proposal, or could return the same to the project proponents for reconsideration on specific issues.

3.3.2 Secondly, if a realignment avoiding the entire PA/ECA/wildlife corridor is not feasible, realignment to at least that extent be attempted so as to avoid the core area/the more crucial ecological portions of the PA or other ECA and to safeguard its ecological integrity and viability. The proposal would be similarly assessed and decided upon by the Expert Permanent Body envisaged in the S.C. order.

3.3.3 If a linear infrastructure intrusion has to be permitted to go through a PA or other ECA when there is no other alternative, they must go **underground**. High tension wires, roads and railways, both in India and elsewhere, have been taken underground in urban and other areas despite the much higher costs involved and additional expense should not form an excuse to evade this norm. In certain instances, such as NH6, the National Highways Authority (NHA) has constructed overhead elevated roads. They still cause noise, light pollution at night and bisect and fragment the habitat and cause most of the other adverse ramifications cited before. It is pertinent to note that in recent years Delhi has constructed 48.6 km of metro railway lines underground, Chennai 24 km, Bengaluru 8.82 km and Ahmedabad 6.5 km, most of them through granite and other hard subterranean rock. In Mumbai, 33 km of Metro lines have been taken underground and the proposed Bullet Train within the Mumbai Metropolitan Region will also be built underground, including under the Thane Creek and Flamingo City. Underground water tunnels have been built below the Sanjay National Park in Mumbai. Powerlines have also been taken underground in the Khadir Sanctuary in Kutch. If roads cannot bypass these special designated areas, they must go through them underground and not on elevated pathways.

3.3.4 If roads or railways have to be permitted to traverse the areas in question overland and are permitted to do so by the Expert Permanent Body appointed by the Hon'ble Supreme Court, they would be required to observe the following norms **(see below in 3.3.5)** which are in accordance with the recommendations of the Sub-Committee on Guidelines for Roads in Protected areas,[31] and approved by the Standing Committee of the National Board for Wildlife in its 30th meeting in September 2013.[32]

3.3.5 Specific Recommendations

(1) Existing roads in PAs/ECA/corridors will be maintained at the current level. There will be no widening of roads nor their upgradation.

[31] Ranjitsinh *et al.* (2013)

[32] https://moef.gov.in/wp-content/uploads/2018/03/wl-141113.pdf

(2) Any new road permitted would be restricted to a 2-lane road.
(3) Any new road to be made in such areas must avoid close proximity of crucial habitats and breeding grounds of animate wildlife and avoid close proximity of watercourses and other water sources.
(4) Alignment of new roads should not be straight to facilitate speeding and to cause greater disturbance and mortality at night.
(5) All existing and new roads should have speed limits, if necessary by the installation of speed breakers.
(6) There will be no traffic movement on roads from dusk to dawn.
(7) Checkposts would be provided at the entrance and exit gates of roads traversing PAs and vehicular traffic could be checked to prevent smuggling of wildlife and forest produce.
(8) Vehicles will not be allowed to stop within PAs or blow their horns.
(9) A labour force required to maintain roads will not be allowed to live inside a PA.
(10) No tourist facilities, shops, food and beverage outlets and human habitation ancillary to the road, would be permitted

In the case of railways, (1) no stations would be permitted in PAs/ECA/corridors and railways would not be allowed to stop within their precincts; (2) Railways would only be permitted to traverse the areas in daylight; (3) Speed limits would have to be imposed when railways are passing through the Protected Area.

Project proponents, including departments of governments, must be advised to take the avoidance of PAs/ECA/corridors into account at the conception and planning stage of projects. If there is no other alternative, prior approval of the SC appointed Permanent Expert Body must be obtained prior to the construction of linear infrastructure intrusions directed towards the borders of PAs/ECA/corridors and project proponents need to be warned that if they adopt the strategy of *fait accompli* by bringing the linear intrusions to the edges of the areas they wish to traverse without obtaining prior approval of the SC-appointed Permanent Expert Body, they will not only be refused permission but could be blacklisted for a period of upto 5 years by the said Expert Body.

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Chapter 4

Forest Clearance and Compensatory Principles

4.1 Introduction

If we look back at India's environmental history, the 1970s and 1980s stand out because that is when the foundations of India's environment, forest and wildlife policy and legal framework were laid down. The Constitution of the country was amended with 'environmental protection' explicitly incorporated for the first time as an obligation on the part of the State and its citizens. Early in the early 1970s when India's forests and wildlife were still being plundered, the Wildlife (Protection) Act, 1972, was enacted to establish protected areas (PAs) and ban wildlife hunting. In 1973 Project Tiger was launched—a flagship programme that established tiger reserves by setting aside large forest areas in varied ecosystems. In 1976, a major policy decision was taken to upgrade the subject of 'forests and wildlife' from the State List to the Concurrent List of India's Constitution, with the federal government having overriding legislative jurisdiction. The Forest (Conservation) Act, 1980, which restricted the diversion of forest land for development activities and made federal clearance mandatory, was another landmark legislation. The Environment Protection Act, 1986, was enacted in the wake of the Bhopal Gas Tragedy of 1984—the worst man-made industrial disaster.

The focus of this chapter is on the Forest (Conservation) Act, 1980, which regulates the diversion of forest land for non-forestry purposes. This legislative instrument ushered in due diligence effectively regulating the rampant diversion of forest land by governments from a massive 1,50,000 hectares per year during 1950-1980 to a more regulated 35,000 hectares per year post-1980. Considering the country's burgeoning population, scarcity of land for development, the imperatives of rapid economic growth, poverty alleviation and job creation, this was no mean achievement—especially when we compare it with other countries with a similar development trajectory, where large tracts of forests were converted to pastures, farms and plantation crops.

In 2008, the Hon'ble Supreme Court in Writ Petition (Civil) 202 of 1995 prescribed Net Present Value (NPV) rates to be charged from user agencies when forests are diverted for development purposes. In this model of compensation, the user agency is obliged to provide alternate land for afforestation, funds for compensatory afforestation, Net Present Value of ecosystem services lost, and in sensitive habitats, further mitigation

funds. This restoration is funded by the user agencies and executed by state forest departments. The underlying assumption of this strategy is that the newly created afforestation 'offsets' would compensate for the loss of diverted forests, resulting in a No Net Loss or Net Gain (NNL/NG) scenario. The Compensatory Afforestation Fund Act, 2016, and Rules, 2018, were notified to create an institutional arrangement and procedure for receiving the compensatory funds, defining permissible activities and laying out the approval process.

4.2 Mandate

The Hon'ble Supreme Court vide its order dated 25th March, 2021 in SLP (C) 25047/2018 by Association for Protection of Democratic Right Vs. The State of West Bengal constituted an expert committee under the chairmanship of Dr. M. K. Ranjitsinh, and provided it with a nine-point mandate. This chapter attempts to contribute to the 2 mandates (f) and (g), namely:

f) The guidelines shall also prescribe the mode of compensation financial or otherwise, the stage of depositing such compensation and the process that governs the computation and recovery. In this regard, the committee may consider the existing regulatory framework regarding calculation of Net Present Value (NPV) and may suggest necessary modification.

g) In addition, the guidelines shall also specify the manner and mechanism of compensatory afforestation to be carried out using the deposited compensation, consistent with the native ecosystem, habitat and species.

These two mandates have been clubbed together as they are part of a single process of diverting forests for developmental projects, valuing them using the Net Present Value approach and subsequently taking up compensatory afforestation. For the sake of clarity in presentation, we address this mandate in three separate chapters that are interlinked. We cover Forest Clearance and Compensatory Principles in Chapter 4; the methodology of the Net Present Value approach in Chapter 5; and Compensatory Restoration in Chapter 6.

4.3 Objectives and methods

The objectives of this chapter are three-fold: firstly, we evaluate the policy and practice of forest clearance; secondly, we assimilate global best practice principles and finally provide policy recommendations to strengthen the process of forest clearance. If there had been a credible impact evaluation of forest clearance, forest valuation and compensatory afforestation policy in operation for the last several decades with a pan India scope, it would have lightened the work of the Committee severalfold. To

compound matters, field visits to compensatory afforestation sites could not be undertaken due to restrictions imposed by the COVID-19 pandemic. Hence, the methodology adopted by the Committee was a review of secondary literature, stakeholder consultations and internal deliberations. In the review of secondary literature, global approaches to compensatory conservation and biodiversity offsetting were studied, a performance review by the Controller and Auditor General of India (CAG) was banked upon, reports prepared by various think tanks and civil society were referred to and scholarly literature was accessed. Based on this methodology, a draft consultation note was prepared and discussed internally by the Committee members. This discussion note was then shared with state governments, union territories and the integrated regional offices of the MoEFCC. This was followed by five regional consultations with these stakeholders online—Central region on 30th June 2021, Western and Northern region on 6th July 2021, Southern region on 8th July 2021, Himalayan region on 13th July 2021 and Eastern and North Eastern region on 15th July 2021. Based on these consultations, the discussion note was fine-tuned and finalized.

4.4 Performance of forest clearance and compensatory afforestation

The following two audit reports of the Controller and Auditor General of India (CAG) throw light on the performance of forest clearance and compensatory afforestation in 2013 and 2018. A summary of these reports is reproduced below:

Audit report on compensatory afforestation in India (CAG 2013)

The Controller and Auditor General of India conducted a compliance audit on compensatory afforestation in India for the period 2006-12, whose key findings are:

- The Ministry's records reveal that against the receivable non-forest land of 1,03,381.91 hectare, 28,086 hectare was received during the period 2006-12 which constituted only 27% of receivable non-forest land. The compensatory afforestation done over the non-forest land received was an abysmal 7,280.84 hectare constituting 7% of the land which ought to have been received. The afforestation over the degraded forest land was done only on 49,733.76 hectare and 49 km out of 1,01,037.35 ha and 54.5 km identified which worked out to 49% in area.
- The record with regard to transfer of ownership to the State Forest Department is equally dismal. Information made available by State/ UT CAMPA revealed that of the 23,246.80 hectare of non-forest land received by them only 11,294.38 hectare was transferred and mutated in the name of the State Forest Department. Of this 3,279.31 hectare was declared as Reserve Forest/ Protected Forest which was only 14% of non-forest land received.

- Audit also observed instances where express orders of the Supreme Court were flouted by Andhra Pradesh State Electricity Board where the diversion of forest land in Nagarjunasagar Dam was allowed without seeking prior permission of the Supreme Court. In five other cases unauthorized renewal of mining leases in Rajasthan and Odisha were noticed, where the approval of the Central Government was not obtained by the State Government as directed by the Supreme Court.
- Non-recovery/under-assessment of Net Present Value and funds for Compensatory Afforestation/Additional Compensatory Afforestation/Penal Compensatory Afforestation/Catchment Area Treatment Plan on the basis of a test check in audit was Rs 5,311.16 crore which constituted 23 per cent of the total principal amount with Ad-hoc CAMPA as on 31st March 2012.
- Out of Rs 2,925.65 crore of the compensatory afforestation funds released by Ad-hoc CAMPA during the period 2009-12 for compensatory afforestation activities, only Rs 1,775.84 crore were utilized by the State/ UTs leaving an unutilized balance of Rs 1,149.81 crore. The percentage of overall utilization of released funds was only 61%.
- Monitoring was very important considering the scale at which irregularities have been noticed in this audit. Absence of MIS/ consolidated database permitted individual cases of irregularities to remain unchecked. MoEFCC failed to appropriately discharge its responsibility of monitoring compliance of conditions of the Forest (Conservation) Act, 1980 relating to diversion of forest land.

Audit report on compensatory afforestation for Maharashtra state (CAG 2019)

The Controller and Auditor General of India conducted a compliance audit for the period 2013-18 in the State of Maharashtra. Of the total 1,671 cases involving 65,363 hectares (ha) that got stage II approval as of March 2018. It was observed that:

- The information of non-forest land (NFL) or degraded forest lands provided for CA against 1,671 cases was neither consolidated by APCCF cum Nodal Officer nor available with Chief Conservator of Forests.
- APCCF (CAMPA) was responsible for implementation of the annual plan of operations (APO). The case wise information on CA works due, proposed in the APO and completed was not available with APCCF (CAMPA).
- There was no information sharing between APCCF cum Nodal officer, responsible for processing of forest land diversion cases and APCCF (CAMPA), responsible for taking up afforestation work in alternate lands identified at the time of approval of diversion cases using CAMPA funds, which could have been used in preparation of APO.

- The test-checked circles and divisions were also not maintaining project wise details to show the alternate lands provided for afforestation against the diverted forest lands and the phase wise expenditure incurred on pre-plantation operations (PPOs), first year operations and second year to 10th year operations on such alternate lands. The details of NFL or degraded forest land declared as RF or PF were also not available.
- A monthly progress return (MPR) containing the details of CAMPA funds collected from the User Agencies, the shortfall in collection of NPV etc. was being submitted by the circles to APCCF (CAMPA) and APCCF cum Nodal Officer. These monthly returns were found to be incomplete as the MPR did not mention the alternative land allotted, the status of CA works done, up to date expenditure incurred etc. Besides, the cases (After 2002) shown by Nodal Officer in respect of three test-checked circles was 1,011 whereas the MPR submitted by the circles showed 374 cases. Thus, all the cases of diversion were not found in the statement.
- Further, in the three selected Circles, audit test-checked 104 cases in which forest land measuring 2,818.684 hectares was diverted for non-forestry purposes during the period 2013-18. Against the diverted forest land, CA work was proposed to be taken up in 3,243.22 hectares of land. Of which, in 1,920.22 hectares (49%) land, CA works (91 cases) were in progress and in the remaining 13 cases, 1,323 hectares (41%) land, no CA works were taken up (March 2018).

As we can note from the above performance assessments, the planning, monitoring and evaluation of the forest clearance and the compensatory afforestation regime is in need of strengthening. We share the gist of the global best practice principles which are regarded as essential components of any forest clearance and compensatory afforestation scheme.

4.5 Principles of compensatory conservation

There are 10 global best practice principles that have come to be regarded as a useful yardstick to evaluate the performance of any forest clearance and compensatory afforestation policy and for it to be judged to be 'successful' in resulting in a No Net Loss (NNL) or Net Gain (NG) of biodiversity.[33, 34]

- **Adherence to mitigation hierarchy:** A mitigation hierarchy is a sequence of steps starting with avoidance of impacts, minimization of inevitable impacts, on-site restoration and finally biodiversity offsets to achieve NNL/NG of biodiversity. A compensatory afforestation project is a commitment to compensate for significant

[33] Pope *et al.* (2021)
[34] ten Kate and Crowe (2014)

adverse impacts on biodiversity identified after appropriate avoidance, minimization and on-site rehabilitation measures have been taken according to a mitigation hierarchy. Diversion of forests should be a last resort in the mitigation hierarchy after possibilities of avoidance, minimization and on-site rehabilitation measures have been ruled out.

- **Limits to what can be compensated:** There are situations when the impacts of forest diversion cannot be fully compensated for by compensatory afforestation because of the irreplaceability or vulnerability of the biodiversity affected.
- **Like for like or better:** Compensatory conservation policies around the world are most often based on the principle of 'like for like or better'. What this means in practical terms is that the loss of a particular kind of forest or natural area can only be compensated by providing another site that is equally rich in its biodiversity, or better.
- **No Net Loss (NNL) and preferably Net Gain (NG) of biodiversity:** A compensatory conservation scheme should be designed and implemented to achieve measurable conservation outcomes *in situ* that can reasonably be expected to result in no net loss, and preferably, a net gain, of biodiversity.
- **Ecological equivalence:** This means much the same as 'like for like' and refers to areas with highly comparable biodiversity components. This similarity can be observed in terms of species diversity, functional diversity, ecological integrity, landscape context and ecosystem services.
- **Lasting conservation outcomes or permanence:** The design and implementation of a compensatory conservation scheme should be based on an adaptive management approach, incorporating monitoring and evaluation with the objective of securing outcomes that preferably last in perpetuity.
- **Additionality in conservation:** A compensatory conservation project should provide a new contribution to conservation, **additional** to any existing values, i.e., the conservation outcomes it delivers would not have occurred without it. Afforestation design and implementation should avoid displacing activities harmful to biodiversity to other locations.
- **Multiplier ratios:** Multiplier ratios are typically applied when determining how big an area is required to achieve habitat protection. These multiplier ratios are typically greater than 1:1 to account for factors including uncertainty, contingency, time delays (e.g., in purchasing the land) and the ecological value of the area being impacted in situations in which the offsets are not like-for-like. These are typically 5:1 for vulnerable ecosystems and as high as 30:1 for critically endangered ecosystems (which are to be considered in exceptional cases only).

- **Stakeholder participation:** In areas affected by a project and by the compensatory intervention, the effective participation of stakeholders should be ensured in decision-making, including their evaluation, selection, design, implementation and monitoring.
- **Equity issues:** Forest-dwelling communities depend on forests for their social, economic and cultural needs. Diversion of forests for industrial use impacts them the most as not only do they lose access to the ecosystem services of the forest but they are also the most exposed to the adverse impacts of developmental activities.

We use these principles as a lens to evaluate the science, policy and practice of forest clearance, forest valuation and compensatory afforestation in India. For simplicity's sake, this mandate is divided into three chapters (4, 5 and 6) namely—forest clearance, forest valuation and compensatory restoration in this report.

4.6 Gap areas in policy and practice

Plantations are a poor substitute for natural forests for a number of reasons. There are risks associated with the sustainability of plantation projects, mostly because there is usually inadequate monitoring and accountability for the survival of planted trees attaining maturity. Further, substitute afforestation often consists of only a handful of species, sometimes just a monoculture, which may be monetarily valuable but represents an ecological impoverishment with very significant attenuation of the ecological services rendered. Plantations of only a few species provide very poor wildlife habitat of little biodiversity value, and almost no usufructs or benefits for the local communities. We have seen that this substitution of manmade forests for natural ones has been a major source of discontent in many tribal regions of the country. Hence, diversion of natural forests for development should be a last resort and should strictly follow a codified mitigation hierarchy as detailed below.

4.6.1 Need for a mitigation hierarchy

In order to minimize the ecological impacts of forest diversion and cutting of trees especially in areas of high conservation significance and in eco-sensitive zones, a strict mitigation hierarchy strategy needs to be adopted. The hierarchy requires a series of essential, sequential steps to be taken throughout the life cycle of developmental projects. These steps include avoidance of impacts, minimization of inevitable impacts, on-site restoration, and lastly biodiversity offsets to achieve No Net Loss (NNL) or overall Net Gain (NG) in Biodiversity.[35]

[35] ten Kate and Crowe (2014)

These steps are explained below:

Step 1: Avoidance

Avoidance is the first step in the mitigation hierarchy (MH). It entails careful planning of the project so as to avoid having any adverse impacts on biodiversity, especially endangered species and their habitats. Avoidance is the easiest, cheapest and most effective way of reducing potential negative impacts on biodiversity and ecosystems. For example, by avoiding the development of infrastructure through a strip of relict habitat or old-growth forest that harbours rare, endemic or threatened (RET) species, project proponents can minimize the impact on such species. Avoidance includes changing the location of project sites, using alternative development practices and limiting the area of impact thereby saving sites of high conservation significance, heritage trees or RET species falling within the influence zone.

Step 2: Minimization

Minimization is the second important step in the MH, after avoidance. This includes measures to reduce the duration, intensity and/or extent of impacts that cannot be completely avoided. Minimization can be integrated into a project through the use of new technologies or methods, e.g., eco-friendly measures to reduce impacts on wildlife[36], reduction in total land or area required for project activities, or even by altering the timing to limit effects on species and habitats. Other examples include such measures as taking deliberate steps to reduce noise and pollution, designing power lines to reduce the likelihood of bird electrocutions, or retrofitting wildlife crossings on roads.

Step 3: Restoration

If a project finds it impossible to avoid or minimize its impacts, the next best alternative is restoration. This step can repair impacts such as soil degradation, increased erosion, disturbed or denuded vegetation, preponderance of invasive plants, and more. Restoration can include labour-intensive practices that restore habitats back to their pre-project state, or they can boost natural processes for recovery of the original landscape elements.

Step 4: Offsets

The first three steps (avoidance, minimization and restoration) collectively help in reducing the overall impacts of a developmental project on species, habitats and ecosystems. Any residual impacts that remain are mitigated using 'offsets' that form

[36] WII (2016)

the last step in the MH. Conservation actions under 'offsets' are usually taken at some distance away from an impacted site but they will only be effective if they happen within the same biome or bioregion. Offsets implemented effectively result in the overall improvement of the conservation status of species and habitat within its range. Offsets too aim to achieve no net loss or net gain with respect to species composition, habitat structure, ecosystem function and peoples' use and cultural values associated with biodiversity. Biodiversity offsets include 'restoration offsets' and 'averted loss offsets' which could be voluntary, regulatory, prospective, retrospective, composite or aggregate, depending upon the situation. Since offsets are often complex and expensive, it is better to pay more attention to earlier steps in the MH. The overall framework of a MH is shown in **Figure 4.1**.

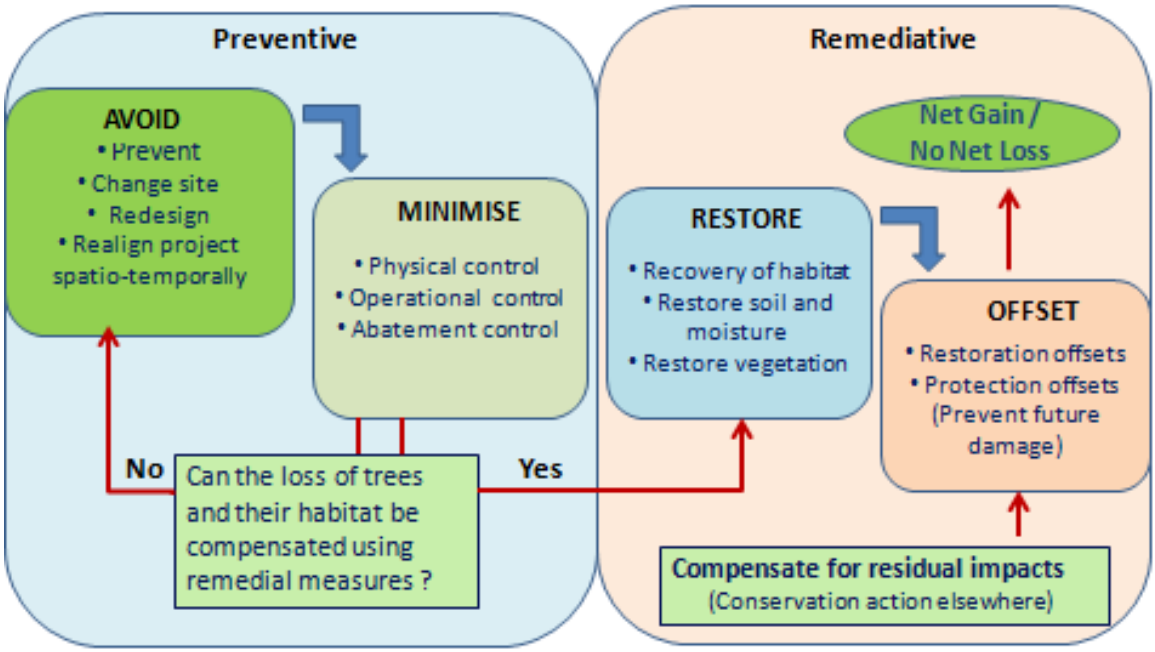

Figure 4.1: The mitigation hierarchy framework to be followed while diverting forests for development

This framework emphasizes the priority of prevention over remediation in achieving NNL/NG. But in order to be effective, we will need to codify a MH and evolve a standard operating procedure (SOP) to support decision-making. In the absence of a clear, codified mitigation hierarchy, decision makers will find it difficult to reject forest diversion proposals in the face of pressure and lobbying from user agencies. This idea received an enthusiastic response in our consultations with state forest departments. An SOP can be based on these two cardinal principles:

- Principle of **avoidability** by permitting only site-specific projects
- Diverting the **minimum** amount of forest land

Avoidability can be ensured by designating inviolate areas, which is something that has been discussed before but has remained at a conceptual level for a long time. The Forest Conservation Act, 1980 which is a regulatory act, now needs to also have a prohibitory role as well in certain aspects. Also, we need to have a differentiated approach for the diversion of natural forests and degraded forests. For the avoidance of forest diversion, a master plan can be developed just like we have for urban areas. On this master plan, biodiversity-rich areas and PAs can be graded and marked so that they are excluded from all infrastructure development plans. Spatial mapping of biodiversity-rich areas at the state level will be very useful and will also help in delineating inviolate areas. The point raised in the central India consultation was that forest lands are now being acquired for polluting projects such as 'dumping flyash', creating landfills, etc., all of which need to be included in a negative list of projects where clearance will be denied. Also, no forest land should be diverted for religious projects or reasons.

With respect to diverting minimal quanta of forest land, it is surprising that public infrastructure has the same unvarying specifications for whether or not it is to be constructed inside or outside a forest area. Road widths can be squeezed, or a road can be taken underground or overground, with passes. Similarly, canals in forest areas can be narrower to minimize the area of forest land diverted. There needs to be an awareness in the minds of user agencies on the need to have different design specifications in forest areas. In the Himalayan state consultation, we were told that the Indian Road Congress recommends that the minimum width for all single-lane roads is 7 metres. This is true even for roads that service remote hamlets in the mountains with just 15 households! Even here, the norm of 7m width is followed religiously. We also need to look at the volume of traffic before fixing its width. We may like to consider roads of 3m width for these isolated hamlets to reduce the extent of forest land diverted for road construction. For minimizing the diversion of forest land, each project needs to be disaggregated for reducing the impacts by applying the filter of site-specificity.[37] For instance, a mining project proposal can be broken up into modules and only the ore body may be permitted to be located within forests while the pellet plant and mining township are located well outside. Likewise, a hydropower project can be broken up into a generating station which may need to be inside, and the township outside forests. A linear infrastructure intrusion like a road can be separated from pit stops and toll plazas which can be located outside.

4.6.2 Net loss of forest land resulting from 'cash for land' policy

We were informed in our consultations that less than one third of the forest land diverted annually is being compensated by 'cash for land', resulting in liquidation of

[37] Bagla (2017)

this valuable natural capital. For the balance two thirds, the substitution is in the form of 'cash for land' which results in a net loss of forest land and ecological loss as noted above. Several project categories have been provided relaxation or exemption from the 'land for land' provision and are benefitting from the 'cash for land option. This special dispensation also adversely impacts the national goal of bringing at least a third of our geographical area under forest and tree cover in the true sense of the term, as elucidated in the National Forest Policy, 1988. Ideally, forests diverted for development need to be compensated with reforestation taken up on additional adjoining non-forest land (NFL) that has been acquired for this purpose. It is important that this additional NFL should have a similar ecology to the forest land that has been diverted. The suitability of NFL for afforestation needs to be assessed before acquiring it. The NFL shall be contiguous to existing forest land so that it can be protected from encroachment, and the soil depth should be more than 30cm. Reforestation should be done with a mixture of the local species that have been cut, ideally the same composition and structure, and not of commercially valuable trees or of species exotic to the area. More and more project categories and user agencies that cause the bulk of diversion cases need to be brought back into the 'land for land' category so that there is no net loss of forest land.

Only public utility projects up to 10 hectares and those up to 20 hectares in districts having a forest area exceeding 50% of their total geographical area, need to be exempted from this norm. Unlike state PSUs that have to acquire NFL, central PSUs which are amongst the largest consumers of forest land, are exempted from provisioning NFL. These double standards have to go, and all PSUs will need to provision NFL in lieu of forest land acquired. Also, for these PSUs, the tenure of forest diversion needs to be indicated upfront and be made co-terminus with the developmental plan and then frozen. Other than private lands, revenue forests can also be transferred to the forest department and notified under the IFA, 1927 in advance, to supplement the NFL land bank. Revenue forests subsist on government-owned lands and are recorded as 'forests' in revenue records, but are not under the administrative control of the forest department, for example *zudpi jungle, chhote-bade jhar ka jungle, jungle-jhari land, orange areas, malguzari, civil soyam,* etc. Maharashtra state informed us that 80% of the NFL acquired has been notified as RF/PF, 100% of the revenue forests have been acquired to create an NFL land bank and 1 lakh hectares of private forests have also been acquired.

However, states with a forest area exceeding 50% of their total geographical area can be exempted from this provision and can instead take up compensatory afforestation on double the amount of degraded forest land (DFL) or unclassed state forests (USF). Most of the northeastern states have a unique forest tenure where the forests are owned by local communities and are designated as unclassed state forests (USF). Many of these states do not have sizable degraded forest land (DFL) for compensatory

afforestation (CA), and hence they face double loss when forests are diverted and CA is transferred to other states for want of DFL. Hence, it is proposed that for these states, CA may be permitted in their USF.

A fallout of this policy can be a delay in according forest clearance, as acquiring, registering and notifying the NFL as RF/PF typically takes 2 to 3 years. This delay can be reduced by developing an accredited NFL land bank, accredited CA offsets and penalizing states for the delay as detailed below:

4.6.3 Prepare a land bank of accredited NFL in advance

As an alternative and to reduce delays in granting clearance, a shelf/land bank of NFL should be created in all districts where diversion is planned in advance with adequate safeguards. The accreditation of the suitability of NFL from the forestry point of view will be carried out jointly by the revenue and forest departments prior to acquiring it. NFL that has good soil depth (greater than 30 cm), is contiguous to existing forest land, or serves some key biodiversity function in the landscape such as a wildlife corridor, a refuge for migratory birds, provides key ecosystem services, etc. as certified by the State Biodiversity Board, needs to be prioritized (**Box 4.1**). However, safeguards regarding the siting of the NFL in the landscape, having good soil depth (greater than 30 cm), demarcating the land, obtaining prior approval before acquisition, additionality from CSR activity and others need to be pre-checked and verified. The NFL that is acquired should be in large contiguous chunks of at least 10 hectares in size and not be spatially scattered. Developing this shelf of accredited NFL land banks in advance and getting it mutated and notified as RF/PF will ensure that inordinate delays are avoided, and more and more projects can shift to 'land for land' without causing delay to development projects as the shelf of mutated and notified accredited NFL is already available for use. It must be ensured that the notification of the concerned NFL as RF/PF in lieu of land diverted must be *pari passu* with the project clearance, and should precede the clearance order and not be subsequent to it.

Box 4.1: Gujarat—Industries to provide land in lion, bustard areas to offset forest land acquired

In a boost to the wildlife of Gujarat, the government has begun implementation of a scheme where industries that have acquired forest land are to compensate by providing private land in the Asiatic lion landscape spread in various districts of the state and the Great Indian Bustard (GIB) habitat in Kutch. The department now accepts land only in lion conservation or Great Indian Bustard (GIB) zones rather than accepting compensatory funds or property in any other district or areas in lieu of forest land diverted to industries. This is based on an internal decision taken by the forest department that instead of accepting compensatory money or land in some other district in lieu of forest land, it will accept land only in lion conservation or GIB areas from industries. When forest land is diverted in any district of the state, the company is suggested to the area in any of the five districts namely Bhavnagar, Amreli, Rajkot, Morbi, and Kutch where the conservation of Asiatic lion and GIB is being

prioritised. These land parcels that have been granted by private and government agencies will be converted into reserved forest areas for the burgeoning lion population.

Source: *The Times of India, 14th Oct, 2021*

4.6.4 Incentivize accredited in-kind CA offsets

The provision of in-kind CA by a user agency already exists in para 2.4 (ix) of the Comprehensive Guidelines of FC/CA. This option can be explored for scaling-up where the onus is on the user agency to not only identify and acquire NFL in consultation with the forest department but also to reforest it. This can be considered as an in-kind CA once the plantation reaches a certain growth stage. In such a scenario, only part of NPV needs to be charged from the user agency. Sizeable exemptions on compensatory levies may be considered if the land falls in pre-identified wildlife corridors or in the buffer areas of PAs, or if it is contiguous to existing forests, in order to incentivize selection of suitable land for establishing these offsets. The big advantage of this model if executed in letter and spirit is that the risks associated with the establishment of plantations are borne by the user agency. The delay in obtaining clearance for Stage I and Stage II will be reduced significantly. However, safeguards regarding the siting of NFL in the landscape, demarcating the land, fencing it, obtaining prior approval, the reforestation model, any additionality from CSR activity and others, need to be however built into this proposal. This approach could lead to developing a market mechanism for accredited forestry offsets in the country, provided it is regulated and monitored well by the government. This would encourage landowners, communities, and companies to undertake forestry activities and provide them as offsets through conservation banking and the generation and sale of CA credits. This model of in-kind CA offsets may perform better than the present in-cash CA as they are being acquired after establishment, and monitoring is independent, as the forest department is not the implementing agency.

4.6.5 Penalize states for delays in notification of NFL as PF/RF

Stage II clearance for a project is withheld until land mutation and notification as RF/PF is completed, which often takes 2-3 years. Abiding by the principle of natural justice, to what extent is it justified to penalize a user agency which has already paid the compensatory levies upfront, when the delay is due to apathy on the part of the state government? This appears *prima facie* to be arbitrary and irrational. As an alternative, the option of holding the state government accountable for this delay must be explored. The best option is to insist on *pari passu* notification. The process of registration and notification of NLF as RF/PF needs to be broken up into a time-bound activity plan with accountability fixed at each level. Non-adherence to this time-bound process ought to be penalized by reducing the sanctioned amount of APOs of the

respective states on a pro-rata basis, i.e., for a state where 10% of the proposals for notification as RF/PF are pending beyond the prescribed time frame, their APO sanctioned amount under the APO component needs to be reduced in the same proportion.

4.6.6 Putting an end to splitting projects to evade central scrutiny

The approval process for forest diversion has been decentralized with smaller projects getting approved at the state or regional level itself. Also, all linear infrastructure projects such as roads, railway lines, canals, powerlines, etc. are approved at the regional level itself or below. Only diversion proposals requiring more than 40 hectares of forest land or those related to mining, hydropower or to the regularization of encroachments, are examined by the central Forest Advisory Committee (FAC). Project developers at times split up their projects into smaller parts and position them as independent projects in order to evade central scrutiny and expedite the clearance process (**Box 4.2**). To put an end to this practice of splitting up projects, it is suggested that user agencies should be asked to explicitly indicate their requirement for forest land along with other ancillary requirements for the next five years, and give an undertaking that they have no other plans or projects in the pipeline in the vicinity that would be related to the one they are seeking clearance of. This will ensure that their proposal for diversion will be processed taking into account the total requirement of forest land for the next five years and not on a piecemeal basis. If a user agency comes up with a subsequent proposal after having given such a commitment, their proposals should be rejected outright. User agencies found suppressing facts or splitting projects will be penalized and their proposal summarily rejected. It has also been noticed that to gain easy approval, clearances of 5 hectares are obtained in vital ecological areas, which subsequently grow beyond the 5 hectare limit with no redressal, often creating a cluster of 5 hectare plots which coalesce into cancerous pockets in pristine, climax forests that severely undermine the ecological integrity and biological significance of a forest. No such small areas should be granted at any “delegated” level without a spot inspection by the officer concerned and a certification to the effect that the diversion of this small parcel of forest land will not have any significant impact upon the integrity, ecology and biodiversity of neighbouring forests plots.

A major lacuna has been the lack of accountability in acts of both omission and commission of the officials concerned. If such dereliction of duty comes to notice, the concerned officer must be asked to explain, and if found guilty, must be suitably punished and an entry to this effect be made in his annual confidential report. Similarly, if a project proposer is found to have transgressed the terms of his project approval or to have suppressed important information, he must be punished

commensurately by fines, suspension or cancellation of his clearance and even by blacklisting the business concern.

Box 4.2: Karnataka—Mini projects mega-disaster

Indian laws give the best protection to the wilderness, on paper. Under the forest conservation act, no forestland can be used for non-forestry purposes, such as roads, railways, dams or industries, without the State's permission. Applications for land diversion are examined by the Forest Advisory Committee (FAC) of the Ministry of Environment and Forests and, if the region harbours wildlife, National Board for Wildlife (NBWL). But if a project requires less than 5 hectares of forestland, the states have the power to decide. When it comes to generating hydroelectricity, no clearance is required under the Environment Protection Act if the installed capacity is less than 25 MW. So in Karnataka, projects are being broken down by all possible means till the components appear small enough to escape the legal filter. To evade central scrutiny by the FAC and NBWL at the centre, the land requirement of each project was kept below 5 hectares and the capacity below 25 MW. But what appears to be mini individual projects on paper are, in fact, parts of bigger projects on ground. Moreover, to dress up these broken-down projects as 'mini'—as details of two projects in Kagneri and Kanchanakumari reserved forests show—land required for paving access roads through forests was not factored in the proposals. The result is potential devastation of the forest landscape with clusters of so-called mini-projects coming up nearly in every valley of the Western Ghats in the state.

Source: *Tehelka, 12th Oct, 2012*

4.6.7 Strengthening compliance of user agencies to final approval conditions

Presently, after Stage II clearance, the Act and Rules do not provide any mechanism for ensuring compliance by a user agencies of the conditions prescribed while according final approval. Monitoring of forest clearances is presently the weakest link in the forest clearance process. Typically, 20-30 conditions are prescribed, which a user agency has to adhere to over the next 20-30 years. The state forest departments cannot monitor every diversion case for the next few decades. Instead, user agencies should be tasked with submitting a voluntary annual compliance report, which can then be selectively monitored. This will shift the onus onto the user agency to comply with approval conditions. Monitoring during key identified project milestones, periodic monitoring, surprise inspections in at least 10 percent of the cases by State Site Inspection Committees and the State Empowered Committees, will greatly aid in bringing about transparency and strengthen compliance with forest clearance conditions.[38] Third-party monitoring of compliance to the prescribed final approval conditions can also be institutionalized. In instances where user agencies are found to be flouting conditions of forest clearance, punitive action in terms of cancellation of

[38] Bagla (2017)

forest clearance or stoppage of a project needs to be taken. Also, all future approvals of the user agency should be linked to compliance with the pre-conditions of previous projects.

4.6.8 Immediate upward revision of NPV rates

A revision of NPV rates is long overdue. NPV rates of Rs. 4.38 to 10.43 lakh based on 6 forest eco-classes and 3 forest canopy cover density classes were notified in 2008. They have not been revised since then despite the Hon'ble Supreme Court orders that they should be revised every 3 years. This has resulted in an undervaluation of the natural capital that is being diverted. The Land Acquisition Act, 2013 has brought in a new normal. Acquiring private land has become many times more expensive and cumbersome than acquiring forest land, which is now the cheapest unencumbered land now available for development. Instead of acting as a deterrent, low NPV rates have created a perverse incentive to prioritize the acquisition of forest land for development. Also, NPV assessment values only the quantum of forests diverted, and do not take into account adjacent forests that are disturbed and impacted by developmental activities. With forest diversion, the livelihood dependence of the local community too gets concentrated on residual forests, thereby accelerating their degradation. Hence, the true impact of diversion goes beyond the actual quantum of forests diverted.

4.6.9 Forest dependent community not compensated for the loss

While NPV is an important instrument for compensation, the concern is that none of this compensation is reaching the local community who depends the most on forests for its livelihoods and sustenance. Hence, it is suggested that half of the value of NPV should be used to improve the health of forests residual and adjacent forests to the project site on which the local community is dependent. Several states supported this idea during consultations and reported that communities are asking the question: 'We protected the forests and regenerated them, now these forests have been diverted for development. What have we got in return for our efforts?'. This has also been recommended by the IIFM Committee headed by Dr. Madhu Verma that was constituted by the MoEFCC in 2012 to review and revise NPV rates. This step will bring in intra-generational equity, sustainability and help in distributive justice. Other than forests, even common grazing lands and other common-pool resources of the village can be taken up for restoration. The objective is to improve the resource base of forest-dependent communities who are the most affected by forest diversion, but who, in the present scheme of things, are not compensated at all. In situations where

residual forests are too small in size, restoration activities can spill over to adjacent forests.

4.6.10 Implementation of compensatory schemes adversely impacted by the CAF Act, 2016

- **Compensatory funds not creating desired additionality to forestry funding**

  After the enactment of the Compensatory Afforestation Fund Act, 2016, (CAF Act), CAMPA funds are now routed through state treasuries. Different income streams merge to constitute the state budget, which at the time of budget allocation does not differentiate between the source of funds. Before the CAF Act, the states used to annually get 10% of accrued CAMPA funds directly into their CAMPA bank account from the centre as an additionality over and above the state's budgetary allocation. Now funds are routed through the state budget and during our consultations, some states raised the concern that CAMPA funds have now started substituting regular state funding to the forestry sector.[39] This has led to a reduction in the state budget for forestry, as many state governments have substituted regular funding to the forestry sector with compensatory funds. This cost-shifting implies that the element of additionality of CAMPA funds is getting lost.

- **Delay in release of funds for approved APOs adversely impacting compensatory afforestation works**

  As funds are now released from the state treasury, it has also resulted in issues related to the timely and adequate release of money and lack of necessary flexibility in the implementation of compensatory schemes. The whole purpose of creating CAMPA was to make compensatory levies available to the states without budgetary allocations, which has been lost with the promulgation of the CAF Act. The timely release of funds is becoming a key issue, and delays are causing the earlier investments to become infructuous. During our consultations, the states were unanimous in their opinion that the operational system of CAMPA was much more efficient compared to the one created by the CAF Act. Forestry works are highly season-sensitive and accessing funds from the state treasury in a timely manner is proving difficult for most of them, adversely impacting the implementation of the approved APO.

[39] Narain and Maron (2016)

Box 4.3: Understanding NPV and CAMPA in terms of statutory obligations

When applied to forest land diversion, NPV is understood as a value to compensate, in money terms, for the loss of tangible as well as intangible benefits flowing from the forest lands due to its diversion to non-forest use. The new user of the forest land is expected to bear the cost of these losses by the payment of NPV. The 2005 judgment of the Hon'ble supreme court concluded that the payment of NPV is for the protection of the environment and not in relation to any 'proprietary right'. The court also clarified that the collection of monies by the CAMPA are for the purposes of conserving a 'national', 'intergenerational', 'public' asset and not government property and that it is a fee that is levied to undertake some activities that are akin to economic and social planning. Rather than a revenue earned by the government for the sale or use of its property, the monies collected by the CAMPA are to 'carry out the statutory and constitutional obligations' i.e. the protection of natural resources.

Source: *Kohli et al. 2011*

4.7 Recommendations

4.7.1 Adoption of the mitigation hierarchy

The core concept of bringing into being a mandatory mitigation hierarchy will need 'in principle' approval and policy integration from the MoEFCC. All future projects involving the development of physical infrastructure within eco-sensitive zones of PAs and threatened habitats notified by the states, which involve infrastructure development leading to diversion of forest land and cutting of trees must follow the mitigation hierarchy outlined above. The mitigation hierarchy will also be applicable to sites that harbour rare, endemic and threatened species as well as heritage trees notified by state governments/Union Territories. All states/UTs, in consultation with their respective Biodiversity Boards, may notify such ecologically sensitive sites, critical habitats and crucial bio-corridors where a mitigation hierarchy will be followed in the event of any forest diversion required in the future.

4.7.2 Operationalizing a mitigation hierarchy

Implementing and operationalizing a mitigation hierarchy will require realistic planning, strict monitoring and institutional mechanisms to ensure conservation action on the ground. Capacity building of the agency dealing with implementing the mitigation hierarchy as well as local stakeholders would go a long way in achieving conservation goals. For avoidance, inviolate areas will need to be designated. For minimizing the area of forest land diverted, infrastructure coming on forest land needs to have different design specifications.

4.7.3 Compensating forest land by acquiring non-forest land

All development agencies will need to provide NFL in lieu of forest land acquired above the threshold value. No exemptions will be provided to CPSUs or any other public sector agencies. Only public utility projects up to 10 ha and those up to 20 ha in districts with forest area exceeding 50% of their total geographical area, will be exempted from this norm. However, in case of special geographical localities of high conservation significance, guidelines suggested in Chapter 2 shall be applicable.

4.7.4 Prepare a land bank of accredited NFL in advance

Delay in granting forest clearance can be reduced if a shelf of suitable NFL is planned in advance jointly with the revenue and forest departments. This NFL needs to be notified as a RF/PF and this advance preparatory work will enable the smooth transition to a 'land for land' policy.

4.7.5 Incentivize accredited in-kind CA offsets

The provision of in-kind CA by a user agency already exists in para 2.4 (ix) of the Comprehensive Guidelines of FC/CA. This option can be explored for scaling-up where a user agency not only identifies and acquires the NFL jointly with the revenue and forest department but also reforests/restores it in advance.

4.7.6 Penalize states for delays in notification of NFL as PF/RF

Final clearance to a project is not accorded until the land mutation and notification as RF/PF is completed which is the responsibility of the concerned state governments. Inordinate delays need to be penalized so that urgency is accorded to this matter by state governments.

4.7.7 Putting an end to splitting projects to evade central scrutiny

The approval process of forest diversion has been decentralized and at times user agencies take advantage of this to avoid higher-level scrutiny and approval by artificially splitting a project into smaller parts or staggering the approval in parts. There is need to end this practice and penalize the defaulters.

4.7.8 Immediate upward revision of NPV

NPV rates have not been revised since 2008, despite the Hon'ble Supreme Court's orders that they be revised every 3 years. While modifications to NPV have been described in Chapter 5, it is recommended that NPV rates be revised immediately so

that the undervaluation of nature is stopped as it is creating a perverse incentive to prioritize forest land for diversion.

4.7.9 Stop the practice of reducing the approved outlay of CA projects

Often there is a mismatch in cost norms of CA projects which get actually implemented, with the ones that were originally approved at the Stage I clearance stage. This practice should be done away with and all the components planned for CA projects during the clearance stage need to be retained in the APO stage as well. Often in the APO stage the approved costing of CA projects is reduced by removing components such as fencing, duration of maintenance, whether there is timely fund flow, etc. All CA projects need to be maintained and monitored for at least 10 years.

4.7.10 Penalize delays in payment of compensatory levies by user agency

There are instances where a user agency does not deposit the CL for many years after obtaining Stage I approval. By the time they do, rates for CA have become outdated and do not match with revised wage rates. Hence, it is proposed that after a period of two years, for every year's delay in depositing the CL, a penal interest of 10% per annum be charged on the CA amount to account for wage escalation and the penalty for delay in timely payment of levies.

4.7.11 Strengthening compliance by user agencies with final approval conditions

After final clearance is given to a user agency, there is very poor monitoring of the prescribed conditions. This needs to be strengthened very significantly with user agencies submitting compliance reports voluntarily, surprise inspections, periodic monitoring during key milestones, third party evaluation and future approvals linked to compliance with the conditions of earlier projects.

4.7.13 Compensatory funds need to create additionality in forestry funding

This Committee recommends that compensatory levies need to be routed directly to the state fund (state-level bank account) rather than the state treasury. This will avoid perverse cost-shifting as compensatory funds are being used to substitute regular state funding to the forestry sector, thereby negating their additionality. This is the standard procedure adopted by other national programmes as well for routing central grants to states. Most of the Centrally Sponsored Schemes (CSS) are operated from separate bank accounts at the state level to which central grants are directly routed. Also, accessing funds from the state treasury is impacting the regularity and ease of fund-flows, thereby adversely impacting forestry operations that are season-sensitive and often resulting in large afforestation investments turning infructuous.

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Chapter 5

Assessing the NPV of Forests: Suggested Modifications

5.1 Introduction

Point (f) of our nine-point mandate states: "*The guidelines shall also prescribe the mode of compensation financial and otherwise, the stage of depositing such compensation and the process that governs the computation and recovery. In this regard, the committee may consider the existing regulatory framework regarding calculation of Net Present Value (NPV) and may suggest necessary modification*".

Point (f) can be seen to have two components—the first concerns the nature, structure and timing of compensation, while the second is about the method of calculating Net Present Value (NPV). This chapter addresses the second component of the mandate.

This chapter needs to be viewed in the broader context of the **mitigation hierarchy** in the form in which it has been proposed by this Committee. The Committee has given primacy to the policy of 'land for land' over the current practice of 'cash for land', as laid out in Chapter 4 of this Report. Therefore, aspects of NPV prescribed here are in addition to the 'land for land' policy and ancillary to it, and not a substitute for it as an easy and monetarily cheaper route that is currently in practice. Hence, at the very outset, it needs to be declared that the mitigation hierarchy of **avoidance**, **minimization** and **offsetting** (along with other aspects recommended in Chapter 4) should be given primacy. The priority should be to look for alternatives in order to **avoid** diverting forests. Where such avoidance is not possible, then the attempt should be to **minimize/reduce** the area to be diverted and limit its impacts as much as possible. If reducing the extent of diversion (and its impacts) is also not found to be feasible, diversion may be permitted by offsetting the impacts through the afforestation of suitable non-forest land.

Past experience, however, has shown that alternate non-forest land is often not made available, with certificates of non-availability of such land being produced from high levels of the bureaucracy. As a result, in many cases—instead of making non-forest land available—twice the extent of the diverted land is taken up for afforestation in a degraded forest. It will be an important duty of the Permanent Expert Body envisaged in this Report to carefully scrutinise such certifications to ensure that there is indeed

no other option than diversion of forest land. While accepting that there are some limitations to offsetting, forests and ecologically critical and culturally significant areas must not be diverted at all. While abiding by the mitigation hierarchy, if forests have to be diverted at all, then their Net Present Value (NPV) should be adopted as a principle for making compensatory payment on account of the ecosystem services lost. The methodology of assessment of the NPV of the ecosystem services of forests and its subsequent application in the policy framework by a template (through a computer or mobile application) is the focus of this chapter.

This chapter briefly explains the notion of 'ecosystem services' of forests, describes the frameworks by which ecosystem services are valued, introduces the notion of Net Present Value (NPV), critically analyses the recommendations of some earlier Committees on NPV for forests in India, and ends with a few recommendations.

5.2 Ecosystem services of forests

All the various goods and services provided to the human community by the organic functioning of natural ecosystems are known as 'ecosystem services'. In this process, forests support the life and livelihoods of millions. Being renewable in nature, forests have an amazing resilience to regenerate. Yet, anthropogenic and non-anthropogenic interventions affect the structure of ecosystems, alter their natural capital base, and result in a rise or decline in the flow of ecosystem services. As per the classification of the Millennium Ecosystem Assessment,[40] the forest offers the human community ecosystem services that can be classified as **provisioning** (e.g., genetic resources, food, fibre, timber, fodder, medicinal plants), **regulating** (e.g., regulation of climate, water, and pathogens), **cultural** (e.g., spiritual enrichment, aesthetic experience, social interaction, tourism, etc.), and **supporting** (e.g., biomass production, provision of habitat, nutrient cycling, soil formation, etc.) in nature. In many cases, the livelihoods of the poor are inextricably linked with such goods and services provided by forests to humans free of cost. For this reason, ecosystem services are also called the "GDP of the poor". An illustrative list of the ecosystem services of forests is given below.

[40] MA (2005)

Table 5.1: A few ecosystem services provided by forests

Ecosystem Service	Produced or Received on Site	Specific Benefits	Beneficiaries
PROVISIONING SERVICES			
Water for agriculture, industry, and households	Yes	Water for drinking, irrigation, domestic and industrial uses	Farming community, industry, service sectors, urban residents, municipalities, water boards, etc.
Food and medicinal plants (natural medicines, pharmaceuticals)	Yes	Nutrition and sources of livelihood, medicines, prevention of epidemics	Local population especially the indigenous population; pharma companies
Timber flow and timber stock	Yes	Livelihood opportunities, building materials	Villagers, households at all levels
Fuel, fodder, NTFPs, and other vegetative biomass	Yes	Livelihood, cooking and heating, fodder for livestock, etc.	Rural population and indigenous people, artisans and farmers
REGULATING SERVICES			
Air pollution control	Yes	Overall welfare of the local population	Local population
Climate and micro-climate regulation	Yes	Overall welfare, agriculture, provides water etc.,	Local population
Carbon sequestration	Yes	Overall welfare	Local and global population
Water conservation and purification	Yes	Water conservation, improved water quality and health	Local population
Flood regulation and moderating extreme events	Yes	Protection of life and property	Local population and the population living in plain areas adjacent to a river
Pest regulation	Yes	Forest productivity and food productivity	Farmers and forest-based communities
Erosion control	Yes	Vegetation cover, prevention of topsoil and control of landslides	Local population
CULTURAL SERVICES			
Cultural and spiritual values	Yes	Sacred groves (Dev Vanas), contributes to (preservation of biodiversity), inspirational value, religious and conservation ethos	Tourists, moderating local climate for enhancement of agriculture/ particularly productivity

Ecosystem Service	Produced or Received on Site	Specific Benefits	Beneficiaries
Tourism and other recreational values	Yes	Source of livelihood through tourism. Recreation, awareness, source of livelihood through tourism and recreation --to be removed	Tourists and local population as well as tourism service providers (hoteliers, taxi, roadside eateries, etc.).
Inspiration of art, folklore, architecture, etc.	Yes	Source of livelihood through tourism and recreation, spreading of local art, culture and values	Tourists and local population, and nature loving artistic population of country and even sometimes, global impact
Social relations (e.g. fishing, grazing or cropping communities)	NA	NA	NA
SUPPORTING SERVICES			
Soil formation	Yes	Agriculture/horticulture production, vegetation, moisture conservation and habitat for living organisms, etc.	Farmers, local population and overall everyone, both locally and regionally
Primary production	Yes	Forest productivity and ecosystem stability	Farmers, local population and overall everyone, both locally and regionally
Nutrient cycling	Yes	Functioning of ecosystems, storage of elements and facilitates the flow of the substances or nutrients from deeper layers to top soil	Beneficiaries at various levels
Biological Control	Yes	Good health and prevention of epidemics	Beneficiaries at various levels
Repository of natural biodiversity. Habitats of species, including critically endangered	Yes	Conservation of flora and fauna habitat of faunal and floral species and the last refugium of endangered and critically endangered species	Beneficiaries at various levels
Pollination	Yes	Richness in biodiversity and harbours pollinators	Beneficiaries at various levels
Gene-pool protection	Yes	Preservation of indigenous crops, animal species for breeding programmes	Farmers largely, and the entire agricultural sector

5.3 Value of ecosystem services of forests

Some ecosystem services can be valued monetarily. However, monetary values of such services need to be used in conjunction with restoration offorests and land-for-land as a compensatory mechanism, as has been stated in earlier chapters. There are various benefits of such monetary valuation exercises in certain instances. Firstly, the valuation of ecosystem services creates an objective basis for decision-making across multiple options by removing ambiguity and arbitrary value judgments and helping to rationalize preferences from available options. Secondly, monetary values create a much stronger scientific and quantitative basis for channelizing efforts and investments for conservation goals, acknowledging the criticality of the trade-off between conservation and development. Thirdly, such valuation exercises help policy-makers in making allocation and distribution decisions while attempting to maximize net social welfare so as to understand and reconcile the inherent conflict between efficiency and equity. A comprehensive valuation exercise can help in reconciling social goals that might otherwise appear contradictory. Fourthly, these values can guide legal proceedings in determining damages where one party is held liable for causing loss to another party. In legal proceedings, where upstream activity causes losses in ecosystem services downstream or vice versa, there is need to evaluate the loss (usually in monetary terms) so that the affecter is made to compensate the affected with the value of the damage. Valuation offers a mechanism for strengthening the hands of the judicial system in the country. Fifthly, such exercises help in designing efficient management mechanisms (economic instruments, controls, etc.) and institutions (PES). Incentive schemes negotiated between two ecosystem service users can lead to a win-win situation in addition to enhanced ecosystem health and sustainable utilization of natural resources. Sixthly, investment decisions on public goods and utilities (such as dams or roads) in many developing nations often ignore the adverse effects on the environment because ecological costs are not considered. In the long run, the ecological cost might turn out to exceed the apparent economic benefits. Valuation of ecosystem services brings to the fore the long-run costs which societies may have to incur because of such decisions.

5.4 The notion of Total Economic Value (TEV) and a proposed framework for valuation

Once classified, ecosystem services are valued using appropriate techniques and then added up to calculate the total economic value or TEV (**Figure 5.1**). Among the numerous services that are provided by ecosystems, a valuation exercise can capture only a subset of them. Unless we capture the values of all services, we really do not arrive at the TEV. It is important to note this limitation. The concept of TEV enables us to compare what we have valued and what we have ignored.

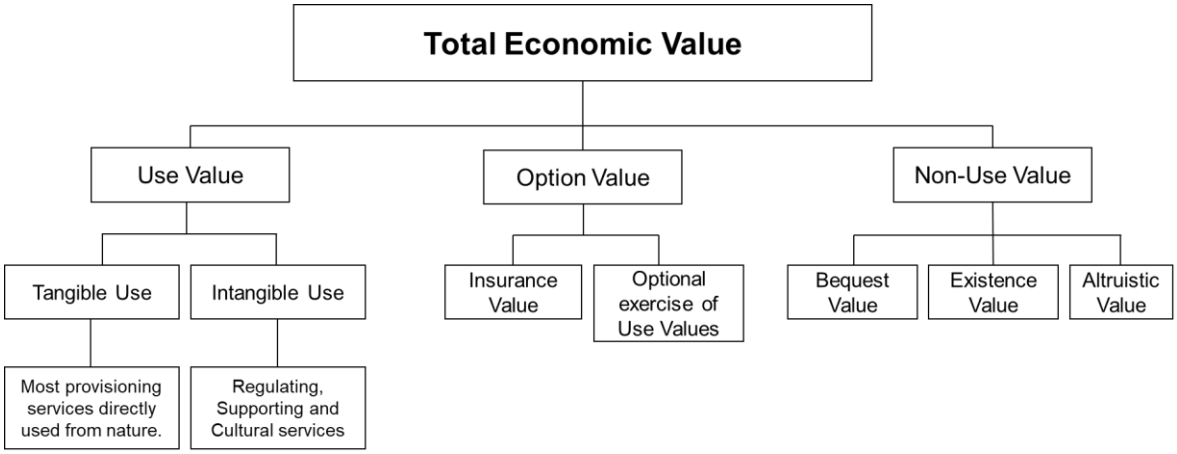

Figure. 5.1: The notion of Total Economic Value and its components

5.5 A framework for valuation of ecosystem services

At the very outset, it is important to delineate the additive framework of valuation through the lens of the Millennium Ecosystem Assessment.[41] **One should avoid the Total Economic Value (TEV) (which consists of use and non-use values) estimation here**, as that takes into consideration non-use values that are often difficult to justify in an annual valuation exercise. This is more so because non-use values are largely imperceptible and barely play any role in decision-making. Moreover, of the four categories of ecosystem services identified,[42] namely, provisioning, regulating, cultural and supporting services, one needs to be extremely careful to **not** include supporting services in the additive framework of valuation. If need be, it is better to value them separately and present two sets of use-values, one as an aggregate of provisioning, regulating and cultural, and the other as supporting services on its own. This is mostly because supporting services (e.g., soil formation, gene-pool protection, pollination, etc.) notionally also provide 'intermediate services' that enable the 'final services' (that are provisioning, regulating, and cultural in nature).[43] Adding such 'intermediate services' to 'final services' will lead to double counting, which should be avoided. Therefore, the simple formula to arrive at the sum of all the ecosystem service values of an ecosystem for a year (be it defined in the form of a micro-ecosystem like a tree or at a bigger scale like a landscape) should be:

[41] MA (2005)
[42] MA (2005)
[43] Fisher *et. al.* (2009)

$$V = V_p + V_R + V_C$$

Where:

V is the sum total of the values of ecosystem services

V_p is the sum of the values of all **provisioning** services

V_R is the sum of the values of all **regulating** services

V_C is the sum of the values of all **cultural** services

5.6 Net Present Value (NPV)

Net present value presents an aggregation of the stream of benefits minus the costs discounted with a rate of discount so as to reflect on the net value of the present period. In the context of forests, these benefits are the ecosystem services provided by the forests, and the costs involved are the costs of accessing or obtaining them.

Mathematically,

NPV_m = Net present value on year *m*

Bt = benefit (or values of ecosystem services) at time t

Ct = costs at time t

r = rate of discount

m = the beginning period

N = the terminal period

5.7 A critical analysis of various recommendations on NPV for forests in India

It needs to be noted here that NPV emerged in India's conservation paradigm as a mode of compensation due to the initiative of the Hon'ble Supreme Court which set up the *Expert Committee on Net Present Value* under the chairpersonship of Prof. Kanchan Chopra, which submitted its report in 2006. With estimates recommended by the Central Empowered Committee (CEC) presently in vogue, it is time to review the NPV estimates because the payment figures used presently are already 15 years old and need to be modified in the light of the latest advancements in scientific knowledge. This section critically analyses the *Report of the Expert Committee On Net Present Value 2006,* the estimates of *the Central Empowered Committee (CEC) 2008*

(the one that is presently in vogue), the recommendations of the IIFM Report of 2014, and the proposed *NPV revision with respect to WPI* as recommended through an Office Memorandum of the MoEFCC in January 2021.

5.7.1 Report of the Expert Committee On Net Present Value 2006 (Professor Kanchan Chopra Committee)

To estimate the NPV of forest diversion on economic principles, the 2006 NPV Expert Committee carried out an exercise of valuing 7 key goods and ecosystem services from forests, namely timber, carbon storage, fuelwood & fodder, NTFP, ecotourism, watershed benefits and biodiversity[44] (**Table 5.2**). The Committee said there were quite a few advantages with this list of ecosystem services: it is small and leads to a do-able valuation exercise. The other important implication of the recommendation of the Committee is that it recommended for site-specific valuation rather than a generic range of values.

Table 5.2: Expert Committee's Recommendations (2006) on ecosystem services and valuation methods

Ecosystem Service	Method of Valuation
Timber	stumpage value or market price
Carbon storage value	value of carbon stock = carbon content x market rate of carbon; carbon content = biomass x IPCC-GPG default value; biomass = growing stock x conversion factor
Fuelwood and fodder	market price method
Non Timber Forest Products	market price method
Ecotourism	per hectare value of eco-tourism in each circle = total value of ecotourism in each circle/net forest area in each circle
Watershed services	value per hectare for soil conservation and hydrological services from secondary site-specific studies

One needs to remember that these methods and valuations were considered 'state-of-the-art' at the time when the exercise was conducted. The last 15 years, however, has witnessed a host of developments and we have much better understanding today of the issues and problems of estimating the value of ecosystem services.

[44] Chopra *et al.* (2006)

Our first line of departure begins with the 'vagueness' with which 'watershed services' were defined and valued. 'Watershed services' include services to humans and nature, as can be seen in this definition: 'The various components that make up the landscape within a watershed—for example forests, grasslands, cultivated areas, riparian areas and wetlands— form groups of ecosystems.[45] These ecosystems provide 'watershed services'. These are defined as the benefits obtained from the ecosystems within a watershed that support downstream water users, including ecosystems'. These cannot be counted as full-fledged provisioning and regulating services because intermediate and supporting services are also embedded in them. For this reason, it is better to avoid catchall 'watershed services' as an undifferentiated basket and to use instead subsets such as: water for agriculture and domestic use, water for industry, soil fertility services, water storage or conservation, micro-climate regulation, and water quality regulation, prevention of soil erosion and landslides, especially in fragile watersheds like the Himalaya, etc.

The second issue we have with this Report is methodological. CER prices (the market price of carbon credits) do not accurately reflect the social cost that needs to be incurred in the form of health costs, number of morbid days, loss in productivity, loss in GDP, etc. A preferable method of estimation has emerged in the form of the Social Cost of Carbon (SCC).[46]

This methodology assumes that compensatory plantations will start providing the same quantum of benefits as diverted forests after 20 years. So what is essentially lost are the (ecological) benefits from diverted forests for a period of 20 years (till plantations attain maturity), and this is what needs to be compensated in the form of an NPV payment. However, there are risks associated with the long term survival of compensatory forestry plantations on public lands. Externalities such as forest fires, biotic pressure, droughts, floods, encroachments, etc. can severely dent the long-term prospects of survival of these plantations. Also, plantations of native species take more than 20 years to mature, and even then may never evolve into natural forests. Plantations are a poor substitute for natural forests as they may never yield the same value as that which was lost when natural forests were diverted. Hence, an NPV amount payable for forest diversion is a gross devaluation on two counts: firstly, it does not account for the risks associated with the long-term survival of plantations, and secondly, it assumes the ecological equivalence of a 20-year-old plantation with that of a natural forest.

[45] IUCN (2006)

[46] Nordhaus (2011)

5.7.2 Estimates of the Central Empowered Committee (CEC)

The estimates that are presently in vogue are those of the CEC which was a follow-up to the Kanchan Chopra Committee in February 2009. The CEC estimated the following services (many of which do not classify as 'services') e.g. timber and fuelwood, NTFP, fodder, eco-tourism, carbon sequestration, ecological services of forests, bio-prospecting and the value of flagship species. As opposed to site-specific values, block values were estimated for 6 eco-classes and 3 forest cover density classes which are currently prevalent as the NPV rates for forest diversion, and range from Rs.4.38 lakhs to Rs.10.43 lakhs per hectare, as shown in Table 3. These values derive from the GIST's GAISP project. The 16 major forest types of India were re-grouped into 6 ecological classes, according to their 'ecological functions'.

Eco-Class I: Tropical Wet Evergreen Forests, Tropical Semi Evergreen Forests and Tropical Moist Deciduous Forests, Tropical Scrub

Eco-Class II: Littoral and Swamp Forests

Eco-Class III: Tropical Dry Deciduous Forests, Tropical Scrub

Eco-Class IV: Tropical Thorn Forests, Tropical Scrub, and Tropical Dry Evergreen Forests

Eco-Class V: Subtropical Broad-Leaved Hill Forests, Subtropical Pine Forests, Subtropical Dry Evergreen Forests and Subtropical Scrub

Eco-Class VI: Montane Wet Temperate Forests, Himalayan Moist Temperate Forests, Himalayan Dry Temperate Forests, Temperate Scrub, Subalpine Forest, Subalpine scrub, Moist Alpine Scrub and Dry Alpine Scrub.

The Central Empowered Committee recommended the following rates for non-forestry use/ diversion of forest land, as shown in **Table 5.3**.

Table 5.3: NPV rates for non-forestry use/diversion of forest land as per the CEC's recommendation 2009

Forest Type	Class and NPV Rates (INR per hectare)					
	Class I	Class II	Class III	Class IV	Class V	Class VI
Very Dense	1043000	1043000	887000	626000	939000	991000
Dense	939000	939000	803000	563000	845000	897000
Open Forest	730000	730000	626000	438000	657000	699000

The advantage with this approach is that these rates offer ready reckoners to the forest department and developers too, to arrive at an NPV based on the eco-class and canopy density of the forest proposed to be diverted, without the need to engage experts or commission new studies. This also makes it much easier to make a cost-benefit analysis associated with development projects.

The criticisms against the CEC's Report are:

a. *Choice of ecosystem services*: The biggest departure is that whereas the KC Committee confined its purview to ecosystem services that are largely tractable and whose valuation methods are based on revealed preference approaches, the CEC's recommendations are not confined to that. Values of flagship species and values of bioprospecting are based on stated preference approaches or hypothetical market methods. Further, under 'ecological services of forests', which as per the classification of MA, are largely regulating services—namely, soil conservation, water augmentation, and flood prevention—it needs to be noted that a forest does not play a role in water augmentation or production or recharge. At best, forests provide a storage service. If this is treated as a 'provisioning service', then conceptually this is wrong as the forest is not a net producer of water. If this is in the form of a 'supporting service', then this needs to be dropped. It provides a storage service to the water (groundwater), and needs to be articulated in that fashion. Therefore, the nomenclature needs to be changed to 'water storage' or 'conservation'.

b. *Choice of methods:* There is need to review the social discounting rate of 4% that the CEC proposed. Further, many of the services were evaluated using studies on stated preference approaches (Contingent Valuation Methods) that do not reflect actual market behaviour. There is also some concern with the CEC's aggregation of values emerging from stated preference methods and revealed preference methods.

c. *Lack of reflection of present market conditions:* The most important issue here is that apart from the choice of methods and the choice of ecosystem services, the values need significant revisions as they do not reflect present market conditions any more.

5.7.3 Report of the Indian Institute of Forest Management 2014: Proposals and Recommendations

A little more than three years after the revised rates of NPV came into force, the MoEFCC vide O.M. dated 5th March 2012 assigned a study to the Indian Institute of Forest Management (IIFM) in Bhopal to suggest revised NPV rates. The IIFM

Committee's Report of 2014[47] made quite a few improvements and used state-of-the-art economic arguments and methodology of the time. It took into consideration the following ecosystem services as shown in **Table 5.4**.

Table 5.4: Ecosystem services proposed by IIFM Committee

Ecosystem Service	Type
Timber	Provisioning service
Carbon Storage	Regulating service
Fuelwood and fodder	Provisioning service
Non Timber Forest Products	Provisioning service
Carbon sequestration	Regulating service
Genepool protection	Supporting service
Bamboo	Provisioning service
Pollination and seed dispersal	Supporting service
Water purification	Regulating service
Soil Conservation	Regulating service
Water recharge	Supporting/ Provisioning service

Some other highlights of this Report are:

a. The study classified the forests of India into 14 Forest Type Groups (FTGs) on the basis of a modified Champion and Seth classification. Recognizing the importance of forests with less than 10% canopy cover, they were included in the classification of forest canopy cover classes along with (i) very dense forest (ii) moderately dense forest and (iii) open forest. Using 14 Forest Type Groups and 4 Forest Canopy Cover Classes, 56 classification units were formed for estimating the economic value of forests.

b. The methodology was designed to objectively estimate the economic value of ecosystem services originating from each of the classification units by appropriately considering their specific characteristics and hence values, rather than using a blanket value spread over the 56 classification units across the country.

[47] Verma *et al.* (2014)

c. Recognizing that forests across the country differ significantly in terms of their ecology, a weighted average rotation period of proposed Forest Type Groups was estimated based on the rotation period of dominant species in each group.

d. It used some state-of-the-art methods in estimation, especially in estimating carbon sequestration, where the Social Cost of Carbon (SCC) is being used.

This Report has the following scientific and conceptual issues:

a. Adding up supporting services with the other two forms of services leads to the possibility of double-counting due to the presence of the intermediate nature of some of the supporting services.

b. The valuation of water flowing from the forests has certain inherent flaws. If this is done in the form of a 'supporting service', then this needs to be dropped. If this is treated as a 'provisioning service', then conceptually this is wrong as the forest is not a net producer of water. It provides a storage service to water (groundwater), and this needs to be articulated in that fashion. Therefore, the nomenclature needs to be changed to 'water storage' or 'conservation', both of which are classified as 'regulating services'.

c. There remains some confusion with valuing felled timber and the timber stock. In the context of ecosystem service valuation exercises, it is the 'flow' values that are taken into consideration. The timber stock value is not only a 'stock' value, but a 'store' of value. It can, at best, be counted as an 'option value' as there remains an option of felling a tree and realizing its value (if this is permitted). Further, when a forest gets diverted, the entire standing timber is automatically felled and sold in the market, and the value gets realized. Therefore, from a developer agency's perspective, the value is already realized and double-counting of compensation can occur.

d. Carbon stock has been treated as 'timber stock' in the Report and classified as a 'stock benefit'. 'Carbon stock' is also a 'flow benefit' especially when one considers the notion of the social cost of carbon. The carbon stock is not a 'store' of value but provides a 'flow' of value. Atmospheric CO_2 is not a benefit (or service) to humanity, but a cost (or disservice). It is not only from the perspective of global warming that it causes a host of negative impacts on the economy, but also from the perspective of health costs, lowered productivity, and negative impacts on GDP that the economy has to bear the cost of enhanced CO_2 in the atmosphere. Therefore, it cannot have a price (as this is not a 'good' that offers a positive]utility at the margin'), rather it is associated with a cost that is imposed on society. Forests sequester carbon in a process that removes carbon dioxide from the atmosphere. Through the process of photosynthesis, the carbon content—assumed to be 27 percent of CO_2—is stored by

a forest, while the remaining 73 percent is released. The carbon is then stored in the forest within living biomass, soil, and litter and contributes to the forest's carbon stock. This is a periodic process. In most studies on ecosystem service valuation, it is this sequestered carbon that is taken into account as a 'flow' benefit and not the carbon storage as a whole. What one needs to note here is that the total carbon storage as also the newly sequestered carbon is a flow benefit! The carbon stock, if released from the forests, will add up to our 'disutility'. Therefore, every moment or every year, the forest offers us the benefit of stored carbon as also sequestered carbon by helping us avoid the cost that the released carbon would have imposed on us.

The IIFM Report recommended more than a 4-times increase in NPV rates which seemed steep, and these rates were not accepted by government. As per a recent note from the Forest Conservation Division in the MoEFCC (Office Memorandum dated January 22, 2021), such an abrupt rise in NPV rates '*…may impact the existing projects and ultimately on national economy i.e., it may increase the tariff rates both for power and other infrastructure sector projects, surge import bills of Central Government and moreover, the smaller projects may be rendered unviable. It was also deliberated that the Ministry of Steel, Ministry of Coal, Ministry of Power and NITI AYOG during the last meeting of CoS held on 28.03.2016 have also raised certain reservations on the proposed abrupt increase in the NPV*.' While such a statement may go against the mitigation of development externalities on conservation goals, given the actual cost incurred, such a rise seems quite justified in terms of present market conditions and meeting conservation goals. Yet the troubling issues of double-counting and certain conceptual problems cannot be wished away.

5.7.4 Why is a revision of NPV with respect to the WPI not advisable?

The note from the Forest Conservation Division, MoEFCC (Office Memorandum dated January 22, 2021) also recommended revising the CEC's rates using the Wholesale Price Index (WPI) with a fitment factor of 1.51 (actually, as a multiplier, to be precise). **Table 5.5** shows existing and proposed rates.

Table 5.5: The matrix for revised rates of NPV using the WPI multiplier

Forest Type		**Very Dense**		**Dense**		**Open Forest**	
		Existing	Proposed	Existing	Proposed	Existing	Proposed
Class and NPV	**Class I**	1043000	1574930	939000	1417890	730000	1102300
	Class II	1043000	1574930	939000	1417890	730000	1102300

Rates (INR per hectare)	**Class III**	887000	1339370	803000	1212530	626000	945260
	Class IV	626000	945260	563000	850130	438000	661380
	Class V	939000	1417890	845000	1275950	657000	992070
	Class VI	991000	1496410	897000	1354470	699000	1055490

Source: *MoEFCC Office Memorandum dated January 22, 2021*

This, however, is definitely not scientific for various reasons, and hence is not an advisable option. First of all, while marketed goods like timber, fuelwood, NTFPs, and fodder have available market prices or surrogate prices which can be reflected in the WPI, the same is not true for most of the other services suggested by the CEC. Certified Emission Reduction (CER or carbon credit) prices have declined (instead of increasing) relative to 2008, and in any case, that is not a true reflection of the social cost. Many values have been arrived at through stated preference approaches, and are not true reflections of market behaviour. Hence, blind consideration of the WPI for revising of NPV numbers will defeat the purpose. Secondly, sticking to the CEC's recommendations of the ecosystem services and methods do not make sense given the immense changes in human understanding, as already pointed out by the IIFM Committee.

5.8 The summary Table

A summary of the strengths and weaknesses of the various recommendations is given in **Table 5.6**.

Table 5.6: Strengths and Challenges of the various Committees' recommendations

Committee Proponent	Expert Committee On Net Present Value 2006	Central Empowered Committee (CEC) 2007	IIFM Committee 2012	WPI correction (MoEFCC 2021)
Strengths	1. Site-specific valuation recommended, leading to precision	1. Block rates offer ready reckoners for forest department and developers to get ready estimates of payments that need to be made	1. State-of-the-art and appropriate methodology reflecting values based on specific characteristics rather than blanket values	1. Updating of the CEC's recommend-ations on the basis of WPI

Committee Proponent	Expert Committee On Net Present Value 2006	Central Empowered Committee (CEC) 2007	IIFM Committee 2012	WPI correction (MoEFCC 2021)
		2. Makes cost-benefit analysis associated with development projects much easier	2. A weighted average rotation period of proposed forest type groups was estimated based on the rotation period of dominant species in each forest type group	2. This can apply well for all the services whose values have been arrived at on the basis of domestic market prices
			3. Use of state-of-the-art methods in estimation, especially for estimating carbon sequestration, where Social Cost of Carbon (SCC) is being used	
Challenges	1. Vagueness in definition of 'watershed services'	1. Choice of Ecosystem Services are problematic	1. Possibilities of double-counting as supporting services are added to provisioning and regulating services	1. This will not apply for all those services whose values are not based on market transactions
	2. Methodological issues with carbon cost estimation through market prices of carbon	2. Based on GIST's GAISP estimates which are 15 years old.	2. Conceptual issues with 'water recharge' as provisioning service, whereas the forest is not a producer of water	2. The fitment factor (or multiplier) of 1.51 is not applicable for carbon prices as those values have declined
	3. The time horizon of 20 years is hardly sufficient to cover the life of the ecosystem or even the regeneration of a new ecosystem	3. The methods are no longer state-of-the-art now, though they were at the time when the studies conducted	3. Double-counting with timber stock and flow, and adding stocks with flow benefits	3. All the challenges prevalent in CEC's recommendations remain without the necessary corrections with state-of-the-art knowledge

Committee Proponent	Expert Committee On Net Present Value 2006	Central Empowered Committee (CEC) 2007	IIFM Committee 2012	WPI correction (MoEFCC 2021)
		4. These hardly reflect present market conditions	4. Conceptual problems by considering 'carbon stock' as a stock benefit, whereas the benefits are flow benefits when estimated through the social cost of carbon	

5.9 Recommendations

The NPV estimation proposed by this Committee suggests the following modifications:

i. Issues of double-counting should be avoided by removing 'supporting services' even if the measure is a conservative one

ii There should be ease of computation for updating values

iii It needs to be conceptually and methodologically robust

iv NPV should be site-specific so as to reflect the existing ecosystem governance mechanism. Both the choice of ecosystem services and the methods of valuation should be updated every five years on the basis of state-of-the-art knowledge.

For all these reasons, this Committee recommends the following broad guidelines for NPV estimation:

(a) The following services and the corresponding methods of valuation are recommended and provide the data sources that may be used. The data sources provide an indicative idea and should not be taken as sacrosanct. New data sources emerge with better information from time to time. As and when better data sources emerge, they should be adopted.

Table 5.7: List of suggested ecosystem services, data sources, estimation methods

Ecosystem Service	Classification	Proposed Methods	Data source
Timber Flow	Provisioning	Product of quantity and price	1. FSI 2. Market price
Total Carbon Storage (includes annual sequestration)	Regulating	Product of (Carbon Stored + Annual Sequestration) and Social Cost of Carbon ($57/ tonne)	1. FSI 2. Ricke et al (2018): "Country-level social cost of carbon", Nature Climate Change 8, (895–900).
Fuelwood and fodder	Provisioning	Product of quantity and price	1. FSI 2. Market price
NTFP	Provisioning	Product of quantity and price	1. FSI 2. Market price
Water purification	Regulating	Landscape population x Average daily per capita water consumption in the landscape or similar landscapes x Treatment cost	1. Census of India 2. Municipality/Municipal Corporation
Soil Conservation	Regulating	Per unit area cost of basin erosion prevention techniques x Forest Area	1.https://www.cbd.int/financial/values/india-valueforestsecolog.pdf 2.Forest Department
Water Conservation	Regulating	Benefit Transfer	https://www.nature.com/articles/387253a - Table 2: summary of average Global value of annual Ecosystem Services
Air Pollution Control	Regulating	Benefit Transfer	1. Ninan, K. N., & Kontoleon, A. (2016). Valuing forest ecosystem services and disservices–Case study of a protected area in India. Ecosystem services, 20, 1-14. 2. Central/ State Pollution Control Board

The above list is indicative, not exhaustive. It is based on the principle that as many tractable and easily estimable provisioning and regulating services should be taken up as are available from the data and methodological standpoint. The Committee strongly recommends removing 'supporting services' from the aggregation process in order to obviate any form of double-counting. The list may be expanded keeping in mind these two principles.

(b) There is a critical need to move away from the 20-year time horizon, as that is too short as a rotation period. The rotation period may instead be pegged at 60 years as that emerges as an indicative average considering the data for 14 FTGs (for which data was made available) as per Champion and Seth's classification, and with area as the weight. The rate of discount (premium) of 3.5% can still be taken as valid (as the existing savings bank rate of interest). However, the rate of discount needs to be updated from time to time through expert consultations.

(c) A standardised template with fixed formulae should be created so that just placing the input data of some of the variables provides us with the present value or PV. In that case, only the necessary data needs to be fed from the various data sources as mentioned to arrive at the NPV. This data from the suggested data sources can be compiled by a nodal officer in a state forest department. An indicative template on the same is attached in **Appendix 5.1** in which the yellow highlighted cells signify the input cells, i.e., the cells in which data needs to be entered. The green highlighted cells are the output cells where the results will immediately emerge as and when the input data are entered. This excel template can be made into a computer programme and a mobile application for ready use by the forest department.

(d) Every forest department in each state should have a nodal officer dedicated to enter the necessary input data in the excel sheet, that will then yield final PV values.

(e) Training should be imparted to the nodal officer for regular updating of input data.

(f) While (a) to (e) provide broad contours of the guidelines to be followed for NPV estimation, this Committee recommends that a dedicated expert committee on NPV be formed with a ToR on the nuances of NPV in terms of expanding the above list, updating the list, updating of methods and datasets. This body should also set the formula and help in updating the template.

5.10 References

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Chapter 6

Graduating from Afforestation to an Ecological Restoration Regime

6.1 Mandate

The Hon'ble Supreme Court vide its order dated 25th March, 2021 in SLP (C) 25047/2018 by the Association for Protection of Democratic Right Vs. The State of West Bengal constituted an expert committee under the Chairmanship of Dr. M. K. Ranjitsinh and provided it with a nine-point mandate. This chapter attempts to contribute to mandate (g) which reads as follows:

(g) In addition, the guidelines shall also specify the manner and mechanism of compensatory afforestation to be carried out using the deposited compensation, consistent with the native ecosystem, habitat and species.

It also meets the requirements of mandate *(i) Any other issues incidental to the aforesaid objectives*.

While the "forest clearance' part of India's compensatory conservation regime has been discussed in Chapter 4, and the 'forest valuation' part in Chapter 5, in this chapter we cover the 'compensatory afforestation' (CA) component. Afforestation is deeply ingrained in India's compensatory conservation mindset and practice and in this chapter we assess the extent to which it is "consistent with the native ecosystem, habitat and species" as indicated in the mandate. We also provide basic terminology, principles of ecorestoration, review of global and national policies and practices and strategies to graduate from compensatory afforestation to compensatory restoration. India is a signatory to the Global Restoration Initiative and Bonn Challenge, and the UN Decade of Ecological Restoration provides a golden opportunity to move forward towards a practical, action-oriented programme on ecorestoration across all our various ecosystems.

6.2 Definitions

We begin with a few standard scientific definitions that are often used interchangeably in policy and practice or misunderstood, leading to misinterpretation.[48, 49]

Afforestation means planting trees on lands which are not forested, with the objective of increasing forested area

Reforestation is planting trees on deforested lands

Ecological restoration (or ecorestoration) is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed

Forest expansion implies the development of forests where they did not historically occur

Forest regeneration is secondary forest regrowth on deforested or degraded lands

6.3 Introduction

The United Nations has declared 2021–2030 as the UN Decade on Ecosystem Restoration to accelerate the restoration of degraded ecosystems worldwide. India is a signatory to the Global Restoration Initiative (Bonn Challenge) that aims to bring 350 million hectares (Mha) of the world's deforested and degraded land back to good health by 2030. This sustainable land restoration will also enhance biodiversity and ecosystem services, thereby contributing to the attainment of multiple UN Sustainable Development Goals 2030 and also the post-2020 biodiversity targets.[50] This global priority for ecosystem restoration provides an opportunity for India to reflect on its large afforestation programme and align it more closely with the science, policy and practice of ecological restoration so as to comply with the ecological imperatives and the biodiversity needs of the nation, and thereby enhance the net gain to human well-being and sustenance, especially of forest-dependent communities.[51, 52]

In this chapter, we first assess the present state of knowledge with regard to ecological restoration. We then assess the policy and practice of afforestation in India and to what extent it is "consistent with the needs of the native ecosystem, habitats and species" as prescribed in our mandate. We then identify key gaps and recommend

[48] Veldman *et al.* (2015a)
[49] Clewell *et al.* (2004)
[50] Edrisi and Abhilash (2021)
[51] Lamb *et al.* (2005)
[52] IUCN and WRI (2014)

measures that have the potential to be transformative if implemented in both letter and spirit.

6.4 Methodology

If there had been a credible impact evaluation of compensatory afforestation policies across India over the last several decades, it would have revealed the truth and lightened the work of this Committee severalfold. Unfortunately, field visits to compensatory afforestation sites could also not be undertaken due to restrictions imposed by the COVID-19 pandemic. Hence, the methodology adopted by the Committee is based on a review of secondary literature, stakeholder consultations, the domain experience of its members and internal deliberations. In reviewing the secondary literature, global approaches to reforestation and ecological restoration were studied, a performance review by the Controller and Auditor General of India (CAG) was banked upon, reports prepared by various think tanks and civil society were referred to, and scholarly literature was accessed. Based on this methodology and supplemented by the recent field experience of Committee members, a draft consultation note was prepared and shared with the state governments, union territories and the integrated regional offices of the MoEFCC and online consultations were held, based on which the discussion note was fine-tuned and finalized.

6.5 The Science of Ecological Restoration

6.5.1 Selecting the suitable restoration approach

Approaches to restoring degraded ecosystems depend heavily on the state of the residual vegetation which is a reliable indicator of the potential for natural regeneration (**Figure 6.1**). Just as ecosystem services decline in a stepwise manner with increasing anthropogenic impacts, restoration approaches can elevate a degraded ecosystem to a higher level in the restoration staircase.[53] Forest ecosystems are categorized into three classes (**Table 6.1**) depending upon the degree of degradation:

- **Degraded ecosystems:** Such ecosystems are characterized by partial denudation of the original vegetation, with soils and seed banks intact. At such sites, a 'natural restoration' approach of ending the drivers of degradation, allied to protection, will suffice to enable the natural regeneration of climax species. 'Natural regeneration' denotes the spontaneous recovery of native tree species that colonize and establish in abandoned fields or natural areas.[54]

[53] Chazdon (2008)
[54] Crouzeilles *et al.* (2017)

- **Damaged ecosystems:** In sites with intermediate levels of degradation where soils are intact but diverse seed sources are lacking, 'natural restoration' has to be supplemented with augmentation of the flora with native species and is termed 'assisted restoration' to enhance the biodiversity, ecosystem services and rural incomes.
- **Destroyed ecosystems**: Such areas are characterized by complete damage of the ecosystem structure and functioning, e.g., mined sites. Reclamation or 'reconstructive restoration' may be the only option in former mined areas where soil removal or toxic substrata limit the establishment and growth of native vegetation. In contrast to natural and assisted restoration, reconstructive restoration requires the planting of nursery-grown seedlings, direct seeding, and/or the manipulation of disturbance regimes (for example, thinning and burning) to speed up the recovery process, often at a high cost.[55] In Figure 6.1 (below), stages 1, 2 and 3 represent the three stages of degradation, viz., destroyed, damaged and degraded states.

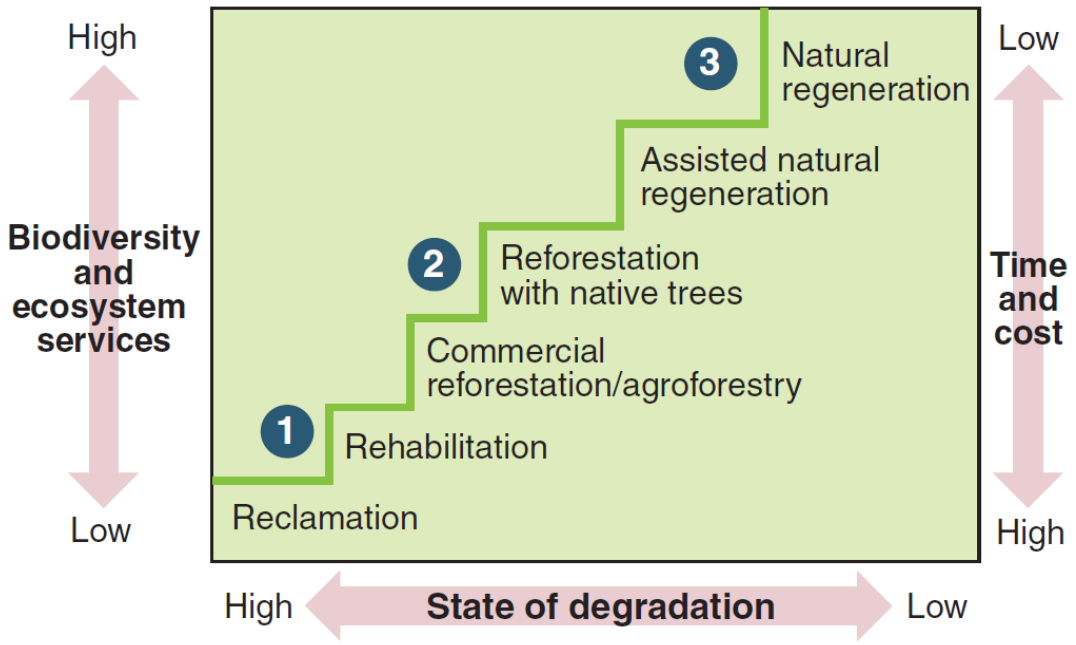

Figure 6.1: The Restoration Staircase. Depending on the state of degradation of an initially forested ecosystem (1–destroyed, 2–damaged, 3–degraded), a range of restoration approaches (1–reconstructive, 2–assisted, 3–natural) can restore levels of biodiversity and ecosystem services given adequate time, safety from further anthropogenic impacts and financial investment

Source: Chazdon (2008)

[55] Crouzeilles *et al.* (2017)

Determining whether natural, assisted or reconstructive restoration is optimal requires knowing the degree of damage, the rate of natural ecosystem recovery, the landscape context in which the site is positioned, and the restoration goals, funds, and costs.[56] Thus, restoration practitioners and stakeholders need to look upon ecological restoration as a set of complementary approaches, viz., natural, assisted or reconstructive, based on their suitability to the local context. For example, restoring native plants at sites that have undergone heavy extractive pressure or have been severely infested with invasive species, may need reconstructive approaches such as invasive species control, partial burning of undesired biomass and seeding of local species (**Box 6.1**). In contrast, there is high capacity for natural or assisted restoration in large forested sites where the causes of degradation have been removed (**Box 6.2**). Hence, restoration approaches need to be looked upon as a continuum where natural restoration will work best at sites with low degradation and reconstructive restoration will work best at sites with high degradation, with assisted restoration suited for sites with intermediate levels of degradation.[57]

Table 6.1: Mapping the extent of ecosystem degradation and the most suitable restoration approach

Degradation type	Restoration approach	Description
Degraded ecosystem with soils intact and diverse seed sources available	Natural restoration	Ending degradation, e.g., removal of contamination source, modifying grazing practices, cessation of logging, fire protection, etc.
Damaged ecosystem where soils are intact, but diverse seed sources are lacking	Assisted restoration	A combination of the above strategy with biotic and abiotic interventions, for example: *Abiotic* Active remediation of substrate, habitat creation, reshaping watercourses, reintroduction of environmental water flows, promoting seed germination, etc. *Biotic* Invasive species management, reintroduction of species, augmenting depleted populations of species, etc.
Destroyed ecosystem where soils have been removed or with toxic substrata	Reconstructive restoration	A combination of the above strategies, along with reintroducing a major proportion of the desired biota, possibly mimicking natural successional dynamics.

Source: Atkinson & Bonser (2020)

[56] Holl and Aide (2011)

[57] Atkinson and Bonser (2020)

Box 6.1: Ecological Restoration of Rainforests in the Anamalai Hills

This is a summary account of the steps followed in carrying out ecological restoration of degraded fragments of mid-elevation rainforests in the Valparai landscape in the southern Western Ghats of Tamil Nadu by the Nature Conservation Foundation (NCF), a civil society organization. These rainforest fragments are embedded within plantations of tea or coffee and some adjoin the Anamalai Tiger Reserve. The forest fragments are infested by invasive alien species such as *Lantana camara*, *Chromolaena odorata* and *Mikania micrantha*. The goal of the project was to identify and then restore the habitat of degraded rainforest fragments on private plantations by first removing invasive alien species and planting native trees and lianas in their place. Prior research had indicated that even small areas could support highly diverse communities of endemic and endangered species, including animals such as the lion-tailed macaque, the Malabar grey hornbill and many species of frogs.

The process followed for Restoration:

- Surveys and research on animal and plant communities in the rainforest fragments
- Assessment of the status of rainforest fragments, identification of their biodiversity values based on key taxa such as plants, birds, mammals, and amphibians
- Studies in larger tracts inside Anamalai Tiger Reserve which served as 'benchmark sites' for the degraded fragments
- Mapping the rainforest fragments. MoUs with the plantation companies to protect and restore the fragments
- Establishment of a nursery with 150 species of seeds and wildlings of plants strictly native to local tropical evergreen rainforest
- Nurturing these seedlings in the nursery for 2-3 years before planting them out
- Site preparation. This involved careful (manual) removal of weedy species (e.g., *Lantana camara*) and retention of all naturally regenerating native species including pioneer and disturbance-adapted species (e.g., *Clerodendrum infortunatum, Mallotus tetracoccus*)
- Planting out in sites prepared for restoration after the onset of the southwest monsoon. Between 50-80 species and 700-1100 saplings per hectare planted
- Planting in disturbed areas of native rainforest species that are tolerant of openness and disturbance. Small amounts of rock phosphate and organic compost were mixed into the soil in the planting pits
- Planting efforts mostly targeted tree species. However, in 15-20 years we expected other plant lifeforms would colonise on their own but that did not happen. This highlights the importance of protecting existing relatively undisturbed natural ecosystems, including rainforests. Once they are lost, even long-term and intensive restoration efforts cannot recreate these ecosystems
- Maintenance of the sites to ensure that weeds do not take over. In our experience, with constant and careful maintenance, a low canopy cover at 3-4 metres establishes within 2-3 years, after which weeds do not proliferate much, as they are mainly light-demanding species

- In the rainforests where the restoration work was done, the plants grew to trees that flower and fruit in about 10-15 years. After this it is likely that the recovery of a disturbed site may start with natural functions such as seed-dispersal, plant and animal recolonization and regeneration

Source: *Contributed by Drs. Divya Mudappa and T. R. Shankar Raman, NCF*

Box 6.2: Natural Restoration in the Khangchendzonga Landscape of Sikkim

Mount Khangchendzonga (8,586 m), the third highest mountain in the world and the highest peak in India, which is revered as a guardian deity, has influenced and nurtured a unique ecosystem—the Sikkim Himalaya, which constitutes a global biodiversity hotspot. Though 40% of the geographical area of Sikkim state has been brought under the protected area network, grazing was prevalent and there was a rising trend of rearing more and more livestock. Studies by several national agencies pointed to high levels of forest fragmentation and disturbance due to the impact of cattle-sheds and over-grazing. Old-growth oak and coniferous forests were being opened up and converted into artificial pastures to meet the needs of the growing livestock population. Due to the opening of the forest canopy and clearing of the bamboo and Rhododendron middle storey, thickets of secondary, unpalatable shrubs increased substantially, reducing the quality of the natural habitat.

To address this issue, the Government of Sikkim—together with several stakeholders—initiated a conservation initiative to make the national park, sanctuaries and forests "cattle-free" which was spearheaded by the joint forest management committees, eco-development committees and local NGOs. As a result of a sustained effort lasting over a decade (2000-2010), more than 10,000 cattle and 500 herders were weaned away from the protected areas (spanning 5,000 square kilometres) and were provided with financial assistance. The impacts of this ban wre independently assessed by various national institutes and NGOs which showed encouraging signs of the recovery of wildlife habitats, wildlife populations bouncing back and herders not reverting back to their earlier livelihood even a decade after they were phased out. This successful experiment serves as a good example of a landscape-level, natural restoration initiative where forests and wildlife bounced back once the causes and drivers of degradation were successfully tackled.

Source: *Contributed by Dr. Sandeep Tambe, Member Expert Committee*

6.5.2 Review of ecological restoration studies

Large-scale plantations of a small number of species that are fast-growing and disturbance tolerant are growing in the tropics and while many appear attractive in the short term, may not support a wide range of species in the future.[58] In many cases, natural and assisted restoration can achieve greater success than intensive

[58] Chazdon (2018)

interventions and are far less costly.[59] Intensive afforestation and forest expansion is a threat to grasslands and open canopy woodlands.[60] Decades of expensive tree planting in North India have had only a limited effect on tree canopy and livelihood goals.[61] Meta-analysis of 133 studies show that natural restoration surpasses active restoration in achieving tropical forest restoration success for all three biodiversity groups (plants, birds, and invertebrates) and five measures of vegetation structure (cover, density, litter, biomass, and height).[62] These studies reveal that natural and assisted restoration may be a more cost-effective or appropriate course of action, and in some cases, reconstructive restoration can even cause more harm than good. For instance, mechanically planting trees and use of heavy earth-moving machinery can damage naturally re-sprouting vegetation as well as soils.[63]

A meta-analysis of 240 restoration case studies suggests that for ecosystems with moderate levels of degradation, natural and assisted restoration might be more cost-effective because most of these systems recovered naturally from disturbances in about 10 years.[64] A global study analyzing 2,200 forest plots across the American and West African tropics revealed that while natural regeneration is frequently disregarded in favour of tree plantations, in tropical forests with low to medium levels of degradation, natural restoration yields better results than restoration plantings.[65] For this study, more than 90 researchers from all over the world came together and their takeaway message was that there is no need to plant more trees when nature is doing an excellent job by itself. These forests have regrown and recovered after human and natural drivers of disturbance such as fire, grazing, clearance, etc. are eliminated. Global restoration experience in the tropics and subtropics unequivocally points to the conclusion that natural and assisted restoration yield better results than reconstructive restoration in ecosystems that have low to medium levels of degradation. Depending on local site conditions and people's needs, the policy and practice of ecological restoration needs to rely on natural and assisted regrowth wherever and whenever possible, and use active reconstructive restoration planting only when it is apt and necessary.[66]

[59] Chazdon (2018)
[60] Veldman *et al.* (2015a)
[61] Coleman et al. (2021)
[62] Crouzeilles *et al.* (2021)
[63] Holl and Aide (2011)
[64] Jones and Schmitz (2009)
[65] Poorter *et al.* (2021)
[66] Poorter *et al.* (2021)

6.6 Review of Policy and Practice of Afforestation in India

6.6.1 Wrong use of terminology

As indicated early in this chapter, the term 'afforestation' refers to the planting of trees on lands which historically never supported forests. However, in India we have been using this term erroneously for plantations taken up on deforested or degraded forest lands. This practice should properly be termed 'reforestation'. In place of 'compensatory afforestation', the term 'compensatory restoration' or, better still, 'ecorestoration' is scientifically more apt as most of the non-forest lands which are to be notified as forest lands may be a part of diverse ecosystems such as grasslands, open canopy forests, mangroves, thorn scrub, meadows, etc. However, afforestation and forest expansion is so ingrained in our forestry policy, laws and programmes and even in the minds of many forest managers that it is difficult to change such thinking.

6.6.2 National guidelines are 'afforestation' centric

The Handbook of Forest Conservation Act, 1980 lays down comprehensive guidelines for Forest Clearance and Compensatory Afforestation and stipulates the following:

- Section 2.4 (i) states that revenue forests, unclassified state forests and other such lands can be considered for the purpose of compensatory afforestation (CA). All such lands on which CA is proposed shall be afforested to the extent of double the area proposed for diversion and then be transferred, mutated and notified as reserve/protected forests under the Indian Forest Act, 1927. The final clearance for diversion of forest land should be given only after the transferred land is notified as reserve/protected forest as a *quid pro quo*.
- Section 2.4 (vi) stipulates that state governments shall prepare a CA scheme with 1,000 plants per hectare for all non-forest lands to be afforested under the scheme. In case it is not possible to raise plantations at the rate of 1,000 plants per hectare on selected non-forest land, then the balance number of plants shall be planted on degraded forest land as per Working Plan prescriptions.
- Section 2.4 (vi) stipulates that for the purpose of CA, all forest lands with a crown density below 40 percent should be treated as 'degraded forest land'.
- Section 2.7 (i) and (ii) deal with the identification of land banks for CA. It stipulates that the States and UTs shall create land banks for CA for speedy disposal of proposals under the Forest Conservation Act, 1980. In addition to non-forest land, degraded forest land with a crown density below 40% and under the administrative control of forest departments may be identified (using satellite imagery and in consultation with the Forest Survey of India) and be made available for CA.

- Section 2.8 (i) stipulates that the number of plants to be planted in Non-Forest Land identified for CA shall be at least 1,000 plants per hectare. If the requisite number of plants @ 1,000/ha cannot be planted on non-forest land identified for taking up CA, then the balance number of the plants will be planted in degraded forest land as per the provisions of working plans.

The first point to note in these guidelines concerns the prescription to plant 1,000 plants per hectare irrespective of the vegetation prevalent in the ecosystem concerned and its current status. We argue that this strategy misses out on two counts:

- **Firstly, it does not stipulate ending the 'drivers of degradation' as a pre-condition for taking up restoration.** One of the most common reasons for the failure of afforestation projects is their failure to deal with the causes of degradation. For example, where the rate of biomass removal (grazing, firewood collection, etc.) is faster than what primary production can replace, then it is imperative to address the economic needs of the local community before afforestation (or restoration) is attempted. Afforestation projects implemented in isolation without first addressing the causes and drivers of deforestation in consultation with the local community will only remain a 'band aid' approach to the malaise (**Figure 6.2**) and not provide a lasting cure[67] particularly as there is no accountability for the long term survival of the planted trees.

Figure 6.2: Only the mounds (where trees were planted) remain as village grazing lands were taken up for afforestation. Communities need to be taken into confidence and made into co-managers and partners while planning restoration projects

[67] Blignaut (2009)

- **Secondly, only reconstructive restoration is envisaged with 1,000 trees per ha.** The uniform prescription to restore all CA lands (whether degraded forest land, revenue forests or non-forest land) with the same formula of 1,000 plants per hectare is misplaced. Restoration science suggests and results prove that a more site-specific and diverse restoration strategy with three models of restoration, i.e., natural restoration, assisted restoration and reconstructive restoration based on the degree of degradation, rate of ecosystem recovery, the landscape context, etc. would be far more successful. The uniform afforestation model of 1,000 plants per ha may work well in deforested sites where the causes of degradation have been dealt with, but even in such cases it would be important that only indigenous native trees are planted. This method will amount to 'reconstructive restoration'. In other kinds of sites where removing the causes of degradation or assisting nature will suffice, natural restoration or assisted restoration strategy will achieve a far superior restoration outcome with less expenditure, too. Research studies that have analyzed tropical forest restoration initiatives challenge the widely held notion that natural forest regeneration has limited conservation value and that active reconstructive restoration should be the default ecological restoration strategy.[68] These studies point out that not only are natural and assisted restoration strategies more successful but are much more cost effective as well in moderately degraded habitats.

While earlier it was mandatory to plant 1,000 trees per ha, now it is permitted to spread them over adjacent forest lands. Instead, assisted natural regeneration, enrichment planting and protection can provide good restoration outcomes instead of having to plant 1,000 trees per ha. While 1,000 trees per ha is specified under CA norms, there is no prescription on site suitability, insistence on planting only native trees, avoiding monocultures, not prioritizing commercial species, etc. and even more importantly, no directive that existing grasslands and grassland-forest mosaics, should not be converted into man made forests. These are some of the most productive ecosystems in the country and the world over upon which depend the existence of local free-grazing livestock and indeed, the livelihood of local people. It is these crucial biomes that are normally—and unfortunately—chosen for 'afforestation'. As a result, plantations done with NPV/CA funds are poor substitutes for the natural biodiversity that is lost when forested lands are diverted.

[68] Crouzeilles *et al.* (2017)

6.6.3 Report on forest clearance and compensatory afforestation by the Controller and Auditor General of India (CAG)

The following 2 Reports of the CAG throw light on the performance of forest clearance and compensatory afforestation projects in India in 2013 and 2018, respectively.

Audit report on Compensatory Afforestation in India (CAG 2013)

The CAG conducted a compliance audit on compensatory afforestation in India for the period 2006-12. Its key observations are provided below:

- The Ministry's records revealed that against the receivable non-forest land of 1,03,381.91 hectare, 28,086 hectare was received during the period 2006-12 which constituted only 27% of receivable non-forest land. The compensatory afforestation done over the non-forest land received was an abysmal 7,280.84 hectare constituting 7% of the land which ought to have been received. The afforestation over the degraded forest land was done only on 49,733.76 hectare and 49 km out of 1,01,037.35 ha and 54.5 km identified which worked out to 49% in area.
- The record with regard to transfer of ownership to the State Forest Department is equally dismal. Information made available by State/ UT CAMPA revealed that of the 23,246.80 hectare of non-forest land received by them only 11,294.38 hectare was transferred and mutated in the name of the State Forest Department. Of this 3,279.31 hectare was declared as Reserve Forest/ Protected Forest which was only 14% of non-forest land received.
- Out of Rs 2,925.65 crore of the compensatory afforestation funds released by Ad-hoc CAMPA during the period 2009-12 for compensatory afforestation activities, only Rs 1,775.84 crore were utilized by the State/ Uts leaving an unutilized balance of Rs 1,149.81 crore. The percentage of overall utilization of released funds was only 61%.
- Monitoring was very important considering the scale at which irregularities have been noticed in this audit. Absence of MIS/ consolidated database permitted individual cases of irregularities to remain unchecked. MoEFCC failed to appropriately discharge its responsibility of monitoring compliance of conditions of the Forest (Conservation) Act, 1980 relating to diversion of forest land.

Audit report on Compensatory Afforestation for Maharashtra state (CAG 2019)

The CAG of India conducted a compliance audit for 2013-18 in the state of Maharashtra. Of a total of 1,671 cases involving 65,363 hectares that were given stage II approval as of March 2018, it was observed that:

- The information of non-forest land (NFL) or degraded forest lands provided for CA against 1,671 cases was neither consolidated by APCCF cum Nodal Officer nor available with the Chief Conservator of Forests.
- The APCCF (CAMPA) was responsible for implementing the annual plan of operations (APO). The case-wise information on CA works due proposed in the APO and completed was not available with the APCCF (CAMPA).
- No information was shared between the APCCF cum Nodal officer who is responsible for processing cases of forest land diversion, and the APCCF (CAMPA), who is responsible for taking up afforestation work on alternate lands that were identified at the time of approval of diversion cases using CAMPA funds, which could have been used in preparation of the APO.
- Test-checked forest Circles and Divisions were not maintaining project-wise details to show the alternate lands provided for afforestation against diverted forest lands and phase-wise expenditure incurred on pre-plantation operations (PPOs), first year operations and 2nd to 10th year operations on such alternate lands. Details of NFL or degraded forest lands that were declared as RF or PF were also not available.
- Further, in the three selected Circles, the CAG audit checked 104 cases in which forest land measuring 2,818.684 hectares was diverted for non-forestry purposes during the period 2013-18. Against the diverted forest land, CA work was proposed to be taken up in 3,243.22 hectares of land. Of which, in 1,920.22 hectares (49%) land, CA works (91 cases) were in progress and in the remaining 13 cases, 1,323 hectares (41%) land, no CA works were taken up (as of March 2018).

It is abundantly clear from the above performance assessments that the planning, monitoring and evaluation of forest clearances and the compensatory afforestation regime are in need of strengthening.

6.6.4 Impacts of afforestation drives on grasslands

Deep misunderstanding exists about grassy biomes, as well as their denigration and devaluation relative to forests.[69] Degraded forests are defined in the CAMPA comprehensive guidelines (Section 2.4vi) as *all forests* having less than 40% crown density. However, all open forests are not necessarily degraded merely on account of their low canopy density. By this yardstick, all natural grasslands and meadows, wetlands, natural open forests and ecologically vital grassland-forest mosaics and other open areas will all come under the ambit of indiscriminate afforestation and forest expansion (**Box 6.3, Figure 6.3**). Natural open forest biomes such as grasslands,

[69] Veldman *et al.* (2015b)

rocky plateau tops and outcrops, shola grasslands (such as those depicted on the cover of this report), alpine meadows, the krummholz zone (adjacent to the alpine tree line), marshy areas, desert ecosystems, ravines and 'badlands' and others need to be protected from inappropriate ecological afforestation and forest expansion.

Box 6.3: Why frenzied tree planting is no answer to ecological restoration

Tree planting often ignores the fact that the restoration of grasslands, deserts, savanna, or rainforests means planting the right species in the right places. Large-scale record-breaking tree planting makes news, not forests. Which explains why politicians, bureaucrats, and celebrities throng these events, while botanists, ecologists, and indigenous people are conspicuously absent. Besides failing to monitor or nurture the large numbers planted, such tree planting can cause more harm than good. Across India, tree planting efforts suffer from six main problems: planting trees in the wrong places, planting the wrong species and species mix, planting too few species, failing to consider seed provenance, planting without considering the rights of local people and planting without ending the drivers of degradation.

The most egregious harm comes when people plant trees in areas that do not naturally support many trees: open natural ecosystems (ONEs). India has a remarkable diversity of ONEs from the hot desert dunes of Jaisalmer to the cold desert steppes of Spiti and Ladakh; from the thorn scrub and savanna woodlands of the Deccan Plateau to the ravines of the Chambal; from the dry grasslands of *Banni* to the wet grasslands of Kaziranga; from the montane grasslands of the Western Ghats to the alpine meadows of the Himalayas. ONEs span about 3,29,000 sq.km. or 15% of India's land area. These open natural ecosystems, mislabeled 'wastelands', are ecosystems in their own right, home to many specialized and endangered plants and animals.

Planting trees by the millions has come to be considered one of the main ways of reining in runaway carbon emissions and tackling climate change. But experts say many tree-planting campaigns are based on flawed science: planting in grasslands and other non-forest areas, and prioritizing invasive trees over native ones. A good forest-restoration project must recreate a forest ecosystem where it was a forest before, a process also called reforestation. But afforestation, or planting a new forest in an area where there was no forest to begin with, can often be problematic. This is because planting forests requires a lot of land. And areas that were never forests historically, but seem open and available for planting trees, are usually another critical ecosystem: grasslands, savannas, shrub lands, meadows, rocky outcrops, or dry lands. Compensatory afforestation projects in India suffer from two major design flaws, one that they are rarely designed as restoration projects attempting to recreate the natural forests that were lost and secondly these projects are implemented without consulting the communities and understanding what they want.

Source: *Mongabay, 25th May, 2021, The Hindu, 6th Aug, 2021*

Figure 6.3: Alluvial grasslands afforested with *Prosopis juliflora*—an invasive alien species introduced into India under an ecologically inappropriate forest expansion drive

6.6.5 Greening at the cost of local biodiversity

Species selection in afforestation projects is most often biased towards fast-growing, non-native tree species that thrive in disturbed habitats but have limited scope for fostering biodiversity or other species that would benefit local forest-dependent communities. Such inappropriate plantations may be more accurately described as 'green deserts'. To make matters worse, in many instances plantations have been raised in areas that never historically harboured trees, but instead contained other types of valuable natural habitats such as grasslands, which were destroyed as a result of mindless tree-planting. Compensatory restoration projects must strive for No Net Loss or Net Gain (NNL/NG) of Biodiversity scenarios. 'What to plant', 'where to plant' and 'whether to plant or not', are key decisions that need to be carefully made when planning a restoration project and must be based on sound ecological principles and the needs of local communities, and not on just 'survival percentages' or growth statistics.

6.6.6 Local community participation in afforestation suffers from tokenism

CA/NPV projects are typically positioned as being 'technical' solutions, oblivious of the socio-ecological system within which they are embedded and often leaving little room for traditional knowledge and the local expertise of local communities. Compensatory conservation is as much an ecological intervention as it is social. Undermining the social dimension and active stakeholder involvement can dent conservation outcomes significantly. In reforestation, the role of the local community has to be envisaged as 'equal partners' and not merely as 'wage seekers', and their stake needs to be built in right from project inception. One good practice from Chhattisgarh is that the entire funds for maintenance of a plantation are transferred into the bank account of the concerned forest committee which is given the responsibility of protecting the plantation. During consultations, the state of Punjab informed us that it has included a component of "entry point activities" amounting to 10% of the CA budget, in the total budget. The case from central India (cited below) underscores the critical importance of community engagement in the restoration of degraded ecosystems (**Box 6.4**).

Box 6.4: Restoration of degraded forests in Madhya Pradesh

Set up in the year 2000, Parsai Village Forest Committee (VFC) in Balaghat district of Madhya Pradesh was assigned 151 hectares of forest land. The area represented a classical case of the tragedy of the Commons, which had been reduced to pollards and stumps with very little left to meet further local demand. The entire area was denuded of grass cover. In the forest working plan 1985-2001, this forest area was assigned to Rehabilitation of Degraded Forest Working Circle. The newly formed forest committee leadership soon swung into action by regulating grazing, firewood extraction, and extraction for other household needs. The forest department provided funds to undertake restoration work like cutting back of pollards and stumps, seeding of local grasses, eradication of invasive species like *Lantana*, planting of native species and for fire protection. Over a period of 20 years, the area now supports moderately dense forest cover of Sal and miscellaneous species. In the new Working Plan, the forest area was included in the Improvement Working Circle, confirming that the work of Parsai VFC had a very positive impact in restoring the damaged ecosystem. A microplan is now under preparation for management and sharing of ecosystem services benefits as per state policy guidelines. Cases like Parsai are not one-off—hundreds of VFCs have restored their degraded forests and are now in a good position to reap the usufructory benefits. In 2020-21, as many as 546 VFCs managed their forests as per such microplans and shared usufructory benefits valued at Rs 7.31 crores. Over the next three years, it is estimated that nearly 50% of the VFCs will make their microplans to manage restored forests for multiple benefits.

Notwithstanding encouraging cases of restoration of degraded forests under JFM in Madhya Pradesh and elsewhere, there is urgent need of further reforms. Some of the key elements to strengthen participatory forest management include: broaden the

basket of benefits from ecosystem restoration to include a range of ecosystem service benefits to local communities though an improved legal and policy framework, further strengthen democratic decentralisation of forest governance to enable decision-making by communities, solicit interdisciplinary and intersectoral support to address the drivers of degradation, learn from the best practices of participatory forest management including management of community forest resources under the Forest Rights Act (FRA), upscale ecorestoration to the landscape level rather being limited to small patches of a few hundred hectares, focus on native species to assist the natural regeneration process, effectively control invasive species and set up long- term ecological and socioeconomic monitoring to assess ecorestoration work.

Source: *Contributed by Shri B. M. S. Rathore IFS (R) and Shri Chitranjan Tyagi, Additional Principal Chief Conservator of Forests, Madhya Pradesh*

6.7 Recommendations

Based on the above findings, the Committee makes the following recommendations to strengthen the policy and practice of ecological restoration in India:

6.7.1 Graduating from afforestation to ecological restoration regime

- 'Compensatory Afforestation' needs to be replaced with 'Compensatory Restoration' both conceptually and in practice. Compensatory restoration of forest implies restoring it to its pristine form, and a degraded grassland to its original state and not into a woodland of fast-growing species. The present practice of treating lands with a crown density below 40 percent as 'degraded' is problematic and must be abandoned.
- We need to shift from routine afforestation projects in relatively small pockets to ecological restoration using a 'landscape approach' so as to enhance the net gain to biodiversity, ecosystem services and local community needs. This proposal received enthusiastic support from state forest departments during our consultations.
- Scientific institutes, research organizations, experts and civil society need to pilot restoration projects jointly with forest departments. Based on these learnings, protocols and models need to be developed to simplify the art and science of restoring different kinds of forest types in each state. Every state/UT needs to then prepare an operations manual that specifies the 'how to' part of restoration, comprising nursery techniques, plantation methods, grassland ecology, weed control, fire control operations, key performance indicators and the like for each forest type. The expected end-results of a restoration project can be assessed against certain reference or benchmark sites identified in advance, as the attempt is to bring the site to be restored to resemble the reference site.
- Intensive training and capacity building of foresters is needed so that they are able to deliver on this front. Various research institutes under the MoEFCC including

the ICFRE need to contribute by way of providing technical expertise in ecological restoration. The expertise of science-based NGOs and experts needs to be roped in to initiate pilot projects and develop restoration manuals appropriate for different ecosystems. National and state forest training academies need to ensure that ecological restoration skills are developed as a key competency of probationers/trainees and that due emphasis on this subject is imparted during training. It should be an important component of foundational and refresher training imparted to foresters. Ecological restoration should be made essential to the writing of Working Plans and Management Plans by foresters. The National Working Plan Code 2014 should be accordingly modifed to replace its afforestation bias with an ecological restoration approach. There are 19 integrated regional offices (IRO) of the Ministry whose services can be used for capacity building, knowledge dissemination, and in mainstreaming restoration principles in practice.

6.7.2 From a uniform reconstructive to a diverse restoration strategy

Several studies on tropical forests clearly show that ecological restoration success is higher for natural and assisted regeneration compared to reconstructive restoration in moderately degraded habitats. This result runs counter to the prevailing policy and practice that active restoration should be the preferred approach for accelerating the recovery of biodiversity and vegetation structure in tropical regions. Reconstructive restoration is suited to areas where natural regeneration is hindered, such as isolated sites with extensive deforestation, low precipitation rates, and a long history of intense disturbances or land uses that lead to severe soil degradation, weed infestation, or loss of the seed bank and root sprouts.[70] Hence, the Committee recommends that the entire gamut of ecological restoration strategies (natural, assisted and reconstructive) need to be made permissible in national policy and national guidelines, which need to be urgently revised and adequate CA funds need to be made available for ending the drivers of degradation before initiating restoration and for providing for the maintenance of restored areas as has been done in Chhattisgarh.

6.7.3 Improving the performance of CA/NPV-funded afforestation projects

Seven steps have been identified to address this issue, as detailed below:

- **Root cause of forest degradation needs to be addressed before reforestation**

Only when the drivers of degradation (such as over-grazing, tree felling, forest fires, the tragedy of the commons, infestation by invasive species, lack of enforcement, etc.)

[70] Crouzeilles *et al.* (2021)

have been identified and effectively addressed, that plantations need to be planned, or they will meet the same fate as the original forests. The most apt way would be to take local communities into confidence and make them equal partners in the revival process as they tend to be fully aware about the causes of degradation and remedial measures thereof.

- **Enforce criteria for selection of sites for ecological restoration**

The Committee proposes the following criteria for selection of sites for CA/NPV-funded restoration:

- Efforts must be made to get non-forest land contiguous to existing forest land so that it can be protected from encroachment and degradation and is ecologically viable. It is equally important that it should be the same forest type/biome as that which has been lost. Restoring small pockets of isolated land is not of much use at all.
- The main cause(s) of degradation in proposed restoration sites need to be ascertained and only when these factors have been effectively addressed should actual restoration work begin. Reference or benchmark sites with good vegetation cover should be used as models for species selection and treatments to be considered.
- Open natural areas such as grasslands, sholas, meadows, wetlands, etc. must be excluded from attempts to plant them up with trees which will change their fundamental character.
- The restoration approach, i.e., natural, assisted or reconstructive, needs to be assessed based on the principles of restoration science elucidated above.
- The consent and participation of Gram Sabha(s), who customarily use these forests, in restoration projects is desirable. They particularly need to be involved and consulted in site identification, species selection, and subsequent execution and protection leading to restoration, so that they develop a stake and a sense of ownership in the project.
- Restoration site needs to be free from all encumbrances and not be part of any future diversion proposals in the pipeline.
- A 'site suitability' certificate furnished by the DCF needs to provide an undertaking on the above aspects along with pre-existing conditions.

- **Taking up multi-species plantations of native species on highly degraded sites**

Monocultures should to be avoided, plantations must be multi-species, and commercial, fast growing species and invasive alien species should be prohibited and

replaced with native species. The focus on numbers, density and survival should be replaced with a restoration mindset (**Box 6.5**).

Box 6.5: Restoring a rocky, semi-arid habitat in Rajasthan

This is a summary of the steps followed in carrying out eco-restoration of a rocky tract of land abutting Mehrangarh Fort in Jodhpur city, Rajasthan (annual rainfall 325mm). This tract consists of 70 hectares of highly eroded rhyolite and welded tuff with very little soil cover. The entire area was densely covered by *Prosopis juliflora*. The objective was to restore the natural ecology of this rocky tract and to create a pleasing 'green' habitat as an adjunct to the Fort. This is how the restoration project proceeded:

- Starting with surveys to understand the landform, contours, subsurface geology, drainage and nature of the soil and its minerals
- Inventory of plants on site, including grasses and ruderal herbs and compiling a list of plants adapted to prospering in rocky substrates
- Eradicating *Prosopis juliflora* by hand, taking care not to disturb the surface with heavy earth-moving equipment or toxic herbicides
- Collecting seeds of desert lithophytes and growing them in our Nursery
- Searching for 'reference sites' to use as a template for how desert lithophytes arrange themselves into 'communities' and in relation to each other
- Learning about the water-needs of particular species and how plants occupy different parts of a moisture-gradient in their natural habitat
- Mulching of planting pits with stones
- Using *Oropetium thomaeum*—a small, rock-loving grass—allied with *Riccia*—a liverwort— to build up substrates of soil on top of rock surfaces

Mehrangarh Fort today is surrounded on three sides by a natural landscape that has become a much admired nature Park. No part of this rocky landscape is watered or fed with nutrients. It is entirely sustainable, which was one of the primary aims of the restoration project. Visitors explore this tract with naturalists who know their flora well. The checklist of birds in this habitat has grown from 40 (before restoration) to over 200 species (last counted in 2019). The key elements of the restoration protocol are:

- Understanding the local ecology (soil, minerals, moisture regime, etc.)
- Making an inventory of suitable plants adapted to grow in this habitat
- Finding a suitable 'reference site' in the desert
- Getting rid of invasive exotic trees without damaging the habitat
- Growing a full suite of native plants in a nursery, especially pioneering grasses
- Weaning perennial plants off irrigation as soon as possible
- Learning and deepening understanding by careful observation and note-taking

Source: *Contributed by Shri Pradip Krishen, Restoration Ecologist and Member of this Expert Committee*

- **Fix accountability for failure of restoration projects**

The survival of plantations has been a major problem and results from inadequate planning, and poor execution and monitoring. Monies collected by the CAMPA are to "carry out statutory and constitutional obligations," i.e., the protection of natural resources. Compensatory afforestation ought to be positioned as discharging a statutory and constitutional responsibility of restoring and long term survival of a 'national', 'intergenerational', 'public' asset and be differentiated from routine forest plantation activity. Forestry plantations will succeed only when accountability is fixed. For plantation failure, accountability needs to be fixed at the level of the RFO, ACF, DCF and CF as they are the key decision-makers. Mid-course corrections are never easy, especially when the outlook, behaviour, and practices are already established. However, this difficult task of making a transformational change is an imperative and is possible only when stringent accountability measures are embedded at every stage of the project cycle and strictly implemented. There is currently weak accountability for survival, growth and the long term success of reforestation/ecorestoration interventions. This should be a mandatory item to be commented upon in all performance appraisal reports of the concerned officers and personnel, written annually by their supervisor officers. This aspect must also be periodically reviewed by concerned central and state audit authorities and individual and collective responsibilities ascribed. Also, exemplary restoration work needs to be recognized and rewarded. Innovations, best practices and effective approaches need to be documented and disseminated.

- **Strengthen monitoring and evaluation**

The Monitoring Group in the MoEFCC constituted under the CAF Act needs to undertake independent evaluation of all plantation/ecological restoration projects at 5, 10, 15 and 20 year stages. Considering the sheer number of projects that will need to be monitored, the Monitoring Group may consider engaging independent national level monitors (NLMs), national institutes and others to assist in this task. Objective criteria for assessing restoration projects need to be developed. Parivesh and eGreenwatch portals can be linked with a mobile app so that data can be directly entered from the field using hand-held devices. Monitoring by state forest departments also needs to be strengthened. The monitoring process needs to begin with verifying whether the decision to divert forest land adheres to the mitigation hierarchy or not, followed by site identification, selecting the most suitable restoration approach, species selection, local community involvement, soil and moisture conservation, plantation survival and growth, benefits to local people along with identifying the drivers of success or failure, best practices and common pitfalls. Wherever the quality of restoration work is found to be below a certain minimum

threshold, accountability needs to be fixed and responsible functionaries suitably penalized.

- **Mandatory proactive public disclosure and transparency measures**

Strengthening public disclosure and transparency measures are needed to assess the performance of all projects sanctioned from national and state funds, by putting in place a stringent monitoring and evaluation framework that is transparent and publicly visible. Every project should be provided with a unique ID and Quick Response code at the national level and all project-level information such as estimates, sanction details, work orders, geo-referenced polygons, plantation journals, expenditure details, completion reports, etc. need to be provided online as public disclosure on a public website. All wage payments need to be released in direct benefit transfer (DBT) mode in the accounts of wage seekers. Annual monitoring reports along with geotagged photos, duly attested by the officers responsible, also need to be also uploaded to this website. Consolidated annual reports with progress of all present and past CAF projects undertaken showing progress on key performance indicators need to be submitted to state legislatures and also made available on a public website in a timely manner. All CAF projects need to be monitored and tracked for at least 20 years to ascertain the survival and growth of the regenerated and planted biota and the permanence or otherwise of biodiversity gains that have accrued.

6.7.4 Imperative to adequately compensate forest-dependent communities affected by forest diversion and in a timely manner

The present compensatory conservation regime turns a blind eye to the livelihood and security of forest-dependent communities who are most impacted by forest diversion. The Committee recommends that half of the NPV should be utilized to strengthen the protection status and restore residual forests, adjacent forests and also the village commons. Some of the activities that could be taken up are fire protection, protection from overgrazing, natural restoration, assisted restoration, groundwater recharge works, etc., all involving the local communities so that they have a stake and an economic incentive to protect and conserve the forests and prevent their degradation in future. This will enable forest-dependent communities to have continued access to usufructory benefits from these restored forests. Also, in CA budgets, 10 percent should be earmarked for entry point activities (EPA) as an additional component, as a confidence-building measure to develop the trust of the local community. Also funds and functions related to maintenance needs to be transferred to the local community so as to build their stake right from inception to establishment. The forest department should also play a nodal role in cordinating various social assistance and developmental schemes in the villages by liaising with concerned government departments at the district and block levels. This will ensure all-round development of

the impacted villages, while also strengthening their food and livelihood security which is often the root cause behind forest degradation.

6.7.5 These recommendations detailed above need to be adequately reflected in the guidelines for restoration to be revised and issued by the MoEFCC. To conclude, the Committee is of the opinion that the graduation from routine afforestation to ecological restoration if achieved in both letter and spirit has the potential to be a game-changer in the transformation of the country's degraded ecosystems—a transformation that will be inclusive, lasting, ecologically sound and cost effective.

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Chapter 7

Need for a Permanent Expert Regulatory Body

7.1 Mandate

The Hon'ble Supreme Court vide its order dated 25th March 2021 in SLP No. 25047/2018 by the Association for Protection of Democratic Right Vs. The State of West Bengal, constituted an expert committee under the chairmanship of Dr. M.K. Ranjitsinh and provided it with a nine-point mandate. One of the important mandates given to the committee is as follows:

(h) The Committee may consider the need for any permanent expert body and its proposed structural form.

7.2 Review of Policy and Practices Pertaining to Implementation of Environmental Laws

Despite having comprehensive policies, laws and action plans relating to the environment, forests and wildlife, India has not been able to adequately safeguard her composite national natural heritage. The implementation of these policies, laws and plans is dependent upon the political agenda of the party in power, sometimes even upon the personal interest or otherwise of a politician or high-ranking bureaucrat. Even the unique constitutional guarantees and directives provided under the Directive Principles of State Policy and the Fundamental Duties of the citizens of India to protect the nation's forests and wildlife, are flouted in letter and in spirit. Decisions are frequently *ad hoc*, occasionally arbitrary and not in consonance with the National Forest Policy, 1988, and laws such as the Forest (Conservation) Act, 1980, the Wild Life (Protection) Act, 1972, and the Environment Protection) Act, 1986, and even with the guidelines and directions issued by the Government itself. Government agencies, committees and boards and even designated autonomous bodies are pressurised to give opinions, clearances and approvals that are desired and efforts are made to keep decisions away from public scrutiny.

In its reply to a Rajya Sabha question in November 2019, the MoEFCC reported that the Ministry, its Forest Advisory Committee (FAC) and its ten Integrated Regional Offices (IRO) gave permission to cut 6,944,608 trees across the country in the three previous years and that 6.2 crore trees were planted in their place.[71] In 2009, 85,849

[71] Down to Earth (2019)

hectares of forest land was diverted. From 2014 to 2016, the same Ministry approved some 300 projects old and new, 29% being mining cases involving the diversion of 47,473 hectares of forest land. Public consultations were diluted and exemptions granted.[72] In the same period, guidelines on the diversion of forest land for linear projects was further 'simplified' and an amendment was made whereby Stage 1 clearance of a project involving forest diversion would be deemed to be a working permission for the commencement of work and the felling of trees. The diversion of 50,000 hectares was approved in the same period.[73]

Barely 5 per cent of the land mass of this country is under Protected Areas (PAs) such as national parks, sanctuaries and reserves, most of them tiny, isolated and surrounded by human habitation. With an increasing population and their economic and infrastructural needs, PAs constitute the only islands of hope for the survival of the nation's floral and faunal wealth and heritage. They are also a major source of the most valuable commodity for human life next to oxygen—potable water. There are other ecologically critical areas (ECAs) which should have been designated as PAs long ago under one of the categories of the Wild Life (Protection) Act, 1972 (WPA), but have not been so done deliberately, in order to facilitate future project approvals and diversion of use. Records prove the abysmally low quantum of areas brought under the PA system of the country in the past 3 decades, and even more so in the current century. Recognizing the ecological, biological, socio-economic and cultural importance of these last remnants of pristine nature, the 'Aranya', hallowed in ancient mythology and literature, the Hon'ble Supreme Court (SC) has given a specific directive to this committees in mandate (c) of its order to '*…provide special treatment for geographical area or eco-sensitive area, they may identify areas which need to be regulated…*' This Report, therefore, lists not only existing Protected Areas declared under various laws and regulations, but also those equally important ecologically and endangered places which should have been brought within the ambit of the country's protected areas system and be thereby given equal status with notified protected areas, in respect of any proposed diversion or destruction. This list can be added upon by the Permanent Expert Body envisaged hereunder.

The statutory authority assigned to ensure the ecological security and conservation needs of PAs, and thereby fulfil a duty and obligation under the Constitution, is the National Board for Wildlife (NBWL). As the NBWL rarely convenes and has not done so at all in the recent past, its functions are carried out by its Standing Committee (NBSC). In the Goa Foundation Vs. Union of India (W.P. No. Supreme Court 460/2004) the Supreme Court directed that areas within 10 km of the boundaries of PAs should be deemed to be 'eco-sensitive zones' and that all forest and forestland clearances

[72] Centre for Science and Environment, 2016

[73] Bhargava (2016)

within them would require approval by the NBSC. In the Godavarman Thirumulpad Vs Union of India (I.A. No. 2365 in 1406/2005), the Supreme Court ordered that the granting of all permissions within PAs, including rationalisation of their boundaries, will lie within the purview of the Supreme Court. However, instead of ensuring adequate, long term conservation of PAs, the NBSC has become a project clearance committee, 'causing irreversible damage to wildlife and their habitat—ecologically destructive projects are allowed in protected areas without any impact assessment—with only standard mitigation measures being stipulated.[74,75] The NBSC has a record of rejecting only 1.29% of the projects it has considered.[76] In 2019, the NBSC considered 156 projects, 87% of which were linear intrusions for infrastructure. Only one project was rejected and not a single sanction provided reasons of how the diversion it dealt with benefitted wildlife or the habitat, which is a prerequisite under sections 29 and 36 of the Wild Life (Protection) Act, 1972, and they were not in consonance with the guidelines of the National Tiger Conservation Authority.[77] In 5 meetings in 2019, the NBSC approved the diversion of 609.5 hectares of PAs, 4,901.5 hectares of eco sensitive zones (ESZ) and 25 hectares of wildlife corridors. In 6 meetings in the first 6 months of 2021, it cleared 944.7 hectares inside PAs, 2,455 hectares of ESZ and 71.5 hectares of wildlife corridors.[78] The large majority of clearances were for 'linear' projects. In 2020, two proposals for the deletion and denotification of areas from PAs—Karera in MP and Hastinapur in UP—were approved, resulting in a reduction of 1,090 sq. km from the protected areas system of the country.[79] In the first 6 months of 2021, approvals were given for the denotification of two PAs in the Andaman and Nicobar Islands and for rationalising the boundary of another PA in the Andamans and of a fourth in Bharatpur, Rajasthan, all of which cumulatively entailed a reduction of 13,855.7 hectares from the PA system of India. Not a single project was turned down. Not a single hectare of land was added to any PA in lieu of the areas deleted and denotified, as was the practice in the past. A single project was split into multiple proposals and approved separately to conceal the true impact of the project and thereby facilitate denotification and clearance.[80]

This situation is so because of two reasons: firstly, decisions are 'closed space' ones, undertaken by government officials, their political masters and a few others chosen by them, involving aspects mentioned in the first paragraph above. Efforts to simplify and facilitate quick decision-making and the non-involvement of public opinion, indeed, the avoidance of this vital ingredient, further raises doubts whether forest

[74] Dutta (2021)
[75] Bindra (2017)
[76] Bhargava (2016)
[77] LIFE (2020)
[78] MOEFCC (2021)
[79] LIFE (2021a)
[80] LIFE (2021b)

clearances are for the public good alone, or for other reasons. Public policy-making is no longer the domain of administrators and elected representatives alone. There is a rising trend in democratic nations whereby researchers, civil society and practitioners are increasingly allowed to influence policy.[81] There is also a growing consensus that citizen involvement is a prerequisite for good governance and a responsive democracy. While buzzwords such as 'participatory process', 'co-governance', 'citizen-centric', 'joint management', etc. have proliferated, the moot question remains as to what extent these arrangements presently allow society to influence public policy and decision-making processes. Levels of participation in the decision-making process can vary from tokenism to citizen control.[10,11] Questions about representation, inclusion and voice are critical while assessing these spaces of citizen engagement.[82] Diversion of forests and wildlife habitats are presently taken in a top-down manner in 'closed spaces' without following inclusive processes.

In a vibrant democracy such as ours, why cannot decisions involving the ecological security of the nation and the livelihoods of concerned communities be taken in a 'deliberative space', involving citizens including the local communities? Public participation can enhance the state's performance by making it more responsive and accountable.[83] Why cannot the people, including those most affected, be allowed to express their opinion within a specified time period?

Secondly, there is no independent body to render advice, regulate or monitor the activities of the people and governments that may be causing grievous and permanent damage to the environment and biodiversity, none even to monitor violations of the Constitution, of the laws of the land and of the efforts to circumvent and even to change these provisions, to the detriment of our national natural heritage. While there are agencies and regulatory authorities like the National Tiger Conservation Authority (NTCA), the Commission for Air Quality Management in the National Capital Region and Adjoining Areas, the National Coastal Zone Management Authority, the Telecom Regulatory Authority of India and others, there is none for the forests and forest lands which constitute almost a quarter of the country's landmass.

Two regulatory bodies have been created following orders of the Hon'ble Supreme Court itself. In accordance with the orders of the SC in M.C. Mehta Vs. the Union of India and others, (1997, 11 Supreme Court Cases 312), a Central Groundwater Board was established under Section (3)(3) of the Environmental (Protection) Act of 1986 as an Authority to regulate, manage and control groundwater management and development. A regulatory Authority was also set up in pursuance of the directions of

[81] Weible *et al.* (2012)
[82] Cornwall (2017)
[83] Aiyar (2010)

the SC in S. Jagannath Vs. the Union of India and Others (1997, 2 Supreme Court cases 87), '*to protect the ecologically fragile coastal areas, seashore, waterfront and other coastal areas and specially to deal with the situation created by the shrimp culture industry*'.

These established regulatory bodies regulate and guide, review and assess, inspect, take corrective action and enforce laws and policies. There is, however, no agency which independently oversees, regulates and monitors diversion of forests and other natural ecosystems, or evaluates and monitors compensatory afforestation and eco-restoration in the country. There is hardly any accountability for unwarranted or inappropriate actions and there is, of course, no protest from any aggrieved party, as environment, forest and wildlife have no voice nor vote.

The Hon'ble Supreme Court (SC) has time and again highlighted the importance of the National Forest Policy, 1988, in its various judgments. In its Kudremukh mining Judgment of 30.10.2002 (2002 (10) SCC 606), the Supreme Court appreciated the aims and objects of the National Forest Policy, 1988, with the following observations:

> **"'***…… it is sad to note that it has virtually been confined in papers containing it, and not much has been done to translate them to reality. Nevertheless, it reflects the anxiety of the Union Government to protect and preserve natural forests with vast variety of flora and fauna, representing biological diversity and genetic resources of the country'.*

In the NPV judgment (WP(C) No. 202 of 1995 (2006) 1 SCC 1), the SC referred to the importance of the National Forest Policy, 1988 and noted that 'the policy has a statutory flavour'.

In a landmark judgement in 2011 (LAFARGE UMIAM Vs The Union of India and Others, 202 of 1995), the Hon'ble Supreme Court laid down guidelines to be followed in future cases (Part II of the judgment), in which directions were issued to implement the National Forest Policy, 1988. The relevant extract of the judgment is reproduced below:

> '*…Time has come for this Court to declare and we hereby declare that the National Forest Policy, 1988 which lays down far-reaching principles must necessarily govern the grant of permissions under Section 2 of the Forest (Conservation) Act, 1980 as the same provides the road map to ecological protection and improvement under the Environment (Protection) Act, 1986. The principles/ guidelines mentioned in the National Forest Policy, 1988 should be read as part of the provisions of the Environment (Protection) Act, 1986 read together with the Forest (Conservation) Act,*

1980. This direction is required to be given because there is no machinery even today established for implementation of the said National Forest Policy, 1988 read with the Forest (Conservation) Act, 1980. Section 3 of the Environment (Protection) Act, 1986 confers a power coupled with duty and, thus, it is incumbent on the Central Government, as hereinafter indicated, to appoint an Appropriate Authority, preferably in the form of Regulator, at the State and at the Centre level for ensuring implementation of the National Forest Policy, 1988'.

While dwelling upon the role of the Regulator, the SC further declared that:

'*…The basic objectives of the National Forest Policy, 1988 include positive and pro-active steps to be taken. These include maintenance of environmental stability through preservation, restoration of ecological balance that has been adversely disturbed by serious depletion of forest, conservation of natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna, checking soil erosion and denudation in the catchment areas, checking the extension of sand-dunes, increasing the forest/tree cover in the country and encouraging efficient utilization of forest produce and maximising substitution of wood'.*

A regulator is a pro-active body with the power conferred upon it to frame statutory rules and regulations. Neither has a permanent regulatory body envisaged under the above order of the Hon'ble Supreme Court been set up at the state or central level, nor have any of the other diverse directives given for the identification of forests and their conservation in the above cited Order been implemented. Indeed, the SC (Justice A.K. Patnaik) subsequently in the Order dated 06/01/2014 in the case of T.N. Godavarman Vs. the Union of India (WP No.202 of 2011), directed that the Central Government should appoint a Regulator under the provisions of section (3)(3) of the Environment Protection Act, 1986, by 31st March, 2014. This directive has been reiterated in the same case on 21/04/2013 and again on 04/08/2014, but a Regulator still remains to be appointed.

One of the important directions issued in the Lafarge judgment concerns the process to be followed for identification of all 3 categories of forests, i.e., notified forests, lands recorded as 'forests' in government records and 'deemed forests/forest-like areas'. As per the Order dated 12.121996 (T.N. Godavarman Thirumalpad Vs. Union of India & Ors.) the Supreme Court ordered that this process should result in the preparation of geo-referenced district forest maps containing details of the location and boundary of each plot of land that may be defined as a 'forest' for the purpose of the Forest (Conservation) Act, 1980.

It may be necessary to reproduce the binding nature of the said guidelines in para no. 33 of the Lafarge judgment, which clearly reiterated directions to be complied with in all future cases while granting approvals under the Forest (Conservation) Act, 1980:

> *'…33. Part II of our order gives guidelines to be followed by the Central Government, State Government and the various authorities under the Forest (Conservation) Act, 1980 and the Environment (Protection) Act, 1986. These guidelines are to be implemented in all future cases. These guidelines are required to be given so that fait accompli situations do not recur. We have issued these guidelines in the light of our experience in the last couple of years. These guidelines will operate in all future cases of environmental and forest clearances till a regulatory mechanism is put in place. On the implementation of these Guidelines, MoEF will file its compliance report within six months'.*

7.3 Appointment of an Expert Body and its Structural Form

In pursuance of the directive of the S.C. to this Committee as well as of the categorical order of the Hon'ble Supreme Court in the Lafarge case of 2011 mentioned above as well as in others subsequently, this Committee recommends the formation of a national forest & wildlife habitat empowered committee to be set up for the country by the Government of India, under the provisions of Section (3)(3) of the Environment Protection Act, 1986. This permanent expert body may be titled the **National Forest Conservation Authority (NFCA)**. It should be headed by a retired judge of the Supreme Court appointed by the Hon. Chief Justice of the Supreme Court. He/she will recommend to the S.C. the appointment of 5 other Members of this Empowered Committee. One of these would be a retired officer of the Indian Forest Service (IFS) known for his/her expertise in and dedication to forest and wildlife conservation. Two other members would be ecologists or environmental scientists, and one member from a non-government agency or perhaps an individual known for his/her knowledge and expertise in forest, grassland and wetland ecology and nature conservation in different regions of the country. The fifth member would be a reputed ecological economist, or one who has successfully worked with local communities in saving and restoring natural biomes. The MoEFCC will nominate a permanent full-time Member Secretary of this multidisciplinary body.

The Authority will report to the Minister in charge of the MoEFCC. Its Chairman and Members will have a fixed tenure of 3 years, which can be extended for a further period of one year with the approval of the Hon. Chief Justice of the Supreme Court. Provisions for office accommodation, secretarial support, emoluments, finances, method of working and procedures, etc. can be on the same lines as provided to Members of the Commission on Air Quality Management, referred to above.

The National Forest Conservation Authority (NFCA) will have regulatory, advisory and monitoring functions pertaining to forest and natural ecosystem diversion, restoration and conservation, relating to MoEFCC and its other related agencies such as the Forest Advisory Committee (FAC), Regional Empowered Committees (REC) and the Integrated Regional Offices (IRO).

The NFCA will work out an institutional mechanism to monitor the progress of compensatory afforestation/eco-restoration programmes, compliance of the mitigation hierarchy by concerned development agencies and the status of trees on public lands outside forests and of important geographical localities proposed by this Committee. This will require a centralized national database, technical staff and the services of independent evaluators for ground-truth verification for all the above-mentioned subject areas.

7.4 Eliciting Citizen Involvement, Public Opinion and the Proposed *Modus Operandi* for Approval of Forest Clearance and Ecologically Critical Area Diversion

Final approvals under the Forest (Conservation) Act, 1980, are given at various levels of the government hierarchy. Proposals of upto 5 hectares other than those pertaining to mining, encroachments and hydel projects, are cleared by an IRO. Projects involving the diversion of over 5 hectares to 40 hectares other than for mining, encroachments and hydel projects, are approved by the concerned REC, while those of the same categories involving more than 40 hectares are approved by the FAC of the MoEFCC. ALL mining, encroachment and hydel cases are approved by the MoEFCC.[84]

In the case of clearances in PAs and adjacent areas under the Wild Life (Protection) Act and the directions of the S.C. pertaining to areas around PAs, proposals are first approved by the State Boards for Wild Life and then cleared by the National Board for Wild Life or its Standing Committee (NBSC).

In view of the past record of project clearances under both categories mentioned above, it is imperative that the approval procedure is transparent and that the dual processes of eliciting the opinion of civil society and scrutiny by the National Forest Conservation Authority (NFCA), are achieved in a given time-frame, before according final approval to a project. Examination and alterations after the grant of approval is time consuming, counter-productive and has proved a failure.

[84] MoEFCC (2019)

The procedure and process recommended for forest clearance and forestland diversion, is as follows:

Taking guidance from the said Lafarge judgment, it is recommended that all future mining projects and all non-mining projects which involve more than 40 hectares of forest land, should first be placed before a Standing Site Inspection Committee, as directed in the said Lafarge judgment, which will undertake site inspection with the objective of ensuring implementation of the National Forest Policy, 1988. It is suggested that the said Standing Site Inspection Committee should also hold public hearings of affected stakeholders when diversion of forest land is proposed in their vicinity. This public hearing should adhere to norms in the United Nations-endorsed Free, Prior and Informed Consent (FPIC) right of the local communities. This procedure of holding public hearing is already in place in the Environment Impact Assessment Notification dated 14.9.2006, issued under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986, for imposing certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities, based upon their potential environmental impact. The same procedure should be made mandatory for **all projects** irrespective of their classification, whether they are mining or non-mining, if it is proposed to be in the 'NO GO' areas which are mentioned in Para 4.3 of the National Forest Policy, 1988, which is reproduced below:

> '4.3. *Schemes and projects which interfere with forests that clothe steep slopes, catchment areas of rivers, lakes, and reservoirs, geologically unstable terrain and such other ecologically sensitive areas should be severely restricted. Tropical rain/moist forests, particularly in areas like Arunachal Pradesh, Kerala, Andaman & Nicobar Islands, should be totally safeguarded.'*

The above definition of 'No Go' areas should also include all such areas above an altitude of 2,000 metres above msl in the Western Ghats region, and in the Aravalli Hill Ranges, Eastern Ghats, North Eastern areas and certain ecologically sensitive ecosystems which have to be identified in the Himalayas on the basis of criteria laid down in the Pronab Sen Committee Report (2000). These 'No Go' areas must necessarily include the core, buffer and eco-sensitive zones of all PAs constituted as per provisions of the Wild Life (Protection) Act, 1972, important migratory corridors for wildlife and other ecologically critical areas (ECA) identified under this report and those that may be subsequently identified.

Proceedings of a Public Hearing proposed to be conducted before finalising the site of any project should be uploaded on the Website of the MoEFCC to ensure public accountability, which is one of the directions given in the Lafarge judgment, even before granting Stage I/In Principal approval under the Forest (Conservation) Act,

1980. Public hearings must occur at the formative stage of a project so that the opinions of affected communities are taken into account in project formulation, and not at a later stage as a mere formality when project approval becomes almost a *fait accompli*.

Also, there should be no deviation in the chronological order of getting clearances. Forest Clearance must be obtained first and only thereafter should the grant of Environment Clearance be considered.

In the case of linear infrastructure projects approaching ECAs, officers and authorities concerned must obtain a holistic, composite proposal and not consider it piecemeal, to thwart and prevent a '*fait accompli*' approach and strategy.

Another strategy commonly deployed to evade requisite impact assessment and obtain fast approvals is to obtain clearances piecemeal, in instalments of less than 5 hectares, so as to stay within the purview of the IRO, or less than 40 hectares to remain within the competence of the REC and thereby evade needing clearance from the FAC. Project approval guidelines should include a declaration from a project proponent to the effect that the project submitted is a 'standalone, composite one and no ancillary demands linked to it for further cutting of trees or diversion of forestland, shall be made in the ensuing 3 years', and if an attempt is made later to circumvent it by submission of a linked/ancillary project, approval if accorded in the original project proposal will be rescinded. The NFCA will, in its examination of project proposals, ascertain that this dictum is not evaded.

It is further recommended that proposals pertaining to Ecologically Critical Areas (ECA)—protected areas and their equivalents identified under this Report etc.—be not considered by the IRO and the REC, even if the areas proposed for diversion are less than 5 hectares and 40 hectares respectively, and hence within their respective purview.

In respect of all approvals given by IROs in categories and limits within the powers delegated to them, the particulars thereof will be uploaded within a fortnight by the concerned IRO on to the website of the NFCA for information.

All proposals received for approval by the REC and the FAC in a given month shall be placed on the first of the following month in the public domain of civil society, by uploading its details on relevant websites, and a period of 10 days given for the people to voice their opinions. Simultaneously, details of project proposals of the previous month should also be uploaded on the website of the NFCA on the first of the subsequent month, and the NFCA will then have a 10-day period to determine which, if any, of these projects requires scrutiny. Upon considering the public opinion

received in this 10-day period, the NFCA on the 21st day of the month may either refrain from making any comment, implying endorsement of the proposal; seek modification of the project or seek additional information on specific issues, or reject the proposal for reasons to be recorded in writing. Every proposal approved by an REC and FAC must mention the public opinion received in its respect and the opinion of the NFCA, wherever they have been mandated. If the decisions of these authorities are contrary to the opinion of the people or of the NFCA, the authorities concerned would have to record in writing the reasons thereof. In the case of a rejection of a project by the NFCA, the authority concerned will withhold its final decision till a consensus is reached.

In the case of proposals affecting ECA, including all PAs and others identified in this Report and others which may subsequently be identified by the NFCA, they would all be considered by the respective State Boards for Wildlife as per the present practice in the case of PAs. Details of all projects approved by these Boards, together with stipulations provided, will be placed in the public domain and simultaneously conveyed to the NFCA by uploading them on their respective websites, and a 10-day period allotted for eliciting public opinion, which will be incorporated in the proposals that would be forwarded to the National Board for Wildlife (NBWL) for its consideration. The NFCA will have a further period of 10 days to concur with the proposal, to suggest modification or ask for more data, or reject the proposal altogether, in which case any decision by the NBWL will be withheld till a consensus is reached.

7.5 Role and Responsibility of the Permanent Expert Body (National Forest Conservation Authority)

The key functions, role and responsibilities of the permanent expert body, i.e., the National Forest Conservation Authority (NFCA) will be, *inter alia*:

1. To periodically monitor the status of forest and wildlife habitats of the country, especially the most crucial habitats and areas identified in this Report, and to add any new areas to this list and give directions for their safety and management, if so required. It will also ensure implementation of the recommendations of this Committee with regard to the diversion of land or usage of these areas, for the purposes of developmental projects.
2. The NFCA shall regulate the diversion of land, usage of forests and the destruction of trees above the minimum thresholds prescribed in this Report, and may issue guidelines in this regard.
3. The NFCA will exercise a regulatory function in the approval of certain proposals under the Forest (Conservation) Act, 1980, as per the procedure described in

paragraph 7.4 above, keeping in view impacts on ecology, biodiversity and on affected communities.

4. Project proposals approved by respective State Boards for Wildlife and requiring the approval of the National Board for Wildlife under provisions of the Wildlife (Protection) Act, 1972, or in accordance with the directives of the Hon'ble Supreme Court pertaining to areas adjoining Protected Areas, shall first be placed in the public domain and then seek the opinion of the NFCA in accordance with the procedure recommend in paragraph 7.4 above, and the NFCA may, for reasons to be recorded in writing, endorse, suggest modifications or reject the proposal, keeping in view the long-term conservation interests of the area concerned.
5. Diversion of land and usage of any other ecologically critical areas (ECA) listed under this Report as well as those areas that may be added hereafter, shall follow the procedure prescribed for Protected Areas in item 4 above.
6. To elicit and analyse public opinion on specific diversion projects for which public hearings have been prescribed in this Report, and give its own observations in this regard.
7. Where NPV is to be deployed, the NFCA shall review the methodology and instruments used for valuing forests and trees and ensure their regular review and revision.
8. It shall ensure that the current inappropriate policies and practices of afforestation are not deployed and that ecological restoration as envisaged under this Report, is implemented.
9. The NFCA will ensure that forest lands and natural ecosystems are diverted or damaged only as a last and imperative resort and not as an easy option for the needs of developmental projects. This will be particularly applicable in the case of areas of special significance identified in this Report and which may be added to subsequently.
10. Where the *modus operandi* of 'land for land' is applicable as advocated in this Report, the NFCA shall ensure that the land to be restored is suitable and ecologically equivalent to the land to be diverted, and is notified as 'forest' or as a 'Protected Area' as the case may be, and be handed to the concerned forest department prior to diversion of the concerned forest land or before its usage is allowed for a development project and the mitigation requirements have been provided for.
11. In the case of an attempt to present a *fait accompli* in order to obtain forest clearance, such as construction of a linear intrusion to the very edge of a forest or Protected Area in anticipation of a sanction, not only must permission be

refused/rescinded, but penal provisions as suggested in this Report should be enforced and responsibilities fixed for the misdemeanour.

12. The NFCA will carefully oversee the implementation of the recommendations pertaining to linear infrastructure intrusions, including avoidance, going underground and of the primacy of the conservation interests of the area in question over the norms of construction prescribed for the intrusion in question.
13. The NFCA will ensure safeguarding of the interests of forest-dependent communities affected by forest diversion for development projects, in order to ensure that they are adequately compensated and that they are actively involved as managers and stakeholders in eco-restoration efforts.
14. In cases of any gross violation of law or policy with serious ecological consequences, the NFCA would determine responsibility and suggest punitive action against the violator.
15. NFCA would draft a model law for the conservation of trees on non-forest public lands, pursue its adoption and implementation by central and state governments and the creation of institutional support required for the purpose.

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APPENDICES

Appendix A :
Process Adopted by the Expert Committee

While going about its business, the 7-member Committee adopted a scientific and broad-based approach to develop this Report. Field visits could not be undertaken due to restrictions imposed by the COVID-19 pandemic. Hence, the Committee banked on secondary information, online stakeholder consultations, internal deliberations and the domain expertise of the expert members. In the review of secondary literature, best practices globally and within the country were assessed, a performance review by the Controller and Auditor General of India (CAG) was banked upon, reports prepared by various think tanks and civil society were referred to and scholarly literature was accessed. Select references pertaining to various sub-themes are listed at the end of each Chapter.

Based on this methodology, a draft consultation note was prepared and shared with the state governments, union territories and integrated regional offices of the MoEFCC. This was followed by five regional consultations with these stakeholders—Central region on 30th June 2021, Western and Northern region on 6th July 2021, Southern region on 8th July 2021, Himalayan region on 13th July 2021, and Eastern and North Eastern region on 15th July 2021. A special consultation was organized with local tree authorities, state forest departments and the Forest Policy Division of the MoEFCC on 6th October 2021 to discuss the policy, laws and practices of protecting public trees. The MoEFCC was requested to grant time for the Committee to make its presentation and get feedback on its Report, but this consultation could not materialise. Thereafter, a request was made to the MoEFCC to give comments on a detailed executive summary of the Report, but these too were not forthcoming. The Committee would have liked wider consultations and engagement with a diverse array of stakeholders before finalising its Report but this was not possible as procedurally, the draft report cannot be made public for obtaining feedback because it has first to be submitted to the Hon'ble Supreme Court who commissioned it.

Many subject matter experts were consulted and they wholesomely shared their expertise and experience, which strengthened the report in many ways. Shri B.M.S Rathore and Shri Chitranjan Tyagi contributed extensively to the chapter on ecological restoration, Shri Praveen Bhargav and Shri Shekar Dattatri provided insights into the forest clearances and ecological restoration chapters. Shri Mahendra Vyas gave particulars of court rulings and present practices, Dr. T. R. Shankar Raman and Dr.

Divya Mudappa shared their expertise on restoration of rainforests in the Western Ghats. Shri Sanjay Kumar, Dr. Pratap Singh, Shri Ved Pal Singh and Dr. Bivash Panda helped compile the list of areas of special conservation significance. Discussions with Dr. Kinsuk Mitra, former President of erstwhile Winrock International India, New Delhi and Dr. Somnath Hazra, Consulting Economist, International Institute of Environment and Development, UK, helped in drafting the recommendations of Chapter 5 on Net Present Value for Indian forests. Scientists from the Indian Council of Forestry Research and Education (ICFRE) contributed to the chapter on the valuation of trees. A number of scientists from the Wildlife Institute of India (WII) and other reputed institutes, experienced foresters and naturalists, contributed in the identification of important geographical areas

The Committee met on a weekly basis, non-stop over a period of nine months to prepare, deliberate and consult, and a total of 32 online meetings were organized. The Committee extensively consulted State/UT's Governments, State Tree Protection Authorities/Tree Preservation Authorities of the States, state CAMPA authorities, Integrated Regional offices of the MoEFCC, Forest Policy Division and various other experts. The date-wise details of the meetings convened and details of the experts consulted is provided in listed below.

The date wise details of the meetings convened is listed below:

S. No.	Meeting Date	Participants
1.	16th April, 2021	Internal deliberations
2.	22nd April, 2021	Internal deliberations
3.	28th April, 2021	Internal deliberations
4.	6th May, 2021	Internal deliberations
5.	12th May, 2021	Internal deliberations
6.	19th May 2021	Internal deliberations
7.	26th May, 2021	Internal deliberations
8.	2nd June, 2021	Internal deliberations
9.	9th June, 2021	Internal deliberations
10.	17th June, 2021	Internal deliberations
11.	30th June, 2021	**Central Region** States - Government of Uttar Pradesh, Bihar, Odisha, Madhya Pradesh, Chhattisgarh, Maharashtra, Jharkhand.

S. No.	Meeting Date	Participants
		and Integrated Regional Office, MoEFCC Western Zone (Bhopal) Northern Zone (Bhubaneswar) Central zone (Lucknow) Western Central zone (Nagpur) Eastern Central zone (Ranchi)
12.	6th July, 2021	**Western and North Region** States - Government of Gujarat, Rajasthan, Punjab, Haryana and Delhi and Integrated Regional Office, MoEFCC Western Zone (Bhopal) Northern Zone (Chandigarh)
13.	8th July, 2021	**Southern Region** States - Government of Goa, Karnataka, Kerala, Tamilnadu, Andhra Pradesh, A&N island, Andaman & Nicobar Islands, Lakshadweep and Integrated Regional Office, MoEFCC Southern Zone Bangalore and Chennai
14.	13th July, 2021	**Himalayan Region** States - Government of Jammu and Kashmir, Ladakah, Himachal Pradesh and Uttarakhand and Integrated Regional Office, MoEFCC Northern Zone Dehradun and Chandigarh
15.	15th July, 2021	**Eastern and North Eastern Region** States - Government of West Bengal, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura and Integrated Regional Office, MoEFCC North Eastern Zone Guwahati and Shillong
16.	20th August, 2021	Internal deliberations
17.	26th August, 2021	Internal deliberations
18.	3rd September, 2021	Internal deliberations
19.	13th September, 2021	Internal deliberations
20.	18th September, 2021	Internal deliberations

S. No.	Meeting Date	Participants
21.	21st September, 2021	Internal deliberations
22.	1st October, 2021	Internal deliberations
23.	6th October, 2021	The Tree Protection Authority/ Nodal officer Tree Preservation Act of the State/UT's Government and Forest Policy Division of the MoEFCC
24.	9th October, 2021	Internal deliberations
25.	19th October, 2021	Internal deliberations
26.	29th October, 2021	Internal deliberations
27.	11th November,2021	Internal deliberations
28.	17th November,2021	Internal deliberations
29.	25th November,2021	Internal deliberations
30.	3rd December, 2021	Internal deliberations
31.	10th December, 2021	Internal deliberations
32.	16th December, 2021	Internal deliberations

Appendix 1.1 :
Review of State Tree Protection Laws

State	Key points
West Bengal, 2006	● **Restrictions to fell trees** in Non-Forest Areas; no trees to be cut, removed or disposed of other than trees that have fallen on their own (without human agency). ● **Procedure for permission:** Apply in writing (with fees) stating particulars of tree to be cut, details of plot on which tree is standing, and reasons for felling. ● **Obligation to plant trees:** Replace every tree felled, in the same plot, and to look after such plantations in compliance with directions. Special provisions for tea gardens. ● **Development projects:** Act applies to all 'development agencies' including government departments, promoters, builders, etc. Essential to get a plantation plan approved before obtaining a clearance certificate, with full details of extent, location, etc. Thereafter, mandatory planting of trees with an approved plantation plan. No building or construction will be allowed if not compatible with the plantation plan. Preparatory work for plantation to begin 60 days from the date of permission. ● **Penalty** for felling trees without permission is imprisonment upto one year or a fine of upto Rs 5,000 (or both). Fines of Rs 50 per day for until the requisite numbers of trees are planted.
Maharashtra, 1975	● Constitution of Tree Authority; appointment of tree officers ● Laying down the duties of the Tree Authority ● Tree Authority fund ● Applications from citizens to the Tree Authority for verification by the tree officer, who must ensure that suitable number of trees are planted based on the site ● Levy and collection of Tree Cess is permitted ● Permission for development of land by the local urban authority to be given subject to the conditions imposed by the Tree Officer. ● Fine of not less than Rs 1,000 which may extend upto Rs 5,000 for every offence and also imprisonment for not less than one week, which may extend upto one year **By an amendment in 2021** The amendment proposed to classify 50-year-old trees as 'heritage' trees, tighten the rules for felling of trees for development works and increase the number of trees to be planted in lieu for trees that have been cut.

State	Key points
	The amendment proposed to make it mandatory to plant trees equivalent to the age of the cut tree, where felling is allowed for a development project. Planted trees need to be 1.8-2.4 metres in height and their survival should be ensured by geo-tagging. Permission for felling more than 200 trees must come from the Maharashtra State Tree Authority. 'The authority will be over the ones that are with various urban local bodies and will look into the conservation of heritage trees and proposals to cut more 200 trees'. Tree census to be carried out every 5 years, where heritage trees will be counted. Fines for illegal felling of trees raised from a maximum of Rs 5,000 to Rs 1 lakh per tree.
Karnataka, 1976	● **Constitution of Tree Authority** in all urban and rural areas with certain duties under Section 3, and its composition with tree officers with support staff ● PCCF **appoints forest officers as tree officers** in all urban and rural areas and other supporting staff ● Explicit **articulation of duties of Tree Authority** in Section 7 covering preservation, census, setting standards, maintaining nurseries and providing seedlings, transplanting of trees necessitated by road widening, planting trees in parks, gardens, along rivers, lakes, etc. and undertaking schemes as needed ● **Restrictions to fell trees** and permissions needed from the tree officer ● **Obligation of** landowners to plant trees ● **Penalty** for contravening any of the provisions of this Act or orders made thereunder shall, on conviction, be punishable with imprisonment which may extend to 3 months or with a fine which may extend to Rs 1,000 or with both.
Kerala, 1986	● Only the following species protected: sandalwood (*Santalum album*), teak (*Tectona grandis*), rosewood (*Dalbergia latifolia*), irul (*Xylia Xylocarpa*), thempavu (*Terminalia tomentosa*), kampakam (*Hopea parviflora*), chempakam (*Michelia champaca*), chadachi (*Grewia tiliaefolia*), chandana vempu (*Cedrela toona*), cheeni (*Tetrameles nudiflora*). ● Dead and diseased trees have been elaborately defined
Goa, 1984	● Very similar to that of Karnataka (1976) in terms of constituting a Tree Authority, tree officers and the like ● Section 9(2) specifies **conditions under which a tree officer should <u>not</u> refuse permission** to fell trees such as dead, diseased, wind-fallen, silviculturally mature trees, or where a tree constitutes a danger to life or property, is an obstruction to traffic, is substantially damaged or destroyed by fire, lightning, etc., or is required in rural areas for *bonafide* use.

State	Key points
	● **Constitution of a tree protection fund** which can receive funds from (i) government grants, donations from companies or institutions, fees, charges received by the Tree Officer; (ii) all proceeds from the disposal of a tree, if any, by the Tree Officer; (iii) all sums collected by the Tree Officer from such other source as may be decided by the Government. The funds shall be applied for meeting all expenses incurred by the Tree Officer or the Deputy Collector exercising the power under section 12-A, as the case may be, in connection with discharge of his functions under this Act. ● **Penalty** for contravening any of the provisions of this Act or rules or orders made thereunder shall, on conviction, be punished with imprisonment which may extend to one year or with a fine which may extend to Rs 1,000 or with both.
Delhi, 1994	● Similar to Karnataka Act 1976 ● Establishment of a Tree Authority and appointment of tree officers and support staff ● Duties of Tree Authority explicitly specified ● Tree Transplantation Policy (TTP) wherein 80% of trees slated for removal have to be transplanted at the cost of the developer, valuation of trees (Rs 34,000 for individuals and Rs 57,000 for government projects); 10 trees to be planted for every tree felled; developer to provide land for plantation. Negative list of tree species also provided (trees which need not be transplanted or compensated).
Uttar Pradesh, 1976	● **Act not to apply to certain Areas:** Act not apply to (a) trees situates in reserved and protected forests; (b) trees situated in a forest or forest land in respect of which any notification under the Indian Forest Act, 1927 as amended in its application to Uttar Pradesh is in force; (c) trees situated in Cantonment areas;] and (d) trees situated in a government garden or on land held by government ● Timber trees and fruit trees are listed in Schedule I and Schedule II ● Amended in 2019, making it mandatory to plant and nurture at least 10 saplings for every tree felled. Earlier, under the tree protection law, one had to plant and tend to only 2 saplings in lieu of cutting a tree.
Bihar, 2019	● Order under FCA, 1980 to ban felling of trees on government property in urban areas. These will need to be compulsorily translocated by the development agency.
Assam, 2002	● Is applicable to non-forest areas ● For felling certain species of trees specified in Section 4.1 such as *aam*, *jamun*, *kathal* etc. no permission needed for felling from private lands

State	Key points
Telangana water, land and trees act 2002	● A Water, Land and Trees Authority is constituted ● Chapter 5 deals with trees ● It gives the **responsibility for protecting trees** in urban public lands and road margins to urban local bodies, and within institutional compounds to the concerned institutional head ● No felling of trees or branches is permitted without the prior permission of the designated officer. In case a tree is to be felled, not less than two seedlings should be planted and when such planting is not possible, the cost of raising seedlings and their maintenance shall be recovered from the concerned individual, organisation or other persons for raising plantations in public places. ● 29(1) Any person, institution, organization or department, public or private, providing a public or private utility service including Roads and Buildings department, Energy department of the Government and Telecommunications Department, shall ensure protection of trees and their branches while developing their infrastructure or carrying on their activities; (2) Wherever laying of new roads or widening of roads involves cutting of existing trees, the Authority may issue suitable guidelines for protection of such trees, as it deems fit. ● 30(1) The Authority may formulate guidelines for tree plantations along road margins, canal banks, tanks, foreshores and water bodies
Tamil Nadu, 1955 (hill areas)	● Constitutes a committee in each hill area ● Regulates the cutting of private trees except when this is done to establish coffee or tea plantations ● Clearing of land with slope more than 1 in 3 for fresh cultivation is not permitted without the approval of the Committee

Appendix 1.2 :
Literature Review of Tree Valuation Studies

S. No.	Paper	Title	Implications
1	Benett 1996	Valuing a tree: the ethics of environmental evaluation	Number of ways to value a tree—economic, instrumental, deeper ethical and cultural. Various definitions such as economic value, material value, functional value, instrumental value, etc. are provided.
2	Doick *et al*. 2018	CAVAT (Capital Asset Value for Amenity Trees): valuing amenity trees as public assets	Various valuation methods, detailed explanation of CAVAT method for amenity trees. Asserts the advantages of CAVAT over other valuation methods, provides examples of how to apply it and what changes it has brought about in the UK. Authorities have started to look at trees as 'assets' that provide amenities and their value appreciates with time and that they are valuable and not easily or quickly off-set. CAVAT has been successfully used to defend trees from loss due to development as well as to secure adequate compensation for their removal through private development by application of the Full and Quick Methods. CAVAT has also been used to trigger alterations to infrastructure development plans, allowing for the conservation of mature street trees by application of the Quick Method. CAVAT is consistently used by many local authorities in the UK for valuing urban amenity trees and for providing an indication of a "market" price. The base value is calculated using trunk area and the current unit value factor (UVF). Trunk area is calculated using the trunk diameter (TD) or circumference at 1.5 m to determine the radius. The UVF represents the full cost of a newly planted tree on the basis of per unit of cross-sectional area of the trunk (i.e. £ per cm^2). Its derivation has two components: the nursery gate price and the planting cost (transport, planting, materials, immediate care and management costs, but not after-care). The unit area cost is the average cost per cm^2 of the stem area determined as the cost, at trade prices, of the top 10 most commonly purchased species/varieties as 12–14 cm diameter standard containerized trees. The 10 species/varieties are: *Pyrus calleryana 'Chanticleer', Betula pendula, Betula utilis 'Jacquemontii', Prunus 'Umineko', Quercus robur, Platanus x hispanica, Sorbus aucuparia 'Sheerwater Seedling', Prunus Sunset*

S. No.	Paper	Title	Implications
			'Boulevard', Tilia cordata 'Greenspire', Crataegus laevigata '*Paul's Scarlet'*. These had been determined via a survey of tree officers and nurseries from across GB as being the most frequently used. The average for 10 species/varieties was selected rather than estimating costs for each individual species (as is the case for the CTLA trunk formula method) in order to smooth differences in pricing caused by production factors or variation in demand. The annually adjusted UVF is published on the websites of CAVAT (www.cavattv.org) and LTOA (www.ltoa.org.uk/resources/cavat) for consistency across CAVAT users. The UVF was re-calculated in 2017 and determined to be £15.88. The base value of a tree is then calculated using Equation (1): BV = πr^2 x UVF (1) where BV is base value; r = radius of tree; UVF = unit value factor (a single value applicable across the UK) Where a group of trees exists, each tree is considered separately. Value = base value × species × condition × location (2) Worked examples. 3 worked examples are presented: tree 1 is an English oak (*Q. robur*) that is part of a group in a public green space, with a DBH of 31 cm and therefore a base value of £11,986. Tree 2 is a common lime (*Tilia x europaea*) that is in a line of late Victorian plantings in a paved footway along the east side of a town centre high street. It has a DBH of 52 cm and thus a base value of £33,725. Tree 3 is a sycamore (*Acer pseudoplatanus*) standing in a private car park with a DBH of 86 cm. The height at which the measurement is taken is adjusted downwards to avoid localised swellings below the crown break. It has a base value of £92,244.
3	Grande-Ortiz et al. 2012	Methods of tree appraisal: A review of their features and applications	Various methods for valuing the benefits of trees in human settlements such as statistical methods, travel cost method, contingent valuation, hedonic pricing and integrated methods. However, these are not used in official valuation of urban trees, in these cases appraisal methods are used. The methods with the highest degree of applicability are the CTLA (Council for Tree and Landscape Appraisal), a simple parametric method, and the Contato method, a mixed method with medium difficulty.

S. No.	Paper	Title	Implications
			The North American method (CTLA 1992; CTLA 2000) gave rise to the idea of a 'base value' as an expression of the unit price of a section of trunk, and considers the maximum value of a tree to be the product of this base value multiplied by the area of the section of the trunk. Corrector indices (for species, condition, and location) can maintain or reduce this value, but not increase it. Value = [trunk area (cm^2) × basic price cm^2] × species × condition × location The North American method of CTLA only considers the utilitarian aspect of trees—initially the value of their wood—but in recent years tree value has also been estimated in terms of energy savings, air pollution, and other environmental functions. CAVAT is an adaptation of this method in the UK. CAVAT can increase, decrease, or cancel a tree's base value by using a corrector index. This method has software that enables automatic calculation of value.
4	Giergiczny 2012	How to assess the value of nature? Valuation of street trees in Lodz city center, Poland	Detailed explanation of how to value nature, various economic valuation methods (which are expert-led). Very good visualizations and economic valuations, articulated in simple terms such as public and private goods, total value of city trees, non-market good valuation methods, and useful box items as well.
5	Killicoat et al. 2002	Economic value of trees in urban areas in Adelaide	Detailed calculations of the economic value of trees in urban areas in Australia. Our estimate of gross annual benefits of a typical Adelaide street tree is $172. The benefits that were quantified include: E = annual price of energy savings (cooling and heating) Q = annual price of air quality improvement (pollutant uptake and avoided power plant emissions) C = annual price of carbon dioxide reductions H = annual price of storm-water runoff reductions P = annual price of property value and related benefits F = annual savings for reductions in repaving streets
6	McPherson 2010	Tools for valuing tree and park services in the USA	Tools for valuing urban trees and parks in the USA: - CUFR Tree Carbon Calculator (CTCC) tool helps in quantifying CO^2 sequestration from plantation projects - i-Tree tool aids in urban forestry analysis and benefit assessment

S. No.	Paper	Title	Implications
			- Park Value Calculator (PVC) calculates the annual monetary value of seven attributes of city park systems
7	Moore 2018	What is a Tree Worth? An Appraisal of the University of Pennsylvania's Tree Population	Illustration of functional uses of trees, use of i-TREE tool developed by USFS and CTLA (Council for Tree and Landscape Appraisal). The methods outlined in CTLA: Guide to Plant Appraisal was used to appraise a sample of trees on Penn's campus. This process involved collecting data on the size, species, condition, and location of trees around campus. Additionally, an estimate of the environmental and ecosystem services rendered by these trees was generated using the i-Tree Eco program. The appraised value for Penn's campus trees was $12.6 million dollars and the environmental benefits totaled approximately $161,000 dollars. Visualization on how the CTLA method was applied is shown on page 9.
8	Nielsen et al. 2014	Review of Urban Tree Inventory Methods Used to Collect Data at Single-Tree Level	Inventory methods of urban trees, four types of inventories for data collection at single-tree level with distinct characteristics were distinguished: 1) Satellite-supported methods 2) airplane-supported methods 3) on-the-ground scanning or digital photography, and 4) field surveys with direct manual measurements. The authors therefore recommend further technological development and scientific testing before these methods replace field surveys in urban tree inventory programs at single-tree level. Inventory of data collected at single tree level (on the last page of the Appendix) is insightful.
9	Nowak et al. 2002	Compensatory value of urban trees in the United States	CTLA compensatory value calculations, along with a worked out example. How Condition and Location factors are assigned values is described in detail.
10	Nowak 2018	Quantifying and valuing the role of trees and forests on environment quality and human health in the USA	Models for assessing ecosystem services like InVEST, i-Tree, etc. and how to assign values to them in order to assess the value of trees.

S. No.	Paper	Title	Implications
11	Ponce-Donoso 2017	Appraisal of urban trees using twelve valuation formulas Formulas and Two Appraiser Groups in Chile	Appraising the monetary value of urban trees using various formulae. The study compares 12 parametric type formulae and find that the CTLA Method can be widely used because of its low degree of difficulty, thus providing a comparatively good and easily available method for use internationally. Moreover, studies highlight the subjectivity of appraisers when applying these formulae, which results in high variability in values, in particular with the Helliwell Method, whereas with CTLA and Burnley Methods, values are reported to be lower. Furthermore, since these formulae were developed for use primarily in temperate, industrialized, English-speaking countries, the factors used might not be relevant to different cultural, ecological, and socio-political contexts (i.e., tree forms and species from tropical environments, land-use definitions from emerging countries, culturally specific tree maintenance practices, translation of English-language variables).
12	Purcell 2019	Tree Appraisal and the Value of Trees (Purdue University)	What is the value of a tree, why should a tree be appraised, factors in appraisal with examples of how to value a tree using the CTLA method.
13	Roy et al. 2012	A systematic quantitative global review of urban tree benefits, costs, and assessment methods across cities in different climatic zones	Conceptual framing of urban trees is provided in Fig 1. Table of urban tree benefits, urban tree ecosystem services (Tables 5 and 6).
14	Rumble et al. 2015	Valuing urban trees in Glasgow, Scotland in order to increase the profile of urban trees	Used i-Tree Eco, a model developed by the US Forest Service to measure a range of ecosystem services provided by urban trees, ranging from carbon sequestration to pollutant removal. Using this method this study values Glasgow's urban trees.

Appendix 1.3 :
Species Rating, Condition Rating and Location Rating

The mitigation hierarchy of avoidance, minimization and offsetting needs to be adhered to. The first priority should be to look for alternatives so as to first avoid the felling of trees; if that is not possible, then reducing the number of trees to be felled; and only if this too is not feasible should felling be permitted and offsetting. While accepting that there are limitations to offsetting trees, culturally significant trees, sacred groves, etc. should not be felled. Following this mitigation hierarchy, if trees have to be felled then there are two options of transplanting and substitution. While substituting, the value of the tree that has to be cut can be appraised using the trunk formula provided below:

Tree value = trunk area × unit price × species rating × condition rating × location rating… (1)

Trunk area is the cross-section area of tree trunk measured at breast height (i.e., at 1.37 meters)

Unit price represents the full cost of a newly planted tall sapling that is at least 1.8 metres tall on the basis of per unit of trunk cross-sectional area (i.e. Rs per cm^2). Its derivation has two components: the nursery gate price and the planting cost (transportation, planting, materials, manure, fertilizers, immediate care and management costs, but not after-care). Specifically, the nursery gate price is the average cost per square centimetre of the stem area, determined as the cost of the top 10 most commonly purchased species based on a survey, and the average is selected rather than producing costs for each individual species.

Species rating: is a comparative value given to a tree species based upon its individual characteristics such as provenance (whether native or not), ability to regenerate with little silvicultural assistance, values in terms of various ecosystem services it provides, etc. Consideration is given to the plant's assets and its inherent qualities. While a rating is provided in this note, it needs to be treated as indicative as it will vary across different regions. Hence, state authorities can be authorized to modify a rating as per the regional context.

Class	Key Characteristics	Examples	Score
I	**Evergreen native species** that enhance amenity values such as aesthetics, socio-cultural linkages and regulate micro-climate (shade); serve as keystone species, important habitat or dispersal corridors for a variety of urban wildlife including birds, bees, and smaller mammals	*Ficus benghalensis, Ficus benjamina, Ficus virens, Ficus religiosa, Mangifera indica, Michelia champaca, Mimusops elengi*	1.00
II	**Avenue, ornamental or fruit-bearing trees**; Also trees with medicinal, cultural and other values; should be relatively easy to propagate	*Aegle marmelos, Azadirachta indica, Drypetes roxburghii, Tamarindus indica*, *Terminalia chebula, Emblica officinalis, Oroxylum indicum, Crataeva adansonii, Syzygium cumini*	0.80
III	**Naturally growing forest trees** which can withstand considerable mechanical injuries. Multi-purpose; Relatively fast growing	*Careya arborea*, *Haldina cordifolia, Schleichera oleosa, Shorea robusta, Spondias pinnata, Terminalia alata*, *Terminalia arjuna, Terminalia bellirica, Toona ciliata*	0.60
IV	**Exotic or native species** in rural landscapes with fuelwood, fodder and other values. Easyily propagated.	*Butea monosperma, Bombax ceiba, Madhuca longifolia* ssp. *latifolia*, *Mitragyna parvifolia, Cassia fistula, Dalbergia sissoo, Holarrhena pubescens, Grevillea robusta, Senna siamea*	0.30-0.60
V	**Fast-growing alien invasive tree species** of little commercial or ornamental value and at the same time pose a threat to native biodiversity.	*Broussonetia papyrifera, Prosopis juliflora, Sapium sebiferum, Leucaena leucocephala*	0.0

Condition rating: To be decided generally on the basis of tree health and tree structure or form. A score of less than 0.50 is to be awarded only for dead, dying, diseased, moribund trees, otherwise the score will always be greater than 0.50. A tree with a well spread canopy and stem in sound condition will always deserve a rating above 0.90.

Condition rating	Tree health and structure	Score
Excellent	Root plate is undisturbed, trunk is sound and solid. Excellent vigour with well-formed canopy	0.90 - 1.0
Good	Minor (less than 10%) damage and defects in root plate, trunk and canopy	0.75 - 0.90
Fair	Sizeable (about 30%) damage and defects in root plate, trunk and canopy	0.50 - 0.75
Poor	Major (more than 50%) damage and defects in root plate, trunk and canopy which would be very difficult to restore	0.30 - 0.50

Location rating: Trees in larger urban areas such as a municipality perform important functions like dust shielding, removal of gaseous pollution, providing shade, etc. They have to be awarded a rating between 0.90 and 1.0. Trees in smaller areas such as a city council would attract a rating between 0.75 to 0.90, whereas trees in rural settings would deserve a rating between 0.50 to 0.75.

Location rating	Site location	Score
Excellent	Location in a municipal corporation (Mahanagar Nigam) or municipality (Nagar Palika) or sacred natural sites or cantonments or campuses of various institutions. Higher score to be given to trees based on their proximity to commercial areas	0.90 - 1.0
Good	Location in city councils (Nagar panchayat). Higher score to be given to trees based on their proximity to commercial areas	0.75 - 0.90
Fair	Location in rural landscapes. Higher score to be given to trees based on their proximity to commercial areas	0.50 - 0.75

Source: Adapted from Purcell (2019)[85]

[85] http://dev.albertlandmanagement.com/wp-content/uploads/2019/11/Tree-Appraisal.pdf

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Appendix 2.1 :
Ecologically Critical Areas (ECAs) in India Outside the Existing Protected Area Network

(BSA = Biologically Significant Area; HS = Heritage Sites;
BC = Bio-corridors; ESZ = Eco-sensitive Zones)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
Andaman & Nicobar Islands			
1	Baratang Karst Forests	Located in Baratang islands of Andaman & Nicobar islands, these forests are unique and extremely rich in biological diversity amidst limestone rocks, gullies and sinkholes, quite different from the surrounding tropical evergreen forest typical of the inland areas of the islands. One of the typical species on these formations is the endangered Edible Nest Swiftlet.	**BSA** Nehru P. (WII)
2	Galathea Bay, Bomoka Islands of Nicobar and West Coast of Great Nicobar	The littoral and evergreen forests along the coastal plains of these islands are extremely vulnerable to anthropogenic pressures. These areas are particularly important for the Nicobar Megapode – an endemic bird which suffered heavy population decline due to the 2004 tsunami. Any further conversion of these forests for other landuses will be detrimental for biodiversity conservation.	**BSA** Nehru P. (WII)
3	Natural grasslands of Central Nicobar Islands (Camorta, Nancowry, Trinket, Bomboka, and Terassa)	Natural grasslands of the Central Nicobar islands are among the unique vegetation formations of India, which are least studied. These grasslands are highly vulnerable to anthropogenic pressures and invasion by alien species.	**BSA** Nehru P. (WII)
4	Katchall Island (Oh hi poh near Upper Katchall, and Pondha near Westbay) Nicobar islands	These sites support remnant *Myristica* swamps (locally known as "*Mitha Khardi*"), a unique vegetation confined to a few localities in the Nicobar group of Islands. These need to be given high priority for conservation.	**BSA** Nehru P. (WII)
5	Rangat Hill, Middle Andaman	One of the important KBAs and the Type Locality of a ground orchid *Habenaria rangatensis* Naik & Prasad	**BSA** Mao *et al.*, (BSI)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
6	Natural Coral Bridge, Neil Island, Andamans	An important site of geological heritage and ecological significance. Threatened due to pollution and global warming.	**HS/BSA** INTACH 2016
Andhra Pradesh			
1	Anantgiri	An important place representing the highest peak in Andhra Pradesh (Eastern Ghats), bordering Odisha. Rich in biodiversity especially floral communities.	**BSA** Rodgers & Panwar 1988
2	Lankamalai Grasslands	The grasslands and scrub jungle in this area are known for the occurrence of the rare Jerdon's Courser. Rapid invasion of this habitat by *Prosopis juliflora* poses a major threat.	**BSA** Rodgers & Panwar 1988
3	Sriharikota Islands	A Site representing Champion & Seth's Tropical Dry Evergreen Forests. Currently under the control of the Department of Space. Needs status survey and long-term monitoring.	**BSA** Rodgers & Panwar 1988
4	Vellikonda	Located along the coastal area of Andhra Pradesh, this area is known for the open grasslands and important faunal elements such as the Indian wolf, tiger and sambar.	**BSA** Rodgers & Panwar 1988
Arunachal Pradesh			
1	Apatani Plateau, Lower Subansiri	The plateau lies between the Panior and Kamla rivers at altitudes of 1,524–2,738m. Apatanis, through traditional village institutions (Builyang) have been conserving their forests and forest resources. These forests around the plateau need to be protected as they harbour rare, endangered and threatened species of flora and fauna.	**HS** Gopi GV (WII)
2	Nyamjang Chhu	The only wintering site for the vulnerable Black- necked cranes in India. The habitat is currently threatened due to the proposed Nyamjang Chhu Hydroelectric Project.	**BSA** Gopi GV (WII)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
3	Zemithang valley, Tawang	Unlike other areas of Arunachal Pradesh, hunting is strictly prohibited in this valley by the local community (*Monpas*) which follow Buddhism. This valley harbours a rich biodiversity including a number of rare, endangered and threatened species of flora and fauna. Monpas manage sacred groves, surrounding forests as well as wildlife.	**BSA** Gopi GV (WII)
4	Ditchu Reserve Forest	This is one of the contiguous and important localities for biodiversity conservation in the state. It represents subtropical to alpine forests including several endemic species such as *Pinus merkusii*. Some birds, viz., Elliot's Laughing thrush, Derby's Parakeet, and Yunnan Nuthatch are known to occur only in this area of India besides several faunal elements and three goat-antelopes, viz., Mishmi takin, serow and red goral.	**BSA** Rodgers & Panwar 1988
5	Mechuka-Monigong-Jorgging Area	Identified as one of the IBAs, this is the easternmost limit of the Great Himalaya in India adjoining Namche Barwa peak and the “Great Bend” on Siang that enters India near Tuting. A large part of this IBA is inaccessible, thus ensuring the existence of pristine wilderness to a great extent.	**BSA** Islam & Rahmani 2004 (BNHS)
6	Nacho-Limeking-Taksing-Majha Area, Upper Subansiri	Another IBA upstream of Subansiri river, this is one of the remotest locations in the state with a number of high peaks rising to over 4,000 m. This area is criss-crossed by a number of streams and small rivers that drain into the Subansiri. The local inhabitants are largely of the Tagin tribe with a small population. The forests range from Subtropical Broadleaf Forests (ca 1200m asl) to Himalayan Wet Temperate and Sub-alpine Forests (4000m).	**BSA** Islam & Rahmani 2004 (BNHS)
7	Thingbu-Mago-Poshingla-Thugari area, West Kameng	This area represents subalpine and alpine habitats adjacent to the Tibetan plateau and peaks reaching upto 7000 m asl. The area is recognized as one of the important IBAs and is also rich in Eastern Himalayan flora and fauna. Major faunal elements are the snow leopard, blue sheep, Takin, Red Panda, pheasants such as Himalayan and Sclaters' Monals, Satyr and Temminck's Tragopan.	**BSA** Rodgers & Panwar 1988

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
8	Mayodia Pass and surrounds, Lower Subansiri	This is yet another biodiversity hotspot in the state known for its rich flora and fauna, the occurrence of several rare birds e.g., Sclater's Monal, Temminck's Tragopan, Blyth's Tragopan, Rusty-throated Wren babbler and Cachar wedge-billed babbler, besides a whole range of birds typical of the east Himalaya. The area is equally rich in other vertebrates such as Mishmi takin (winter visitor), serow, goral, Asiatic black bear, and a number of primates and other mammals.	**BSA** Gopi GV (WII)
9	Dipterocarp forests in Western Tirap	A few relicts of Dipterocarp forests can be seen in western Tirap district. There is a need to carry out a status survey and delineation of a few patches for protection and future monitoring.	**BSA** Rodgers & Panwar 1988
10	Lado area, Western Kameng Distt	Located in Wali-Sarli region of West Kameng District, this area contains a rich diversity of alpine plant and animal communities, including several rare birds. It is said to be a probable locality for the occurrence of Shou or Sikkim stag.	**BSA** Rodgers & Panwar 1988
11	Kalatang	Represents 'Lowland wet-evergreen forests' along the Bhutan border and also serves as a corridor for the movement of elephants between Arunachal Pradesh and Bhutan.	**BSA** Rodgers & Panwar 1988
12	Palin	This area represents mid-elevation evergreen forests with typical Aka-Abor hills flora and associated fauna.	**BSA** Rodgers & Panwar 1988
13 - 20	All Elephant Corridors	Pakke- Doimara at Dadzu-Lumia, Pakke - Papum at Seijosa Nullah, Pakke - Papum at Longka Nullah, D'ering - Mebo at Sigar Nullah, Pakke - Doimara at Tipi, Durpong - Doimukh at Khundakhuwa, Dulung – Subansiri	**BC** WTI
Assam			
1	Katakhal and Inner Line RFs, Barak Valley (Surma Valley)	These RFs represent remnant Northern Tropical Wet Evergreen Forests and Cachar Hill Semi-evergreen Forests and still harbour several endemic and rare species of flora and fauna. The forests are threatened due to monoculture plantations and invasive alien species.	**BSA** A. Das (WII)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
2	Majuli, Assam	This is an island (*diyara*) situated in the middle of the Brahmaputra River that harbours unique Ecological and Cultural Heritage.	**HS** Gopi GV (WII)
3	Puba / Poba	Represents a small patch of wet-evergreen forest along the border with Arunachal Pradesh. Its current conservation status is not known. Status surveys need to be done.	**BSA** Rodgers & Panwar 1988
4	Mikhir Hills	Serves as an important corridor for the migration of wildlife in the area. Rich in plants, birds and mammals.	**BC** Rodgers & Panwar 1988
5	Mayeng Hill Reserved Forest, Kamrup District	Important habitat of the endemic Smith's Litter Frog (*Leptobrachium smithi*). The area is prone to deforestation and pollution of its streams	**BSA** WWF 2008
6-15	All elephant corridors	D'ering – Dibru Saikhowa, Kalapahar – Daigurung, Kaziranga - Karbi Anglong at Kanchanjuri, Kotha – Burhidihing, Upper Dihing East - Upper Dihing West Block at Bogapani, Upper Dihing East - Upper Dihing West Block between Golai – Pawai, Kukurakata - Bagser at Amguri, Bornadi – Khalingduar	**BC** WTI
Bihar			
1	Blackbuck Refuge, Rohatas District	This area, also known as Buxar Plain, harbours Bihar's largest blackbuck population. It is a mosaic of grasslands and cultivation.	**BSA** Rodgers & Panwar 1988
2	Jamui Hill Range	Jamui hill range and forests form an important biological corridor between Bhimbandh Wildlife Sanctuary of Bihar to Koderma Wildlife Sanctuary in Jharkhand, which further extends upto Palamau Tiger Reserve. The presence of tigers was reported from Bhimband WLS about two decades ago.	**BSA** S.A. Hussain (WII)
3	Stretch of Gandak river from Luvkush ghat to Dhekhwah	This area supports a significant population of the Gangetic dolphin and gharial. This area deserves the status of a Community Conservation Reserve	**BSA** S.A. Hussain (WII)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
4	Ganga river stretch in Munger	One of the important habitats for the Gangetic Dolphin. Recommended for extension of Vikramshila Dolphin Sanctuary upto Munger for the protection of dolphins.	**BSA** S.A. Hussain (WII)
Chhattisgarh			
1	Hasdeo Arand, Surguja District	One of the intact and contiguous forests in Chhattisgarh, rich in coal reserves. This area is prone to diversion for coal mining.	**BSA** TFRI, Jabalpur
2	Tamor Pingla - Semarsot – Balrampur , Surajpur and Koriya districts	Serves as an important corridor for the movement of elephants and tigers. The corridor is intact and passes through forests without any major breaks.	**BC** Elephant Cell, WII
3	Kanha – Boramdeo – Achanakmar Corridor, Marwahi and Bilaspur Districts	The intervening areas between Kanha and Achanakmar WS are contiguous with frequent movement of hardground Barasingha, tigers and other species.	**BC** Elephant Cell, WII
4	Bagicha – Tapkara – Sundargarh FD (Odisha)	Forests are fragmented here, but there is regular movement of elephants	**BC** Elephant Cell, WII
5	Dharamjaigarh to Hemgir (Sundargarh FD, Odisha)	An important elephant corridor between eastern Chhattisgarh and Odisha. Very rich in orchids.	**BC** Elephant Cell, WII
Daman & Diu			
1	Damanganga watershed	The riverine forests and catchment of Damanganga harbour a rich array of flora and fauna. This area needs a status survey and long-term conservation planning	**BSA** Official website Daman & Diu
Delhi / National Capital Region			
1	Yamuna Biodiversity Park, Jagatpur Khadar	Spread across 9770 ha on the Yamuna river front, this is one of the most favoured habitats of both migratory and resident birds. This area gets over 200 species of birds, 75 species of butterflies, 10 species of snakes and mammals such as the Indian porcupine, Indian civet, wild boar and nilgai.	**BSA** P. Kamei Outlook Traveller 2019
2	Aravali Biodiversity Park, Gurgaon	This park (ca 153.7 ha), near Guru Dronacharya Metro Station is a restored quartzite mining site, now complete with walking trails, plant nursery, over 300 species of plants, over 185 species of birds and a number of mammals and reptiles. In addition, it supports a few	**BSA** P. Kamei Outlook Traveller 2019

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
		small mammals such as the common palm civet, Indian grey mongoose, golden jackal, and Indian hare.	
3	Neela Hauz	Located on the South Central Delhi Ridge of the Aravali Range, it is spread over about 3.90 ha. It is primarily a freshwater lake, a restored wetland which is now home to over 70 species of migratory as well as resident birds inside a large metropolitan city.	**BSA** P. Kamei Outlook Traveller 2019
4	Tilpath Valley	It forms a part of South Delhi Ridge and is spread over about 68 ha. It harbours more than 105 species of woody species. The park was earlier a barren land, with sand quarries, dead waterbodies and no forest cover.	**BSA** P. Kamei Outlook Traveller 2019
5	Tughlakabad Biodiversity Park	The park is spread across an area of over 80 ha and falls under the Southern Ridge. It consists of the Tughlakabad fort and the lake area. A lot of sewage water treatment has been done in the park along with the restoration of the lake area to attract birds and animals.	**BSA** P. Kamei Outlook Traveller 2019
Goa			
1	Purvatali Rai, Bicholim	Well known Sacred Grove, spread over an area of 7300 m^2 area.	**HS** WII
2	Usgalimal rock engravings	This area has the earliest known traces of human life in India and therefore represents an important heritage site.	**HS** Anonymous
Gujarat			
1	Riverine Vegetation near Trambo Reservoir, Abdasa Taluka, Kutchh District	The river beds and riverine scrub are the last refuge for the Caracal and Indian Wolf. Currently this area falls under Revenue 'Wasteland' and is likely to be encroached and developed	**BSA** Dr. M.K. Ranjitsinh
2	Khari river Gorge, Bhuj Taluka, Kutchh District	The river gorge of the Khari river is a unique natural heritage having uncanny similarities to the Grand Canyon. It is also a breeding ground for many important bird species such as the White-rumped Vulture, Indian Eagle Owl, Red-necked Falcon. However, this area is vulnerable to mining activities. It is recommended that no mining should be permitted within a radius of 1km from the river.	**BSA** Dr. M.K. Ranjitsinh

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
3	Chadva Lake, Bhuj Taluka (Kutchh)	A lake with the highest density of crocodiles in the district. Prime habitat for a variety of birds. It is a habitat of the Indian Leopard, Indian Fox, Jackals, Chinkara, Honey Badger, Caracal and Jungle Cat. The entire area called Chavda Rakhal within a 5 km radius of this lake deserves high conservation priority.	**BSA** Dr. M.K. Ranjitsinh
4	Guneri Mangroves, Lakhpat Taluka, Kutchh	Proposed as a Biodiversity Heritage Site, this mangrove is unique due to its location on a low hillock almost 100 kms from the coastline, and about 3km from Lakhpat Fort. It deserves to be given special status for conservation. Its current landuse is 'Revenue Land'.	**BSA** Dr. M.K. Ranjitsinh
5	Gorges along Kadia Dhro, Laiyari rivers including Palar Dhuna Waterfalls in Lakhatrana Taluka, Kutchh	Geologically unique, these gorges have uncanny similarities with the Grand Canyon. This landscape also provides habitat to several species such as the Caracal, Jungle Cat, Vultures, Owls, etc.	**HS** Dr. M.K. Ranjitsinh
6	Khetakhatali-Narbad grasslands in Bhavnagar district	These grasslands intermixed with thorn scrub form ideal habitat for several species of the semi-arid region such as the Indian wolf, fox, hyena, blackbuck and many threatened birds. The area needs to be conserved for its intrinsic values.	**BSA** Dr. M.K. Ranjitsinh
7	Rajgadh Bhatho Grasslands, Bhavnagar	This area lies 2-3 kms from Blackbuck National Park and serves as an important habitat for the wolf, fox, hyena, blackbuck and many threatened birds including the Lesser Florican.	**BSA** Dr. M.K. Ranjitsinh
8	Mandvi Grasslands	An important grassland area with significant populations of GIB and the Lesser Florican.	**BSA** Rodgers & Panwar 1988
9	Kori Creek	Represents threatened mangrove and coral systems within Kutch's coastline. Surveys are required to identify the optimum locality for protection.	**BSA** Rodgers & Panwar 1988
10	Cambay	The historic gulf of Cambay represents shallow mudflats and sandbanks that provide nesting sites for green turtles.	**BSA** Rodgers & Panwar 1988
11	Site of old Baobab trees (*Adansonia digitata*) at Godpar Village	Two very large Baobab trees, reported to be over 700 years old and with a diameter of ~30 meters each, are located in a private farm in this village. So far, the farmer has preserved it with religious	**HS** WII

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
		sentiments, but there is a need to protect them for the future.	
Haryana			
1	Nimbi, Mahendragarh Distt	This area represents the northernmost tip of Aravalli Hill Range surrounded by sand dunes. It has representative floral and faunal communities of high conservation significance. Important species include *Salvadora oleoides* with *Capparis sepiara* and *Acacia senegal.*	**BSA** Rodgers & Panwar 1988
2	Mangar Bani Forest grove, Faridabad District	This remnant forest grove adjacent to Kot and Damdama represents an *Anogeissus pendula* forest and deserves high priority for conservation because it is the only site of steeply sloping quartzite hills that is thickly afforested with this species. It also serves as an important wildlife habitat.	**BSA** WII & FRI
3	Forest patches around Raisina, Bhondsi, Gamroj, Nayaan (Nimatpur), Khol Khaletha in Rewari	These areas represent natural habitats rich in wildlife, prone to encroachment and development.	**BSA** FRI
4	Mandhna and Hathia forests in Panchkula District	This area harbours some of the best forests of Harad *(Terminalia chebula)* that need to be given high conservation priority.	**BSA** WII
5	Forests of Sohlabudin, Mahendrergarh district	This area harbours patches of *Prosopis cineraria* and *Tamarix articulata,* and forest formations in its easternmost distribution range with high conservation significance.	**BSA** WII
Himachal Pradesh			
1	Upper Sural Valley, Pangi Valley	Represents intact subalpine forest, alpine scrub and meadows, Lower areas support forests of Chilgoza pine and birch. Excellent habitat for the Himalayan Brown Bear	**BSA** WII
2	Upper catchment of Giri river and Chandi Kuppar, Shimla District	An important upper catchment in Shimla District, extremely rich in flora and fauna. Vulnerable for encroachment and infrastructure development	**BSA** HFRI, Shimla
3	Chandra Nahan, the Upper Catchment of Babbar River	This catchment up to Chanshil Dhar adjacent to the Uttarakhand border is another important area from a biodiversity and hydrological point of view.	**BSA** HFRI, Shimla

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
4	Kukum Sheri, Lahaul	The hill slope on the left bank of the Chandrabhaga river in Lahaul is the only known locality for a rare herb *Colchicum luteum*. This deserves high conservation priority.	**BSA** HFRI, Shimla
5	Outer Fringes of Srikhand Mahadev, Kinnaur	The Forested tract between Sarpara–Phancha to Srikhand Mahadev (52m) is undergoing tremendous developmental pressures.	**BSA** HFRI, Shimla
Jammu & Kashmir			
1	Pauni Bharkh, Reasi Forest Division	This area harbours a dwindling population of an endemic plant, *Eremostachys superba* (Lamiaceae). This area is prone to erosion, encroachment and land conversion.	**BSA** SFRI, Jammu
2	Riverine Forests in Gurez-Tilail area (Left bank of Kishenganga)	This area connects Drass/Kargil and the Sindh Valley. It harbours populations of Kashmir musk deer, Hangul, Himalayan Ibex, Himalayan brown bear, snow leopard and is also recognized as one of the priority sites for rare and endemic medicinal plants.	**BSA** WII
3	Nurpur Gali	This is an intervening area between Tattakuti and Khara Gali that serves as an important refuge for markhor and western tragopan populations after Kazinag. The area is also very rich in high value medicinal plants. The area faces heavy exploitative pressures leading to decimation of threatened species.	**BSA** WII
4	Great Lakes area in upper catchment of Sindh River	This area includes the famous five high altitude lakes in the upper catchment of the Sindh viz., Gangebal, Gade Sar, Kishen Sar, Vishen Sar, and Yan Sar. They are rich in biodiversity and are all sacred natural sites in Kashmir.	**BSA** WII
5	Shamshabari, Kupwara District	This area falls within the historic distribution range of the markhor and is known for its floral diversity and birdlife, including the threatened western tragopan and cheer. Other threatened species include the Kashmir musk deer, Himalayan goral and Himalayan brown bear. It is not included under any PA.	**BSA** WII
6	Mahore, Reasi District	Located on the southern slopes of the Pir Panjal, the Mahore area represents	**BSA** WII

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
		remnant forests in these ranges. The area is rich in floral and faunal diversity including goral, musk deer, and western tragopan.	
7	Upper catchment of Aharbal	This area is famous for the presence of a sacred high altitude lake, Kounsar Nag. It has rich alpine meadows, birch and conifer forests. It adjoins the Hirpora WLS and besides markhor, the area harbours Himalayan musk deer, Himalayan brown bear, Himalayan griffon, bearded vulture, golden eagle and other birds of prey. The area is also an important site for medicinal plants.	**BSA** WII
Jharkhand			
1	Trikut hill	Biodiversity rich forests harbouring a large number of valuable timber and species of non-timber forest products especially medicinal and aromatic plants.	**BSA** IFP, Ranchi
2	Ligirdah Swamp in Singhbhum district	Old growth forests of sal and some remnant swamp forests in this area are rich in wildlife and floral diversity.	**BSA** WII
3	Ghaghri and Lodh Falls within Palamau Tiger Reserve and Netarhat, Latehar District	Some of the richest moist deciduous forests in erstwhile Palamau district. These sites are extremely rich in epiphytic and ground orchids.	**BSA** WII
4 - 15	All 11 elephant corridors in Jharkhand	Ankua – Ambia, Dalma – Asanbari, Dalma – Asanbari, Dalma – Chandil, Dalma – Rugai, Dalapani - Kankrajhor ,Jhunjhaka-Banduan, Raibera - Pulbaburi , Dumriya - Nayagram, Mahilong - Kalimati, Anjadbera- Bichaburu, Chandil - Matha	**BC** WTI
Karnataka			
1	Nallur Tamarind Grove, Devanahalli, Bengaluru	A notified BHS, spread over 54 acres comprising a population of nearly 300 very old trees of tamarind. It is believed to be a relic of a plantation established 800 years ago in the Chola regime.	**HS** Karnataka Forest Deptt
2	Hogrekan Sacred Grove, Kadur taluk, Chikmanglur	Important corridor between Kudremukh and Bhadra WSs, represented by Tropical Dry Deciduous forest. It is also contiguous with Bababudanagiri and Kemmangundi areas.	**BSA** Karnataka Forest Deptt

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
3	Ambaraguda, Shimoga	Revenue land located between Sharavathi and Someshwara WSs. It has typically Shola – grassland vegetation of Western Ghats.	**BSA** Karnataka Forest Deptt
4	Pilarkhan, Mangalore Forest Division	This area is a 'Type Locality' for Champion & Seth's 'West Coast Semi-Evergreen Forest' in north Mangalore Division.	**BSA** Rodgers & Panwar 1988
5	Kundapur, Kundapur Forest Division	Representative sites for the Carnatic coast landscape that remains unprotected. Consists of a few patches of degraded mangroves and littoral vegetation in Kundapur Division	**BSA** Rodgers & Panwar 1988
6-10	All Elephant Corridors	Tali-Bilikkal, Chamrajnagar - Talamalai at Muddahalli, Chamrajnagar - Talamalai at Punjur, Begur – Brahmagiri	**BC** WTI
Kerala			
1	Asramam, Kollam	This site has been identified as a Biodiversity Heritage Site (BHS) with a unique diversity of mangrove species and diverse flora and fauna. The area harbours 15 sp. of true mangroves, 22 sp. of mangrove associates, 122 sp. of other plants, 34 sp. of edible fish and atleast 62 sp. of birds. Most importantly, the site has rare and endangered heritage trees of *Syzygium travancoricum* which is listed as critically endangered in IUCN Red List.	**BSA** WII
2	Riverine forest of Pooyamkutti, Ernakulam District	This forest located in Kothamangalam Taluk, Ernakulam district, is very unique and one of the last remaining patches of lowland riverine forest that is home to a number of narrow endemic riparian habitat specialist trees such as *Garcinia wightii, Syzygium occidentale, Memecylon* sp, *Cynometra beddomei* and *Dipterocarpus bourdillonii*. This habitat is not part of any PA network and is threatened by encroachment and habitat loss.	**BSA** WII
3	Chirikala	This is a Type locality for Champion & Seth's '*Myristica* Swamp forest' category. It is a small remnant that needs restoration and urgent protection.	**BSA** Rodgers & Panwar 1988
4	Kurathimalai	A remnant patch of Hill Valley Swamp Forest, located on the western slope (base) of Nilgiris.	**BSA** Rodgers & Panwar 1988

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
5	Karimpuzha	Represents an intact but evergreen and semi-evergreen forest communities along an altitudinal gradient of 300-2554m asl, adjacent to Silent Valley, rich in flora	**BSA** Rodgers & Panwar 1988
6	Kallar Forest, Thiruvananthapuram District	Type Locality of a rare endemic species *Knema flavostamina* Govind & Dan (Myristicaceae)	**BSA** Mao et al., BSI
7-10	All Elephant Corridors	Nilambur at Appankappu , Periyar at Pakranthalam, Nilambur Kovilakam - New Amarambalam, Kottiyur - Periyar	**BSA** WTI
Ladakh			
1	Hanle Marshes, Nyoma Block	Marsh meadows of Hanle and other parts of Changthang Plateau in eastern Ladakh represent unique habitats which serve as nesting grounds for the threatened Black Necked Crane and other migratory birds. These meadows also support thousands of livestock during winter.	**BSA** WII
2	Rangdum area in Suru valley, Kargil	Alpine steppe and scrublands, moist and wet meadows in and around Rangdum are rich in high value medicinal and aromatic plants.	**BSA** WII
3	Alpine scrub near village Khardong	Type locality of *Berberis ulicina* as a constituent of alpine dry scrub.	**BSA** WII
4	Skuru Village, Nubra	Riverine scrub dominated by Sea buckthorn, *Myricaria germanica, Phragmites australis*, and *Populus euphratica* and adjacent sand dunes form unique habitats in Nubra Valley. These habitats are vulnerable to landuse change for tourism infrastructure and overuse for camping.	**BSA** Ladakh Forest Deptt
5	Hemis Shukpachen, District Leh	A relict patch of ancient Steppe Forest of *Juniperus semiglobosa*, adjacent to a village grazingland. Local people assign high religious significance to this patch. However, there is very poor regeneration of *Juniperus* at this site.	**BSA** Kunzes Angmo SKUAST, Leh
6	Sangrah, Sankoo Block, Kargil	An important site well known for its diversity of medicinal and aromatic plants (including species of *Aconitum*) as well as wildlife. This area has a distinctive geomorphology dominated by Quartzitic rocks and conglomerates.	**BSA** Kargil Forest Division

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
7	Sapi, Kargil District	An important area for high-value medicinal plants (reported to harbour more than 30 such species. Amchis from all over Western Ladakh visit this area to collect wild medicinal herbs. This area has a sacred lake and a glacier, both of which are ecologically significant and vulnerable.	**BSA** Kargil Forest Division
8	Juniper forest, Thasgam	One patch of *Juniperus semi-globosa* stands near village Thasgam, Kargil. This patch has been protected by villages but lies close to the highway and is vulnerable to diversion.	**BSA** Kargil Forest Division
9	Shershay, Soad Block	This area (including Handerman, Poyen, Soad villages upto Batalick) harbours a relict Juniper woodland and has potential to serve as a seed bank for this species. Currently this area faces heavy exploitation and smuggling of Juniper branches for religious purposes.	**BSA** Kargil Forest Division
10	Yaldore, Soad Block in Dah-Hanu (Aryan Valley)	Remnant patches of juniper and birch in this area are of high conservation significance. Both these species are reported to be regenerating well and need to be given full protection as they harbour other floral and faunal (bird) communities.	**BSA** Kargil Forest Division
11	Sashi Lake, near Lalung Village, Soad Block	This lake and surrounding area are extremely picturesque and rich in high-value medicinal and aromatic plants. The area is vulnerable to degradation owing to its scenic beauty and in the event of future development for tourism, this place is likely to become degraded.	**HS** Kargil Forest Division
12	Panzi La (Pensi La), Glacial Lake and Surrounds, Zanskar	The glacial lake, high pass and nearby glacier around Pensi La is very rich in high value medicinal and aromatic plants. The area is prone to degradation and over collection of such species. The area is the source of both the Suru and Zanskar rivers.	**BSA** Kargil Forest Division
Lakshadweep			

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
1	Kalpeni Group of Islands	These Islands are located at 287 km (155 nautical miles) from Kochi, in the south-east of Kavaratti Island. They hold populations of several rare and threatened species of flora and fauna including a good population of Giant Clam *Tridacna maxima.* Recommended for establishment as Community Reserve.	**BSA** Apte 2005 (BNHS)
2	Minicoy	The Minicoy Island is the southern-most island of Lakshadweep, situated at a distance of 398 km (215 nautical miles) south-west of Kochi. Important site for conservation of native biodiversity. It is recommended for establishment as Community Reserve.	**BSA** Apte 2005 (BNHS)
3	Bitra	Holds second highest population of *Tridacna maxima*. It has high quality of reef cover and good recruitment of Giant clams.	**BSA** Apte 2005 (BNHS)
4	Cheltan Island	Cheltan is also one of the important localities for conservation of Giant clam. The island holds highest adult giant clam population and very high sub-adult population. Recommended for establishment of Conservation Reserve	**BSA** Apte 2005 (BNHS)
Madhya Pradesh			
1	Keotigarhi village, Rewa District	Special Habitat; Proposed BHS. Mining has been stopped as per directions of the NGT; BMC in place	**BSA** TFRI, Jabalpur
2	Jatashankar, Chhatarpur District	Special Habitat. Proposed BHS. Also regarded as SNS, well known for high-value MAPs used by Gonds, Bhils and Bediyas	**HS** TFRI, Jabalpur
3	Naro Hills, Satna	Unique and varied geology and supports diverse ecosystems and species of Flora and Fauna.	**HS** TFRI, Jabalpur
4	Patalkot, Chhindwara	Terrain of 1700 feet deep valley and ecosystem of estimated age of 6 Million years and species of rare flora and fauna including rare Bryophytes and Pteridophytes.	**BSA** TFRI, Jabalpur

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
5	The Bhimbetka rock shelters, Raisen District	An archaeological site of Paleolithic and Mesolithic periods, site exhibiting traces of early human life in India and cave paintings from ca 10,0000 years ago. It is a UNESCO World Cultural Heritage Site. The Paintings provide rare glimpses into human settlement and cultural evolution from hunter-gatherers, to agriculture, and expressions of prehistoric spirituality.	**HS** Wikipedia
Maharashtra			
1	Angria Bank, Ratnagiri District	Unique habitat. Submerged plateau, 105km offshore from Ratnagiri coast. Rich in coral reef and other communities. Proposed PA	**BSA** TFRI, Jabalpur
2	Allapalli, Gadchiroli	Well known Reserved Forest preserved for its biological, cultural and historical values.	**BSA** WII
3	Tamhini ghat road section in Raigad District	This area harbours a highly threatened species i.e., *Bauhinia foveolata* and another endemic species - *Erinocarpus nimoonii*. The area is threatened by logging and habitat loss due to road widening and construction	**BSA** WII
4	Panchgani and Kaas Plateau	Extensive rocky plateaus in the Western Ghats of Maharastra represent unique grassland habitats which harbour diverse flora many of them rare and endemic	**BSA** WII
5	Wood Fossil Park, Kothari Range, Chandrapur District	This site harbours large-sized tree fossils of palaeoecological interest. The area also supports excellent teak forests with representative flora and fauna	**BSA** Rodgers & Panwar 1988
6	Harishchandragad, Ahmednagar	Type locality for two recently described angiosperm taxa viz., *Pinda shrirangii* and *Vicoa gokhalae*	**BSA** Mao et al., (BSI)
Manipur			
1	Kaihlam	An area representing a wide altitudinal range from 500 - 2000 m asl in the state. Known for its rich floral diversity.	**BSA** Rodgers & Panwar 1988
2	Hunter Valley, Eastern Manipur	Located along the Indo-Burma Border, this area is known to be a Type Locality for a rare ground orchid, *Cymbidium viride*.	**BSA** WWF 2008

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
Meghalaya			
1	Khlaw Kur Syiem KmieIng, Umling	An old sacred grove representing a mosaic of natural habitats along with significant diversity of life forms.	**HS** WII
2	Saipung Link	An area of evergreen forest in the south east, a zone of much botanical and zoological interest, joining Barail and Cachar Hills of Assam.	**BSA** Rodgers & Panwar 1988
3	Krem Mawmluh Caves, Cherrapunji	One of the important sites representing palaeohistory and also known to have registered signals of early Holocene (Anthropocene) that is named as the Meghalayan Age that dates to 4,200 years before present. This area is vulnerable to coal mining and needs to be given the status of a National Geological Heritage site.	**HS** Umashankar, NEHU
4 - 10	All Elephant Corridors	Baghmara-Balpakram, Siju – Rewak, Rewak – Imangre, Nokrek – Imangre, Ranggira - Nokrek	**BC** WTI
Mizoram			
1	Rengdil Lake	A sacred lake with surrounding forests rich in flora and fauna. It harbours several migratory waterfowl and has historical importance.	**BSA** Rodgers & Panwar 1988
2	Phuaibuana Forest	Located in Aizawl Forest Division, this area harbours a diverse array of flora and fauna. It deserves high conservation priority.	**BSA** SOEM 2016
3	Palak Lake	Located in Saiha district, Palak is the largest freshwater lake in Mizoram. It harbours a rich array of wetland flora and fauna.	**BSA** SOEM 2016
Nagaland			
1	Shilaoi	High altitude areas on the eastern side of the state with high floral and faunal values.	**BSA** Rodgers & Panwar 1988
2	Mount Saramati, Kiphire District	An important biodiversity area, also serves as Type Locality for a rare endemic plant *Didymocarpus sinoindicus* Prasanna *et al*.	**BSA** Mao et al. (BSI)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
Odisha			
1	Mandasaru, Kandhamal	Mandasaru gorge, a BHS, is a rich abode of 1563 species of plants, animals and fungi spread over an area of 528 ha	**BSA** Rodgers & Panwar 1988
2	Mahendragiri	A site of historical and mythological importance, rich in flora and fauna	**HS** Rodgers & Panwar 1988
3	Chilika Lake	Satpada, Magarmukh to Sea Mouth. Key habitat for the Irrawaddy dolphin and for many threatened waterfowl and waders.	**BSA** M.V. Nair & Aditya Panda
4	Mangalajodi and Bhusandpur wetlands	Important Bird Area. Habitat of breeding populations of the fishing cat, smooth coated otter	**BSA** M.V. Nair & Aditya Panda
5	Tinimuhani delta of rivers Daya, Bhargavi and Luna	Large freshwater marshlands with widest known channels in the Chilika lake.	**BSA** M.V. Nair & Aditya Panda
6	Astarang beach and Devi River mouth	Intact estuarine and coastal habitats for a number of species including the Olive Ridley turtle	**BSA** M.V. Nair & Aditya Panda
7	Rushikulya River Mouth	Intact estuarine and coastal habitats for a number of species including the Olive Ridley turtle	**BSA** M.V. Nair & Aditya Panda
8	Hirakud Reservoir	Huge man-made lake of 743 sq.km. A wetland of National importance and an IBA. Sambalpur and Bargarh districts	**BSA** M.V. Nair & Aditya Panda
9	Jatadhari Muhan	An estuary close to Paradip, south of the river Mahanadi, which supports large congregations of waterfowl in winter	**BSA** M.V. Nair & Aditya Panda
10	Barbara RF, Khurda Disrtrict	Has relict mesic habitats. Very rich floristically and avifaunally	**BSA** M.V. Nair & Aditya Panda
11	River Mahanadi between Baliput and Mundali	Key habitat for the Indian skimmer, mugger, gharial, black bellied tern, extensively used by the Asian elephant, also as a corridor	**BSA** M.V. Nair & Aditya Panda
12	R. Mahanadi between Huma and Satkosia Gorge	Key habitat for *Tor tor mahanadiensis*, also gharial and mugger, wintering waterfowl including reports of merganser	**BSA** M.V. Nair & Aditya Panda
13	Ghumsar North and South forest divisions	Large, contiguous landscape with little human habitation; presence of the Asian elephant, gaur, leopard, sambar, chital, sloth bear, wild dog, transient tigers and	**BSA /BC** M.V. Nair & Aditya Panda

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
		part of an extensive habitat contiguity between Odisha and the Central Indian Tiger Landscape	
14	Bhetnoi – Balipadar, Ganjam District	Large population of blackbuck, scrub-covered rocky granite hillocks have geological value. Ideal habitat for leopard, sloth bear	**BSA** M.V. Nair & Aditya Panda
15	Pradhanpat Reserved Forest, Deogarh District	Floristically rich area	**BSA** M.V. Nair & Aditya Panda
16	Khandadhar RF, Sundargarh District	Floristically rich area known for its waterfall	**BSA** M.V. Nair & Aditya Panda
17	Madanpur Rampur and Thuamulpur Rampur forests of Kalahandi district:	Large forested blocks with high presence of leopard, transient tigers likely from the Central Indian Landscape	**BSA** M.V. Nair & Aditya Panda
18	Malyagiri Reserved Forest Block, Angul District	Floristically rich, including *Mesua ferrea* patches	**BSA** M.V. Nair & Aditya Panda
19	All RFs of Kandhamal District	Known corridor for tigers connecting Kandhamal and Kalahandi with the Central Indian Tiger Landscape and Sunabeda-Udanti-Sitanadi TR complex	**BC** M.V. Nair & Aditya Panda
20	Deomali Peak, Koraput District	Tallest peak in the Eastern Ghats as well as in Orissa at 1672 m height. Limestone caves, and the presence of large mammals including leopards; unique floral elements	**HS** M.V. Nair & Aditya Panda
21	Ampani Hills, Kalahandi District	Floristically rich; prehistoric cave paintings	**HS** M.V. Nair & Aditya Panda
22	Gupteswar RF, Koraput	Floristically rich area of the Eastern Ghats	**BSA** M.V. Nair & Aditya Panda
23	Chitrakonda RF, Malkangiri	Floristically rich area of the E. Ghats, very poorly explored because of left wing extremism	**BSA** M.V. Nair & Aditya Panda
24	Gandhamardhan Plateau, Balangir and Bargarh districts	Grassland and dryland plateau, high diversity of medicinal plants, high conservation potential for dryland species. At risk because of bauxite reserves	**BSA** M.V. Nair & Aditya Panda

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
25	Hemgir RF, Sundargarh Forest Division	Rich reserve of megafauna, contiguous to the Central Indian Tiger Landscape. There is camera trap evidence of a large leopard population including a melanistic leopard, and regular tiger presence. At risk from the presence of coal reserves nearby.	**BC** M.V. Nair & Aditya Panda
26	Malyagiri Hills, Angul District	Part of the floristically rich Garhjat Hills	**BSA** M.V. Nair & Aditya Panda
27	Niyamgiri Mountain Range, Kalahandi District	Floristically rich area of the Eastern Ghats and home to the Dongria Kondh indigenous people	**BSA/HS** M.V. Nair & Aditya Panda
28-39	All Elephant Corridors	Karo – Karampada, Tal- Kholgarh, Nuagaon - Baruni, Kotagarh – Pankhalgudi, Badampahar - Dhobadhobin, Baula - Kuldiha, Aswakhola - Sunajhari, Badampahar - Karida East, Karo - Karampada, Kahneijena - Anantapur, Anantapur - Aswakhola (Via Jiridimal), and Buguda-Central	**BC** WTI
Punjab			
1	Dholbaha, Hoshiarpur District	This area represents typical Shiwalik vegetation dominated by Chir pine and associate species	**BSA** Rodgers & Panwar 1988
2	Nara, Hoshiarpur District	A remnant dry deciduous forest of the Shivalik hills, threatened due to anthropogenic pressures	**BSA** Rodgers & Panwar 1988
3	Kanjli Wetland, Kapurthala	Well known for its rich wetland Flora	**BSA** FRI
4	Cholti Kheri (Khera Mandal Block), Fatehgarh Sahib	SNS, especially known for its Great Banyan Tree	**BSA** FRI
5	Kukanet Forest, Hoshiarpur	Only patch of Shiwalik pine and bamboo in Punjab. This area is of much ecological significance	**BSA** FRI
6	Terkiana Marshland, Hoshiarpur	A freshwater wetland connected to the original Beas river. Serves as an important habitat for migratory birds during winter	**BSA** FRI
7	Matterwara Forest, Ludhiana	Remnant forest patch threatened by rapid infrastructure development	**BSA** FRI
8	Mote Majra wetland, Banur (Mohali)	Important site for conservation of the Greater Flamingo (*Phoenicopterus roseus)*	**BSA** FRI & WII

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
Rajasthan			
1	Sheeliberi-Dholiya Forest formations, Pali district	Beautifully forested with amazing rock formations	**BSA** Pradip Krishen
2	Ahore hillocks, Jalore district	These are hillocks in the Aravallis of Jalor district of Rajasthan. Great example of a granitic landscape, relatively unspoilt	**HS** Pradip Krishen
3	Jasai-Para dunes and hillock, Barmer district	A big 'obstruction dune' banked up against a rocky hill, featuring 2 very different landscapes abutting one another	**BSA** Pradip Krishen
4	Psammophytic vegetation along Indo-Pak Border, specially from Mianjlar to Munabao, District Jaisalmer and Barmer	A long swathe of desert scrub on sand dunes dominated by *Calligonum polygonoides* (phog), *Leptadenia pyrotechnica, Aerva pseudo-tomentosa* etc.	**BSA** Pradip Krishen
5	Dudheshwar Mahadev ka Oran, Jalore District	A sacred grove with good population of *Tecomella undulata* and associated species. It serves as a relict site	**HS** AFRI, Jodhpur
6	Joleyali Oran, Jodhpur	A small patch of forest dominated by *Anogeissus sericea* var. *nummularia.* Unique in species composition	**HS** AFRI, Jodhpur
7	Kolu Pabuji Ka Oran, Jodhpur	Typical arid woodland dominated by *Prosopis cineraria* (Khejri) and *Ziziphus nummularia* (Ber)	**HS** AFRI, Jodhpur
8	Dardevi Mata ji Ka Oran, Kota	This sacred grove supports several rare and endangered species.	**HS** AFRI, Jodhpur
9	Tarkeshwar Mahadev Oran, Udaipur	A sacred grove with multiple species including *Putranjiva roxburghii*	**HS** AFRI, Jodhpur
10	Ubeshwar ji Oran, Udaipur	Multiple species including some rare and endangered species	**HS** AFRI, Jodhpur
11	Granite Hill at Sendra in Pali District	Unique patch of forest and geological structure	**HS** Pradip Krishan
Sikkim			
1	Tso Lhamu Plateau	This plateau represents the smallest Biotic Province in the Himalaya, characterized by the presence of several threatened and endangered species such as Argali sheep, the Tibetan Gazelle, Eastern Kiang and Snow Leopard. Current status of the land is Reserved Forest and requires greater attention in terms of conservation.	**HS** Rodgers & Panwar (1988)

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
Tamil Nadu			
1	Marakanem	Area bordering Puducherry and Tamilnadu. Type Locality for Champion & Seth's Tropical Dry Evergreen Forest	**HS** Rodgers & Panwar 1988
2-12	All Elephant Corridors	Edayarhalli – Guttiyalattur , Bilikkal – Javalagiri, Talamalai – Guttiyalattur, Srivilliputhur – Saptur, Mudumalai – Nilambur via O' Valley, Jaccanaire Slope - Hulikal Durgam, Anaikatti North – Anaikatti South, Segur Plateau, Vazhachal – Anaimalai via Sholayar, Vazhachal - Anaimalai via Ryan	**BC** WTI G.O. (Ms) No.125 dt. 31.08.2010 w.r.t. Segur Plateau
Telangana			
1	Anantgiri, Northern Telangana	Represents the highest peak in Telangana bordering Odisha. It is known to harbour moist evergreen forests with distinct floral and faunal assemblages of moist evergreen forests.	**BSA** Rodgers & Panwar (1988)
2	Velikonda, western territories	Represents Wet-evergreen Forests of NE Ghats	**BSA** Rodgers & Panwar 1988
3	Mudinanipalli, Anantpur Dt.	Anantpur District. Represents Southern TF; Potential habitat of Chinkara, Blackbuck and GIB	**BSA** Rodgers & Panwar 1988
4	Anantgiri	Representing brackish water swamp community in the extreme north, this area supports a number of migratory and resident waterfowl and is also a nesting site for Pelicans.	**BSA** Rodgers & Panwar 1988
5	Sriharikota Island	It is a 'Type Locality' for Champion & Seth's Dry Evergreen Forest, a biome scarcely protected anywhere in India	**BSA** Rodgers & Panwar 1988
6	Donubhavi, Srikakulam Ditt.	This area represents the southern limit of Sal forests in India. It also exhibits a teak-sal transition and has rich wildlife values, including populations of migratory elephants.	**BSA** Rodgers & Panwar 1988
Tripura			
1	Betling Shiv	This is the highest peak (939m asl) in the state of Tripura and forms an important catchment for most streams in the area, deserving high priority for conservation.	**BSA** Wikipedia

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
Uttar Pradesh			
1	Gangetic Khadar from Bijnor to Hastinapur Upper Ganga River stretch, Bulandshahar. Some of the specific localities are given below.	Migratory route for endangered swamp deer and hog deer, swamp francolin; scattered trees of *Barringtonia* and *Ficus benghalensis*. Near Narora there is a sacred Banyan, which is said to be the world's 10th largest Banyan tree.	**BSA** FRI Dehradun
2	Jogga Jheel complex, Muzaffarnagar	Around 16.34 km^2 area of wetland along the course of the Solani river has patches of grassland that support the Northern Swamp Deer and Hog Deer populations, besides other elements of wetlands.	**BSA** WII Dehradun
3	Haiderpur, Muzaffarnagar & Bijnor Districts	Approximately 38.48 km^2 area along the Ganga and Solani rivers has typical Terai Grassland that harbours the Northern Swamp Deer and Hog Deer populations. It is crucial to save these grasslands as threatened habitats.	**BS** WII
4	Benni Nagla grasslands in Bulandshahar	About 1.72 km^2 area of Terai Grasslands is another remnant habitat for two threatened deer species: The Northern Swamp Deer and Hog Deer. This area is of utmost conservation significance.	**BSA** WII
5	Nagla Khangi & Dhapar Grasslands in Badaun District along Lower Gangetic Plains	Known for scattered populations of Swamp Deer and Hog Deer, this 2.47 km^2 area in the Lower Gangetic Plains deserves high priority.	**BSA** WII
6	Chhidkuri Grassland in Shahjahanpur area	Part of the Terai Arc Landscape, this grassland serves as a remnant habitat for Hog Deer and Black Buck. As of now only about 4.34 km^2 of this area is intact and is vulnerable to landuse change.	**BSA** WII
7	Koylabas, Near Jarwa , Balrampur Distt	Site for the monotypic endangered (EN) species of tree *Indopiptadenia oudhensis.*	**BSA** FRI
8	Kodwa, Puraina, and Khebli wetlands in Dewa and Barabanki districts; Sarsai Nawar wetlands (Etawa)	Important sites for wetland birds and threatened *Saras* crane	**BSA** FRI and WII
9	Marihan-Sukrit-Chunar areas of Mirzapur Forest Division	Representative Tropical Dry Deciduous Forests of the Vindhyan range, important for conservation of the sloth bear	**BSA** FRI and WII
10	Samda and Bisauli Wetlands, Ayodhya (Sohawal)	Two large wetlands in this district serve as an important refuge for a large number of migratory waterfowl.	**BSA** WII

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
11	Govardhan Hill, Mathura	One of the important Sacred Natural Sites in Braj (Mathura). Northernmost extension of Aravalli Range, this site is rapidly undergoing transformation in terms of its original vegetation communities due to invasion by alien species such as *Prosopis juliflora.*	**BSA** WII
Uttarakhand			
1	Ranjeetpur Grassland, Haridwar District (Ganga Khadar)	Approximately 1.59 km^2 area harbours populations of endangered northern Swamp Deer and Hog Deer. Liable to be threatened due to changes in landuse and agricultural expansion	**BSA** WII
2	Baanganga Wetlands, Haridwar district	Approximately 4.55 km^2 area along the Baan Ganga serves as a migratory corridor for Swamp Deer between Jhilmil Jheel Conservation Reserve and Hastinapur WS. It has a small population of Hog Deer and rich aquatic fauna.	**BSA** WII
3	Nakraunda & Golatappar Swamp Forests, Dehradun	Remnant Freshwater Swamps of the Doon Valley, prone to encroachment and habitat degradation	**BSA** FRI & WII
4	Kanwa Ashram (Pauri Garhwal) and Kunjapuri Ashram (Tehri District)	Sacred Natural Sites with intact old growth forests	**BSA** FRI
5	Forests of Patuwadangar, Naini Tal	Biodiversity-rich temperate forest. Known for populations of an endemic species, *Meizotropis pellita*	**BSA** FRI
6	Rungling Forest, Pithoragarh	SNS. One of the intact temperate forests covering an altitudinal range of 2200–2800m asl. It has patches of eastern Hemlock (*Tsuga dumosa*) and several east Himalayan elements.	**BSA** WII
7	Riverine Forests in Lower Gori Valley, Pithoragarh	One of the important hotspots for orchids in the Western Himalaya. Much of the forest has now been degraded due to the construction of a road. Remaining old trees of Tun (*Toona ciliata*) still harbour a rich diversity of orchids.	**BSA** WII
8	Thal Kedar forest, Pithoragarh	SNS and proposed BHS. Locality for several rare, endemic and threatened species	**HS** FRI and WII
9	Dudhatoli, Pauri District	An important site of ecological significance that harbours sub-alpine mixed broadleaf and conifer forests. It	**BSA** Rodgers & Panwar 1988

Sl. No.	State & Geographical Area	Conservation Significance	Type & Reference*
		serves as the upper catchment for four of Uttarakhand's non-glacial rivers, viz., Eastern and Western Nayar, Western Ramganga and Gagas	
10	Site of Monumental Deodar Tree at Tolma, Joshimath block	A monumental Deodar tree, *Cedrus deodara*, ca 14.5 meters in girth (approx. 460 cm dbh) and approximately 30 m tall is located at this village. This is one of the largest trees of the Pinaceae in the Himalaya.	**HS** WII
11-20	All nine elephant corridors in Uttarakhand	Kansrau-Barkote, Motichur-Barkote, Fatehpur-Gadgadia, Rawasan –Sonanadi (Via Lansdowne FD), Rawasan –Sonanadi (Via Bijnore FD), South Patlidoon, Chilkiya- Kota, Manali – Kota, Kilpura-Khatima-Surai Range. Each of these bio-corridors harbour rich forests.	**BC** WTI
West Bengal			
1	Dhotrey BHS, Darjeeling	A biodiversity-rich site with a variety of medicinal plants	**BSA** WII
2	Chilkigarh Kanak Durga Sacred Grove, Jhargram Distt	A remnant forest with traditional beliefs and taboos of local inhabitants and rich in biodiversity covering an area of 55.9 acres	**BSA** WII
3-17	All Elephant Corridors	Buxa - Titi (Via Beech And Barnbari Te), Nimati - Chilapata, Buxa - Ripu at Sankosh, Apalchand - Mahananda, Apalchand - Gorumara, Apalchand - Kalimpong At Mal Block (Via Sylee), Chapramari-Kalimpong (Mal Block), Rethi - Moraghat, Moraghat – Central Diana, Titi – Rethi Via Dumchi, Titi – Rethi, Buxa - Titi (Via Torsa), Apalchand-Kalimpong At Mal Block (Via Meenglass), Rethi - Central Diana	**BSA** WTI

*** Institutions Abbreviated:**

AFRI	Arid Zone Forest Research Institute, Jodhpur
BSI	Botanical Survey of India, Kolkata
BNHS	Bombay Natural History Society
FRI	Forest Research Institute, Dehradun
HFRI	Himalayan Forest Research Institute, Shimla
IFP	Institute of Forest Productivity, Ranchi
NEHU	North Eastern Hill University, Shillong
SFRI	State Forest Research Institute, Jammu
SKUAST	Sher-e-Kashmir University of Agricultural Science & Technology
TFRI	Tropical Forest Research Institute, Jabalpur
WII	Wildlife Institute of India, Dehradun
WTI	Wildlife Trust of India

Appendix 5.1 :
Template for Estimation of NPV with Examples from the Darjeeling and Jharkhand Landscapes

(Yellow highlighted cell in each row marks the input data, and the green coloured cell implies the output data)

Example 1: The template for PV estimation with data on Darjeeling landscape											
Ecosystem Service	**Fodder (in 000 tons)**	**Total Forest (hectare)**	**Price per ton (INR/ton)**	**Value of fodder (INR million)**	**Value of fodder per hectare (INR per hectare)**						
Fodder	4292	237800	700	3004.40	12634.15						
Water Purification	**Population**	**Total Forest (hectare)**	**Pop. Density (pop per sq km)**	**water consumption (l/person/day)**	**Annual consumption (million cubic metres)**	**Purification cost per cubic metre (INR)**	**10% nature provided purification (million INR)**	**Value of water purification (per hectare)**			
	1846823	237800	586	135	91.00	51	464.11	1951.69			
Timber	**Outturn of timber (000 cubic metre)**	**Total Forest (hectare)**	**Price of Timber (Rs per 000 cubic metre)**	**Value of Timber (million INR)**	**Value per hectare (INR/ hectare)**						
	4610	237800	600000	2766	11631.62						
Air Pollution Control	**Total Forest (ha)**	**Total Forest (ha)**	**SO2 (Kgs /ha)**	**NO2 (Kgs /Ha)**	**SO2 mitigated (tons)**	**NO2 mitigated (tons)**	**Abatement cost of SO2 (in 2019-20)Rs / tonne**	**Abatement cost of NO2 (in 2019-20) in Rs /tonne**	**value of SO2 abatement (INR million)**	**value of NO2 abatement (INR million)**	**Value of SO2 and NO2 abatement per ha (INR/ha)**
	237800	237800	10.8	15.6	2568.24	3709.68	46741	102726	120.04	381.08	2107.33
Carbon Stock	**Forest carbon stock (000 tons)**	**Total Forest (hectare)**	**Social Cost of Carbon (INR/ ton)**	**Value of Carbon stocking (million INR)**	**Value of Carbon stock per hectare (INR/ hectare)**						
	29894	237800	4218	126092.89	530247.65						
Firewood	**Outturn of firewood (000 cubic metre)**	**Total Forest (hectare)**	**Price (INR/ ton)**	**Conversion factor (ton/ cubic metres)**	**Outturn of Firewood (ton)**	**Value of firewood (INR million)**	**Value per hectare (INR per hectare)**				
	1588	237800	3500	0.73	1150725	4027.54	16936.65				
Soil Conservation	**Soil Conservation**		**Price (INR per hectare)**								
			30496								
Annual Value of Ecosystem Services per hectare				**606005.09**	Rotation period (years)	**60**	Rate of discount (%)		**3.5**		
PV (INR 10^7/ hectare)				**2.13**							

Example 2: The template for PV estimation with data on Jharkhand landscape

Ecosystem Service	Fodder (in 000 tons)	Total Forest (hectare)	Price per ton (INR/ton)	Value of fodder (INR million)	Value of fodder per hectare (INR per hectare)							
Fodder	55482	2361100	700	38837.70	16448.99							
Water Purification	Population	Total Forest (hectare)	Pop.Density (pop per sq km)	water consumption (l/person/day)	Annual consumption (million cubic metres)	Purification cost per cubic metre (INR)	10% nature provided purification (million INR)	Value of water purification (per hectare)				
	33002424	2361100	586	135	1626.19	51	8293.59	3512.60				
Timber	Outturn of timber (000 cubic metre)	Total Forest (hectare)	Price of Timber (Rs per 000 cubic metre)	Value of Timber (million INR)	Value per hectare (INR/ hectare)							
	168150	2361100	600000	100890	42730.08							
Air Pollution Control	Total Forest (ha)	Total Forest (ha)	SO2 (Kgs /ha)	NO2 (Kgs /Ha)	SO2 mitigated (tons)	NO2 mitigated (tons)	Abatement cost of SO2 (in 2019-20)Rs / tonne	Abatement cost of NO2 (in 2019-20) in Rs /tonne	Total value of SO2 abatement (INR million)	Total value of NO2 abatement (INR million)	Total value of SO2 and NO2 abatement (INR million)	Value of SO2 and NO2 abatement per ha (INR/ha)
	2361100	2361100	10.8	15.6	25499.88	36833.16	46741	102726	1191.90	3783.71	4975.61	2107.33
Carbon Stock	Forest carbon stock (000 tons)	Total Forest (hectare)	Social Cost of Carbon (INR/ ton)	Value of Carbon stocking (million INR)	Value of Carbon stock per hectare (INR/ hectare)							
	178012	2361100	4218	750854.62	318010.51							
Firewood	Outturn of firewood (000 cubic metre)	Total Forest (hectare)	Price (INR/ ton)	Conversion factor (ton/ cubic metres)	Outturn of Firewood (ton)	Value of firewood (INR million)	Value per hectare (INR per hectare)					
	8846.81	2361100	3500	0.725	6410730	22437.56	9503.01					
Soil Conservation	Soil Conservation		Price (INR per hectare)									
			30496									
Annual Value of Ecosystem Services per hectare				422808.51	Rotation period (years)	60	Rate of discount (%)		3.5			
PV (INR 10^7/ hectare)				1.49								