Study on Implementation of Compensatory Afforestation in India

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

ACA	Additional Compensatory Afforestation
APO	Annual Plan of Operation
ANR	Assisted Natural Regeneration
AR	Artificial Regeneration
CA Sites	Compensatory Afforestation Sites
CAFA	Compensatory Afforestation Fund Management Act
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CAT	Catchment Area Treatment
CA	Compensatory afforestation
CRM	Conservation, Regeneration and Management
DDA	Delhi Development Authority
DFO	District Forest Officer
FCA	Forest (Conservation) Act
FVC	Fractional Vegetation Cover
LULC	Land Use Land Cover
LTF	Less than 10% Canopy Cover Forests
MDF	Moderately Dense Forest
MoEF&CC	Ministry of Environment, Forest and Climate Change of India
NCAF	National Compensatory Afforestation Fund
NIC	National Informatics Centre
NDVI	Normalized Difference Vegetation Index
NPV	Net Present Value
NTFP	Non-Timber Forest Produce
OF	Open Forest
PAF	Protect Area Funds
PCA	Penal Compensatory Afforestation
PF	Protected Forest
RF	Reserved Forest
RS	Remote Sensing
GIS	Geographic Information System
SCAF	State Compensatory Afforestation Funds
SMC	Soil and Moisture Conservation
SLR	Systematic Literature Review
SSO	Subsidiary Silvicultural Operations
SZ	Safety Zone
UT	Union Territory
VDF	Very Dense Forest

Glossary

Ad-hoc CAMPA	A provisional body established to manage the funds collected for compensatory afforestation in India before the formal establishment of the Compensatory Afforestation Fund Management and Planning Authority (CAMPA). This body was created as a temporary measure to handle and accumulate the funds received from user agencies for various activities such as afforestation, reforestation, wildlife management, and forest conservation until the permanent CAMPA was operationalized.
Additional Compensatory Afforestation	Provided that in case the non-forest land or portion thereof provided by the user agency is not fit for raising compensatory afforestation of a specified density, then additional compensatory afforestation shall be raised on a degraded notified or unclassed forest land under the management control of the Forest Department which is twice in size of such shortfall in the given compensatory afforestation land and the user agency shall also bear the additional cost on such account."
Afforestation	The process of planting trees on land that has not been forested for a long time or has never been forested.
Annual Plan of Operation	A document detailing the planned activities and budget for afforestation and conservation projects for a specific year.
Asset Site	Locations where infrastructure like buildings, roads, etc., is created using NPV funds. These can be either existing or proposed assets.
Asset Works	Physical or infrastructural assets created to support forest and wildlife management, including facilities like ranger stations, fencing, water holes, and fire lines.
Assisted Natural Regeneration	Methods to enhance the natural regeneration of forests by protecting and managing the existing vegetation, removing invasive species, and sometimes planting native species to support growth.
Biodiversity conservation	Efforts to protect, manage, and restore biodiversity, ensuring the survival of various species and ecosystems through measures like habitat protection, restoration, and legal regulations.
CAMPA	A body established to oversee the implementation of compensatory afforestation and related activities, ensuring proper utilization of funds collected for forest conservation and management.
Catchment Area Treatment	Funds allocated for treating areas that catch water, with the aim of improving water quality and forest health.

Compensatory afforestation	Compensatory afforestation means afforestation done in lieu of the diversion of forest land for non-forestry use under the Forest (Conservation) Act, 1980. (CAF Act, 2016)
Compensatory Levies	Compensatory Levies includes all money and funds specified in clauses (iii) and (iv) of sub-section (3) of section 4 of the Compensatory Afforestation Fund Act, 2016 (38 of 2016);
Compensatory Afforestation Sites	Specific areas identified for afforestation activities to compensate for forest land diverted for non-forest purposes, ensuring no net loss of forest cover.
De-reservation	An order issued by the State Government or Union territory Administration or any authority thereof, for change in the legal status of a land statutorily or otherwise recognized as forest to any other category of land.
Ecological restoration	The practice of restoring degraded ecosystems to their natural state, aiming to recover biodiversity, ecological functions, and resilience.
e-Green Watch	An online platform that provides data on forest land diversion, compensatory afforestation, and plantation work, used for monitoring and analysis.
Forest Clearance	The process of obtaining legal permission to use forest land for non-forest purposes, typically involving environmental impact assessments and compensatory measures.
Forest conservation	Efforts to protect, manage, and restore forest ecosystems to maintain their ecological functions and biodiversity, often guided by legal and policy frameworks.
Land Diversion	An order issued by the State Government or Union territory Administration or any authority thereof for the use of any forest land for non-forest purpose or assignment of a lease of any forest land for non-forest purpose.
Land Fragmentation	The process of dividing large continuous areas of land into smaller, isolated parcels, often due to development or agricultural expansion, leading to habitat loss and decreased biodiversity.
Land Unavailability	The lack of suitable land for afforestation or conservation activities due to competing land uses, legal issues, or environmental constraints.
Less than 10% Canopy Cover Forests	Degraded forest lands having canopy density less than 10 percent. These are classified as scrub forests in State of Forest Report by Forest Survey of India.
Moderately Dense Forest	All lands with forest cover having a canopy density between 40 and 70%.
Monoculture Plantations	Plantations where a single species of tree is planted, often criticized for their lack of biodiversity and ecological resilience.
National Compensatory Afforestation Fund	A national-level fund established for managing compensatory afforestation activities, ensuring standardized implementation and monitoring across states.

Net Present Value	Net Present Value means the quantification of the environmental services provided for the forest area diverted for non-forestry uses, as may be determined by an expert committee appointed by the Central Government from time to time in this regard. (CAF Act, 2016)
Other Plantation Sites (Non-CA Sites)	Lands where plantation work is undertaken using Net Present Value (NPV) funds instead of CA funds. These are existing lands managed by the forest division.
Open Forests	All lands with forest cover having a canopy density between 10 and 40%.
Parivesh	A Single-Window Integrated Environmental Management System developed to facilitate the submission and tracking of forest clearance proposals.
Penal Compensatory Afforestation	Penal Compensatory Afforestation means afforestation work to be undertaken over and above the compensatory afforestation specified in the guidelines issued under the Forest (Conservation) Act, 1980, in lieu of the extent of area over which non-forestry activities have been carried out without obtaining prior approval of the competent authority under the Forest (Conservation) Act, 1980.
Plantation Work	The process of planting trees to create forests or restore degraded lands, typically involving site preparation, planting, and maintenance activities.
Protect Area Funds	Financial resources allocated specifically for the management and conservation of protected areas, ensuring the protection of biodiversity and ecosystems.
Protected forest	A forest area notified under the Indian Forest Act where certain activities are regulated or prohibited to protect and conserve forest resources.
Reforestation	The process of planting trees on deforested lands to restore the forest cover and improve ecological balance.
Reserved forest	Forest land notified under the Indian Forest Act where all activities are prohibited unless expressly permitted by the government, providing a higher level of protection.
Revenue Forest	Forest land managed primarily for revenue generation through timber and other forest produce, often with a focus on sustainable harvesting practices.
Safety Zone	A designated area around industrial or infrastructural projects where specific measures are taken to mitigate environmental impacts and protect surrounding ecosystems.
State CAMPA	State-level Compensatory Afforestation Fund Management and Planning Authorities responsible for implementing afforestation projects and managing the funds collected.
State Compensatory Afforestation Funds	Funds collected at the state level for compensatory afforestation, used for forest conservation and management activities within the state.

Survival rate	The percentage of planted trees or seedlings that survive over a specific period, used as a measure of the success of afforestation and reforestation efforts.
Unclassified Forest	Forest land that has not been classified into reserved, protected, or other categories under legal frameworks, often managed for various purposes.
User Agency	User Agency means any person, organisation or company or department of the Central Government or State Government making a request for diversion or de-notification of forest land for non-forest purpose or using forest land for non-forest purpose in accordance with the provisions contained in the Forest (Conservation) Act and the rules made and guidelines issued thereunder.
Very Dense Forest	All lands with forest cover having a canopy density of 70 percent and above.
Wildlife Management	The practice of managing wildlife populations and habitats to achieve specific conservation goals, including protection, monitoring, and restoration efforts.

Executive Summary

Introduction

Forests are essential for sustaining life on Earth, providing crucial ecosystem services and livelihoods while playing a key role in addressing the biodiversity and climate crisis. However, deforestation has significantly reduced forest cover in India, beginning with ancient invasions and intensifying during the British colonial period, World War II, and subsequent decades due to agricultural expansion and developmental needs. Recognizing the need to balance development with conservation, the Forest (Conservation) Act (FCA) was enacted in 1980 to regulate the diversion of forest land for non-forestry purposes. The Act significantly reduced the rate of forest land diversion and introduced the concept of Compensatory Afforestation, which mandates afforestation on equivalent non-forest land and funds to compensate for the loss of ecosystem services.

This study aims to evaluate the effectiveness of compensatory afforestation in India by reviewing relevant legislation, secondary literature, assessing fund utilization, and employing the use of Remote Sensing (RS) and Geographic Information Systems (GIS) for monitoring forest cover. It also involves identifying challenges within the compensatory afforestation framework and developing a set of recommendations.

Methodology

This study on compensatory afforestation in India employs a systematic approach to evaluate the effectiveness of the program, focusing on policy and legal framework review, program implementation assessment, and remote sensing and GIS-based analyses. Data was collected through desk reviews, key personnel interviews, and advanced satellite imagery analysis, utilizing sources like government portals (e-Green Watch, Parivesh) and state CAMPA websites.

The study begins by reviewing the legal framework governing afforestation, followed by a national and state-specific analysis of program implementation, with Odisha, Haryana, and Uttarakhand selected based on key indicators. An indicator-based assessment evaluates institutional design, forest land diversion, fund utilization, and monitoring mechanisms within these states.

Advanced GIS algorithms and remote sensing techniques have been used to evaluate forest quality and land-use patterns within CAMPA sites from 2016 to 2023, utilizing high-resolution Landsat 8 and Sentinel-2 imagery to analyse variations in forest density and

land cover. For Land Use and Land Cover (LULC), a comprehensive framework has been applied to analyse and monitor changes over time. This approach enables the examination of spatio-temporal landscape changes. Using Sentinel-2 imagery with a 10-meter resolution, LULC maps for 2016 and 2023 have been developed, identifying various land cover classes. Fractional Vegetation Cover (FVC) measures the percentage of vegetated area within a study region, reflecting vegetative density. Change maps of Fractional Vegetation Cover (FVC) for 2016 and 2023 have been created to assess afforestation, deforestation, degradation, and enhancement within CAMPA sites. These layouts visually represent variations in Forest cover density over time, highlighting significant areas of change.

The national as well as state analysis led us to understand some key challenges in terms of land for plantation, data transparency, implementation, etc. which are detailed in the report. This is followed by suggestions and recommendations which have been put forward.

Review of Policy and Legal Framework

The policy and legal framework for compensatory afforestation in India stems from the Forest (Conservation) Act of 1980, which was influenced by global environmental movements and the 42nd Amendment of the Indian Constitution. The roots of this legislation trace back to the Stockholm Conference in 1972, which inspired India's 42nd Constitutional Amendment in 1976. This amendment emphasized environmental protection through Articles 48(A) and 51(A)(g) and shifted the management of forests to the Concurrent List.

The Forest (Conservation) Act, 1980, was enacted to regulate the diversion of forest land for non-forest use, requiring central government approval. Although this act shifted the decision-making power from states to the centre, it did not initially mention compensatory afforestation. The term was introduced in the Forest (Conservation) Rules, 1981, and has since been strengthened through various amendments, guidelines, and rules. Key legislations have been categorized into:

Land Diversion and Collection of Funds

- Forest Conservation Act, 1980 (Amended in 1988 and 2023)
- Forest (Conservation) Rules, 2023

Utilization and Management of Funds

- State CAMPA Guidelines, 2009
- Compensatory Afforestation Fund Management Act, 2016
- Compensatory Afforestation Fund Management Rules, 2018

The Forest (Conservation) Act, 1980, mandates central approval for forest land diversion. The Forest (Conservation) Rules, 1981, provided detailed procedures for land diversion, compensatory afforestation, and funds collection. The rules have been revised multiple times, with the latest update in 2023. Various conditions are imposed on land diversion proposals, such as maintaining the legal status of forest land and compensatory afforestation.

Conditions imposed on user agencies for land diversion are categorized into general, standard, and specific conditions, based on the project type. Funds are collected under different heads such as Compensatory Afforestation (CA), Net Present Value (NPV), Catchment Area Treatment (CAT), and others, depending on the project's impact.

Compensatory afforestation requires transferring non-forest land to the state forest department. This process involves identifying suitable land, preparing a comprehensive afforestation scheme, and securing funds. Exceptions exist, such as for small-scale diversions (less than one hectare) or specific public undertakings. There are three stages of approval for forest land diversion: In-Principle Approval, Final Approval, and Final Diversion Order by the State.

While compensatory afforestation aims to balance development with conservation, criticisms exist regarding its effectiveness in truly compensating for lost ecosystem services. However, the policy could be viewed to channelize funds for forest conservation, aligning with the polluter pays principle.

Initially, funds collected for compensatory afforestation were not effectively utilized. The Supreme Court, in the T.N. Godavarman case (2002), mandated the creation of a Compensatory Afforestation Fund (CAMPA) for better management. Ad-hoc CAMPA managed funds until State CAMPA Guidelines (2009) decentralized fund management.

State CAMPA guidelines established a three-tier structure for fund management, involving a Governing Body, Steering Committee, and Executive Committee. Despite these efforts, audits revealed mismanagement, leading to the enactment of the Compensatory Afforestation Fund Act in 2016 and its rules in 2018. The legal and policy framework for compensatory afforestation in India has evolved to balance development needs with forest conservation. However, challenges remain in the effective implementation and utilization of funds, necessitating continued oversight and refinement of the system.

Review of Implementation of Program

National Analysis

A national analysis, using data from the e-Green Watch portal, remote sensing, GIS assessments, research papers, and articles, reveals a complex picture. Quantitative data shows that forest land diversion predominantly impacts reserve and protected forests, with states like Madhya Pradesh, Uttarakhand, and Odisha experiencing the most significant diversions. Despite these diversions, there is often a mismatch between the land diverted for non-forest purposes and the land identified for compensatory afforestation, leading to ecological imbalances. For example, afforestation efforts in one state might compensate for land diversion in another, which can disrupt local ecosystems and fail to replace the lost ecosystem services adequately.

The qualitative analysis delves deeper into the systemic issues. Although the program aims to restore degraded lands and enhance forest cover, its implementation has often disregarded local ecological conditions and social contexts. Standardized approaches to afforestation have led to ineffective outcomes, such as the loss of native grasslands and high mortality rates in restoration projects. Furthermore, community involvement, which is crucial for the success of such initiatives, has been minimal. The forest department's actions, including the enclosure of lands and planting of non-native species, have often displaced local communities and disrupted traditional practices. This has been particularly problematic in tribal areas, where compensatory afforestation has led to conflicts over land use and access to resources.

The review also highlights that the centralized control of funds and decision-making processes, often at the expense of local governance structures like gram sabhas, has further marginalized affected communities. The disconnect between policy goals and ground realities is evident in various states, where afforestation projects have failed to address the unique ecological and social dynamics of the regions. Additionally, issues like inadequate data management, ineffective use of Net Present Value (NPV) funds, and a lack of transparency in the implementation process continue to hamper the program's success. Despite its potential to contribute to ecological restoration and climate change mitigation, compensatory afforestation in India is hindered by these persistent challenges, necessitating a more localized, community-driven approach for future improvements.

The national analysis was conducted by scoring each State and Union Territory based on seven parameters related to the efficiency of State CAMPA, forest area, land diversion, compensatory afforestation, and plantation work. The parameters include the year of CAMPA notification, public transparency of documents, achievement percentage from 2016 to 2023, percentage of forest area, land diverted, compensatory afforestation land identified, and plantation work done. Based on these criteria Haryana, Odisha and Uttarakhand were selected and presented as case studies for detailed analysis.

State Analysis

The analysis of Odisha, Haryana, and Uttarakhand was carried out using two-way approach. First, an Indicator-Based Analysis assessed the states on four criteria: Institutional Design, Land Diversion and Compensatory Levies, Utilisation of Funds, and Monitoring and Evaluation. This analysis reviewed the effectiveness of institutional frameworks, the processes for land diversion and levies, the allocation and use of funds, and the mechanisms for monitoring and evaluating CAMPA activities. Second, Remote Sensing and GIS-Based Assessment utilized advanced machine learning models to analyse changes in forest density and land cover in CAMPA sites across 15 districts. This study focused on forest circles with significant compensatory afforestation activities since 2016, examining trends from 2016 to 2023 to assess forest cover and land use patterns. Together, these methodologies provide a comprehensive view of CAMPA's impact and effectiveness in the selected states.

Odisha

The first case study about Odisha showcases a balanced state in terms of forest and non-forest areas, with significant land diversion driven by mining. Odisha is also advanced in plantation work and serves as a model for effective CAMPA implementation and community involvement.

Indicator based Analysis

Odisha State CAMPA, established in 2018 under the CAF Act of 2016, features a well-structured governance framework that ensures transparency and operational efficiency. The Steering Committee plays a pivotal role by approving Annual Plans of Operations (APOs) and overseeing fund allocation according to CAMPA guidelines. This committee meets annually, with its decisions meticulously recorded for accountability. Complementing this is the Executive Committee, responsible for translating approved plans into actionable on-ground activities. The clarity in roles and responsibilities within Odisha CAMPA, along with comprehensive documentation, contributes to effective management, making it a model of good governance in the realm of compensatory afforestation.

From 2009-10 to 2022-23, the Government of India has released Rs. 186,576.72 to Odisha for the implementation of CAMPA activities (CAMPA APO 2019-2024). These funds have been directed toward various forest protection and wildlife conservation initiatives. The analysis of fund utilization, particularly for plantation activities, reveals that while Odisha has consistently met its physical targets, it has struggled to fully utilize the allocated funds. For example, from 2019 to 2023, only 60% of the allocated Net Present Value (NPV) funds were utilized for plantation activities, highlighting a gap between financial allocations and actual spending. The state has also effectively used CAMPA funds for non-core activities such as research, capacity building, and infrastructure development.

Monitoring and evaluation (M&E) play a crucial role in assessing the on-ground implementation of CAMPA activities. Odisha has diligently conducted internal and external

audits since 2009, with external M&E covering periods up to 2021. The reports highlight both the successes and challenges of CAMPA activities, noting that most plantations have performed well, though some have faced issues such as poor site selection and weed infestations.

Odisha's CAMPA implementation has been marked by significant achievements in afforestation and conservation. However, challenges persist, particularly in fund utilization, accurate tracking of forest land diversion, and ensuring the sustainability of community engagement in forest management. Despite these hurdles, Odisha's efforts in forest protection and compensatory afforestation continue to make a positive impact on the state's environmental landscape.

RS-GIS Based Assessment of Forest Cover Quality and Land Use Pattern in Odisha

The results from the analysis of Land Use and Land Cover (LULC), Fractional Vegetation Cover (FVC), and forest canopy cover change detection reveal significant insights into the dynamic changes within CAMPA sites of the selected forest circle.

The analysis of Land Use and Land Cover (LULC) within the CAMPA sites of Rourkela Forest Circle from 2016 to 2023 shows a decrease in Tree Cover from 36.89 sq. km to 35.34 sq. km. Conversely, the Other Vegetation category, which includes newly planted areas, has grown from 5.62 sq. km to 8.32 sq. km. This indicates a reduction in dense forest cover but an increase in areas with sparse trees and new plantations.

Based on the FVC analysis, The non-forest area has increased from 2.05 sq. km to 3.10 sq. km. The Open Forest (OF) class has increased by 1.5 sq. km, rising from 7.32 sq. km to 8.82 sq. km, reflecting an increase in sparse vegetation or small plants. Dense Forest cover has seen a marginal decline, with Moderate Dense Forest (MDF) decreasing from 22.50 sq. km to 19.48 sq. km and Very Dense Forest (VDF) declining from 9.95 sq. km to 9.73 sq. km. Overall, total forest cover (including OF, MDF, and VDF) has decreased by 1.74 sq. km.

Based on the FVC change analysis in the CAMPA sites of Odisha, afforestation has occurred over 0.66 sq. km, deforestation has affected 2.41 sq. km area, enhancement has been observed in over 6.23 sq. km area, while degradation has impacted 9.12 sq. km of area. This indicates that, despite some regions experiencing enhancement in forest quality, there has been a consistent decrease in both the quantity and quality of forest cover over the past seven years.

Haryana

Next case study about Haryana has been chosen to demonstrate how forest diverted from well-forested states is compensated in a state with low forest cover. Haryana has utilized CAMPA funds effectively due to available land, focusing on plantation along roads and railways.

Indicator based Analysis

Haryana, having limited forest cover, experiences relatively few forest land diversions. Despite this, its effective utilization of CAMPA funds for compensatory afforestation activities makes it a significant case for examining compensatory afforestation practices in India. Haryana CAMPA, established in 2010 and reconstituted in 2018 in accordance with the Compensatory Afforestation Fund Act, 2016, functions with a well-defined governance structure. The organization is overseen by three key committees: the Governing Body, led by the Chief Minister of Haryana; the Steering Committee, chaired by the Chief Secretary; and the Executive Committee, headed by the Principal Chief Conservator of Forests. These committees convene regularly, follow prescribed guidelines, and maintain transparency by consistently uploading meeting minutes on their official website.

Haryana's Recorded Forest Area (RFA) is 1,559 sq. km, accounting for 3.53% of its geographical area. The total area diverted for non-forestry purposes is 43.69 sq. km. Interestingly, the compensatory afforestation (CA) and plantation areas are notably larger than the diverted areas, reflecting the state's ability to accommodate compensatory activities. There are 4,934 projects reported, with 2,600 being unspecified (small-scale diversions) and 2,334 categorized (primarily for infrastructure like roads and bridges). Notably, 70.11% of Haryana's Forest area is classified as open forest, indicating a canopy cover of less than 40%. Compensation activities have primarily targeted degraded notified forests.

From 2010 to 2020, Haryana's Forest department planted approximately 182,923.48 plants over 238.76 sq. km, with a diverse range of plantation types, including tall plantations, ridge plantations, avenue plantations, Assisted Natural Regeneration (ANR), urban forestry, and herbal forestry. The survival rate for these plantations stands at 67%, with performance rated as satisfactory to excellent. Wildlife conservation efforts include the establishment and upgrading of facilities, procurement of rescue equipment, and construction of essential infrastructure. NPV funds have supported training programs on patrolling, human-wildlife conflict resolution, and legal issues, enhancing conservation skills. Community initiatives focus on reducing reliance on forest resources through alternative energy sources like biogas and promoting stall-feeding of cattle for biogas production.

Since its establishment in 2010, Haryana CAMPA has emphasized monitoring and evaluation through both internal and external audits. M&E reports are accessible on the CAMPA website, ensuring transparency. Internal monitoring includes inter-range and inter-division checks, with a specialized M&E Division assessing both plantation and non-plantation activities. Out of 22 territorial divisions, 16 have completed internal monitoring. External M&E reports for 2020-21 indicate survival rates ranging from 74% to 83% across different circles, while report for 2019-20 shows an overall survival rate of 80.7%. Internal M&E for 2020-21 reported an overall survival rate of 61.38%, with varying survival rates across circles. Challenges include data management issues, such as outdated or incorrect information on e-Green Watch, and the need for improved record maintenance.

RS-GIS Based Assessment of Forest Cover Quality and Land Use Pattern in Haryana

The results from the analysis of Land Use and Land Cover (LULC), Fractional Vegetation Cover (FVC), and forest canopy cover change detection reveal significant insights into the dynamic changes within CAMPA sites of the selected forest circle.

The analysis of LULC changes in the CAMPA sites, from 2016 to 2023 shows a slight decrease in Tree Cover by 0.08 sq. km from 2.74 sq. km to 2.66 sq. km. Conversely, the Other Vegetation class (including sparse trees and new plantation activities) has increased by 1.08 sq. km from 3.80 sq. km to 4.88 sq. km indicating successful improvement in green cover.

Based on the Fractional Vegetation Cover (FVC) analysis, from 2016 to 2023, the non-forest class within the CAMPA sites decreased from 91.03 sq. km to 87.50 sq. km, signalling increased vegetation growth. The Open Forest area has increased from 3.97 sq. km to 4.64 sq. km. Moderate Dense Forest and Very Dense Forest areas have also increased marginally, from 1.47 sq. km to 1.79 sq. km and 0.26 sq. km to 0.44 sq. km, respectively. The total forest cover, including Open Forest, Moderate Dense Forest, and Very Dense Forest, has increased by 1.17 sq. km. This reflects an overall improvement in forest quality in the region.

Based on the FVC change analysis, there has been afforestation of 3.63 sq. km, deforestation of 2.47 sq. km, enhancement of 0.69 sq. km, and degradation of 0.67 sq. km. An area of 91.59 sq. km experienced no change. This indicates an overall improvement in the quality and quantity of forest cover.

Uttarakhand

Final case study on Uttarakhand shows a state with 71.27% forest area, making in-state compensation difficult due to limited non-forest land. As a result, compensation is often done in other states, leading to ecological and wildlife habitat losses. Uttarakhand was selected to highlight the challenges of compensating for high-quality forest loss.

Indicator Based Analysis

Uttarakhand, known for its rich biodiversity and forest resources, faces significant challenges in managing its natural ecosystems due to increased developmental pressures, particularly in its ecologically fragile mountainous regions. Compensating for lost forest areas through afforestation is a major challenge for the state.

Uttarakhand CAMPA (Compensatory Afforestation Fund Management and Planning Authority) was established in 2009 and has undergone multiple restructurings, including after the CAF Act of 2016. The governance structure includes a Governing Body chaired by the Chief Minister, a Steering Committee led by the Chief Secretary, and an Executive Committee under the Principal Chief Conservator of Forests. These committees meet regularly to oversee the planning and implementation of CAMPA activities.

Uttarakhand's recorded forest area constitutes 71.2% of its geographical area. However, the state struggles to adequately compensate for forest diversion due to the scarcity of non-forest land for afforestation. Most diverted lands have not been fully compensated, with afforestation often taking place on degraded forest lands. The state has seen significant forest diversion, especially for infrastructure projects like roads and bridges, which contribute to forest fragmentation, habitat loss, and increased human-wildlife conflicts.

Since 2009, Uttarakhand has received substantial financial support under CAMPA, with funds allocated for afforestation, forest protection, wildlife conservation, and infrastructure development. Despite challenges, the state achieved 85.2% of its physical targets and 77.6% of its financial targets from FY 2011-2021, contributing to an increase in forest cover by 1,035 sq. km. Uttarakhand CAMPA has been less consistent in monitoring and evaluating its activities. There are no available reports on the state's CAMPA website indicating internal or external evaluations of the funded activities.

RS-GIS Based Assessment of Forest Cover Quality and Land Use Pattern in Uttarakhand

The results from the analysis of Land Use and Land Cover (LULC), Fractional Vegetation Cover (FVC), and forest canopy cover change detection reveal significant insights into the dynamic changes within CAMPA sites of the selected forest circle.

The analysis of temporal variation in LULC within CAMPA sites of Garhwal Circle in Uttarakhand from 2016 to 2023 shows a slight decrease in Tree Cover, reducing by 0.59 sq. km from 65.86 sq. km to 65.27 sq. km. Conversely, the Other Vegetation class, representing newly planted areas, has grown 1.9 sq. km, increasing from 76.58 sq. km to 78.48 sq. km. This indicates successful efforts to enhance the overall green cover in the region.

The Forest Density (FVC) analysis shows a decrease in non-forest area from 28.06 sq. km in 2016 to 26.56 sq. km in 2023, indicating a moderate increase in vegetation. The Open Forest (OF) class has significantly increased from 46.37 sq. km to 58.16 sq. km, reflecting an expansion of 11.79 sq. km. Conversely, the total dense forest cover has seen a marginal decline, with the Moderate Dense Forest (MDF) reducing from 44.6 sq. km to 41.04 sq. km and the Very Dense Forest (VDF) decreasing from 13.51 sq. km to 6.57 sq. km.

There has been afforestation of 17.43 sq. km, deforestation of 16.14 sq. km, enhancement of 10.82 sq. km, and degradation of 27.29 sq. km, while 88.57 sq. km remained unchanged. This indicates a moderate decline in the overall quantity and quality of forest cover in the CAMPA sites over the 7 years.

Challenges

The implementation of compensatory afforestation in India, even though guided by well-established rules, faces numerous challenges that affect its effectiveness. First, there is a substantial discrepancy between the land diverted for non-forest purposes and the land identified for compensatory afforestation, exacerbated by limited availability of non-forest land in densely populated areas. Additionally, the replacement land often consists of fragmented parcels, hindering effective ecological restoration. Underutilization of funds is another critical issue, with many states consistently falling short of their financial targets, achieving less than 20% of their goals in most years. Moreover, inadequate record-keeping across many states further complicates efforts, with essential documents and reports often missing or poorly maintained, undermining transparency and accountability in the CAMPA process. These challenges underscore the need for improved land management, better fund utilisation, and robust record-keeping to enhance the effectiveness of compensatory afforestation programs.

Suggestions

Based on the analysis and its findings, the following recommendations have been proposed to enhance the implementation of CAMPA:

1. Enhance Data Transparency: States and UTs should upgrade CAMPA websites to include comprehensive and current data, such as Annual Plans of Operation (APOs), Monitoring and Evaluation (M&E) reports, and expenditure details. Regular updates to the e-Green Watch portal and state CAMPA websites are essential.

2. Address Land Issues: States should consolidate land for compensatory afforestation to prevent fragmentation. Establish Land Banks for identifying degraded and potential non-forest land, considering soil quality. Promote inter-state coordination to address land availability challenges.

3. Improve Fund Utilization: Implement stricter guidelines and audits to ensure efficient use of funds. Provide capacity-building programs for state forest departments to enhance project planning, execution, and monitoring.

5. Revise Policy Framework: Periodically review and adjust Net Present Value (NPV) rates to reflect the value of ecosystem services lost. Ensure afforestation efforts account for local ecological and climatic conditions.

6. Promote Community Involvement: Engage local communities in afforestation projects and develop benefit-sharing mechanisms to incentivize their participation.

7. Advance Research and Development: Support research on innovative afforestation techniques and utilize advanced data analytics and GIS for improved planning and monitoring.

Conclusion

This report provides a comprehensive evaluation of Compensatory Afforestation (CA) in India, examining its status, achievements, and challenges. It begins by analyzing the policy and legal frameworks governing CA, highlighting gaps between policy directives and actual implementation, which underscores the need for continual policy updates to address evolving environmental issues. The review reveals significant disparities in CA performance across states, with some demonstrating progress while others lag. Notably, cases in Haryana and Uttarakhand illustrate a disconnect between documented compliance and genuine implementation, with compensatory measures sometimes failing to offset environmental degradation effectively. Additionally, infrastructure development, particularly roads and bridges, has contributed to forest fragmentation and increased human-wildlife conflict. Remote Sensing and GIS analysis of CAMPA sites from 2016 to 2023 indicates varying outcomes. For example, Haryana has seen improvements in forest quality, while Odisha shows decrease in total forest cover over the past seven years. Conversely, Uttarakhand has experienced both new plantations and broader forest degradation trends. Key challenges identified include land unavailability and fragmentation, inefficient fund utilization, and inadequate record maintenance, which hinder effective afforestation. Limited transparency and data accessibility further complicate management and accountability. To address these issues, recommendations include improving data transparency, consolidating land for afforestation, enhancing fund utilization, and strengthening monitoring and evaluation. Revising Net Present Value (NPV) rates periodically and ensuring community involvement are also essential to bridge the gap between policy and implementation and promote sustainable afforestation efforts.

1. Introduction

Forests play a crucial part in sustaining life on our planet. They are important for people's lives, homes and livelihoods and have a crucial role to play in tackling the biodiversity and climate crisis. However, forests have been inadequately destroyed to provide for the needs of the humankind. According to FAO, in around 3000 B.C, nearly 80% of India was forested but the subsequent invasions changed the entire landscape, and first era in deforestation was shortly after absorption into British Empire. Second major deforestation was in 1940s with demands of World War II and transition to independence for India and Pakistan in 1947. In late 1950s and early 1960s, major diversions were undertaken for farming, as agriculture was given priority. 1970 to 1980 witnessed acute shortage of fuel wood and fodder in rural areas resulting in further exploitation along with the settlement of refugees in the forest areas.

The best way to conserve forest is to let it stand without interference, however that would be too idealistic to achieve. When the subject of concern is not just forest, and we take the entire progress of a country in consideration, development is inevitable. Unfortunately, it is almost impossible to execute several developmental projects in space where forests can be put out of question. It is crucial to come at a common ground where development and conservation can work around parallelly. It becomes utmost important that there exists a system where it can be analysed whether the development work is worthy of the sacrifice of forest, and if sacrificed, how can the loss be incurred if not compensated.

Thus, Forest (Conservation) Act (FCA) was enacted on 25th October 1980 to check on alarming rate of deforestation in India. The basic objective of the act is to regulate the indiscriminate diversion of forest lands for non-forestry uses and to maintain a logical balance between the developmental needs of the country and the conservation of natural heritage. The act has succeeded in controlling the indiscriminate release of forest land for non-forestry purposes. Prior to 1980, the rate of diversion of forest lands for non-forestry purposes was about 1430 sq. km per annum but, with the advent of the FC Act, 1980, the rate of diversion of forest lands has come down to around 150 sq. km per annum. The diversion of forest land is allowed to meet the developmental needs for Drinking water projects, Irrigation projects, Transmission lines, Railway lines, Roads, Power projects, Defense related projects, Mining etc. (MoEF&CC).

The Forest (Conservation) Act, 1980 introduced the concept of "Compensatory Afforestation". It means "afforestation done in lieu of the diversion of forest land for non-forestry use under the Forest (Conservation) Act, 1980".As per the Forest (Conservation) Act 1980, whenever forest land is to be diverted for non-forestry purpose, usually the

conditions relating to transfer, mutation and declaration as Reserve Forest/ Protected Forest, the equivalent non-forest land for compensatory afforestation and funds for raising compensatory afforestation etc. are to be imposed.

As will be explained further below, compensatory afforestation is much more than just afforestation. The compensation for forest area diverted is in terms of land and fund, not just for afforestation but also to compensate the ecosystem services lost. Based on the kind of project, various kind of fund are imposed that are further to be utilised for forest conservation. It covers a wide range of activities, including compensatory afforestation, catchment area treatment, assisted natural regeneration, forest fire prevention and control, soil and moisture conservation in forests, wildlife management, improvement of wildlife habitat, management of biological diversity and biological resources, research and innovation in forestry, and monitoring and evaluation of compensatory afforestation works.

Objectives of the Study

The study aims to evaluate the effectiveness of compensatory afforestation in meeting the goals, as outlined in the current policy framework. This involves examining the implementation status and outcomes of the Compensatory Afforestation Fund Management in India, identifying challenges within the compensatory afforestation framework, and developing a set of recommendations.

The specific tasks of the study include:

- **Legislation and Procedure Review**: Analyse the laws and procedures related to land diversion and compensatory afforestation.

- **Assessment of Fund Utilization and Management**: Assess the use and management of funds collected for land diversion based on available data.

- **Monitoring and Evaluation through Remote Sensing-GIS:** Effective monitoring and assessment of forest density and tree cover in CAMPA sites are essential for ensuring the success of compensatory afforestation.

- **Identifying Challenges and Suggesting Recommendations**: Identify challenges in the design and implementation of compensatory afforestation and provide recommendations.

- **Stakeholder Engagement**: Share findings with stakeholders and invite their comments.

Given the pressures of a growing population and escalating climatic challenges, especially for a developing nation like India, enhancing the system's efficacy is crucial. We believe, this can be achieved through a sustainable development approach that addresses the needs of a burgeoning economy while also providing solutions to the pressing issue of climate change. The purpose of this report is to propose potential improvements to the existing framework, rather than to highlight its shortcomings.

Expected outcomes from the report:

- Understanding of intricacies around different laws and regulations related to diversion of forest land for development works and compensatory afforestation activities.

- The outcomes from the RS-GIS based assessment are expected to enhance the understanding of forest dynamics within CAMPA sites, aid in better planning and implementation of conservation strategies, and promote sustainable forest management across India.

- Understanding the challenges of compensatory afforestation in India thoroughly validated from different stakeholders.

- Recommendations from subject matter experts which would guide policy makers in better decision making.

2. Methodology

The methodology adopted for the study on implementation of compensatory afforestation follows a systematic approach where different segments of the program have been analysed through various methods for identification of challenges, if any, and suggestions have been thus recommended.

The entire flow of the report has been summarised below in Figure 1. There are three broad methods used for building up on the analysis. The qualitative and quantitative analysis has been presented under two broad headings i.e., review of the policy and legal framework and review of the implementation of the program, and further recommendations have been put forward to address the challenges identified.

Figure 1: Overview of the Methodology
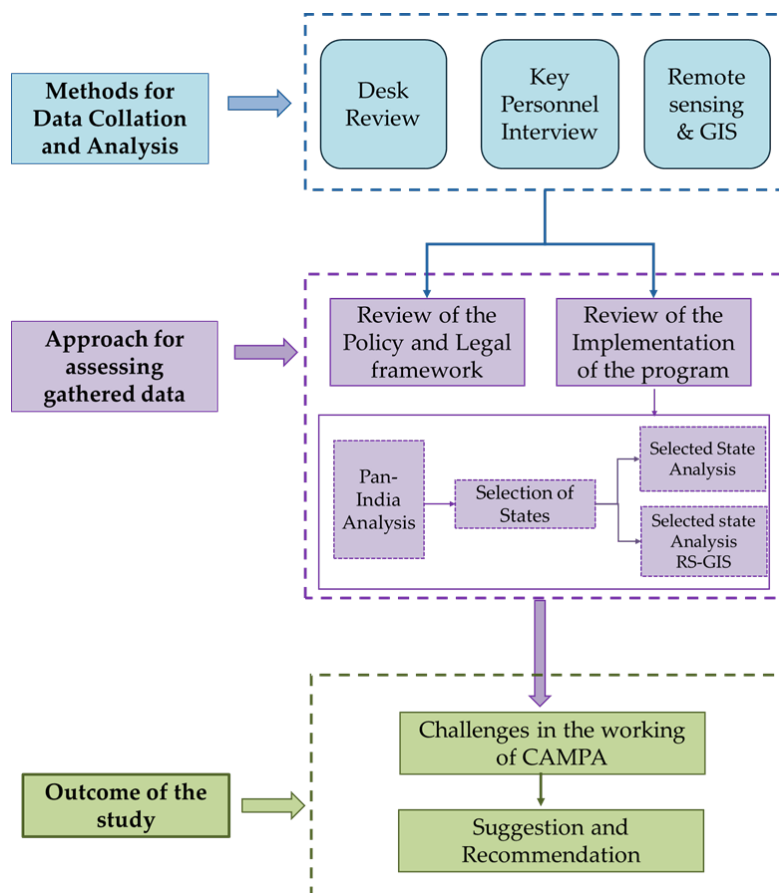
The entire methodology has been broken down into different sections and has been explained in detail in the following section.

2.1 Methods for Data Collation and Analysis

For this study, the collation of data, evidence and information has been done through the data available in public domain. There are different data sources used for building up the analysis through each method. The data sources have been summarised below in Figure 13.

Figure 2: Data Sources for each method

#1 Desk Review
- Government Portals (e – green watch & Parivesh)
- Acts, Rules and Guidelines
- Systematic Review of Literature
- State CAMPA Websites

#2 Remote sensing & GIS
- e – green watch
- USGS Earth Explorer

#3 Key Personnel Interview
- State CAMPA CEOs
- Divisional Forest Officers
- M&E Agencies
- Experts on the subject
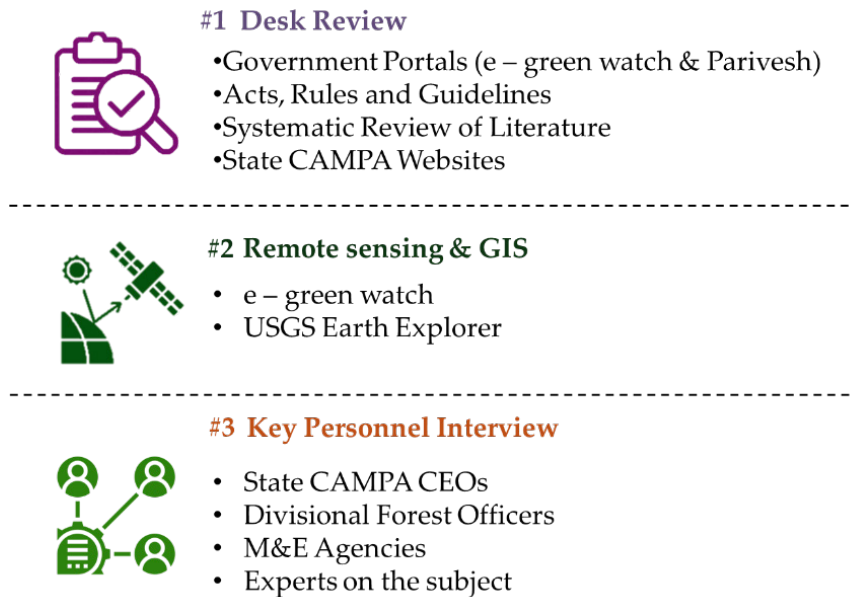
The details of each method have been explained in the following section.

2.1.1 Desk Review

The primary objective of desk review is to identify the data sources and assess the information available on the sources identified. For the review of compensatory afforestation in India, four major sources were identified, which are explained below:

Acts, Rules and Guidelines

The implementation of compensatory afforestation in India has been set under the guidance of various laws, rules and guidelines. These policies and laws have been studied to bring light on the concept and mechanism of compensatory afforestation.

Highlights from each of the major legislative framework are described in further sections of this report. It also contains review of the milestones that took place in between to formulate the whole series of amendments and improvisations in the implementation of compensatory afforestation in India.

Online Government Portals

The two major online Government portals for locating the data on land diversion and compensatory afforestation, that are '*e-green watch*' and '*Parivesh*', have been used.

a.   **e-Green Watch**

It is an integrated e-Governance portal for automation, streamlining & effective management of processes related to plantation & other forestry works under various heads of expenditures, as allowed under the CAMPA guidelines (e-Green Watch).

The system is designed and targeted to be mainly used by all Range Offices, Division Offices, State Forest Departments, MoEF&CC, Forest Survey of India and agencies responsible for the evaluation of Forestry works. The forest department officials upload the data on the portal for their respective region under various heads as per the manual. The kind of information that can be accessed from the portal is mentioned below:

1.   Details of project approved under the Forest (Conservation) Act, 1980
2.   Details of land diverted in a particular range, division, circle or state.
3.   Details of land identified for execution of work through CAMPA funds
4.   Details of plantation and non-plantation work done through CAMPA funds
5.   Funds allocated to the state and received by the state
6.   Polygons of the land diverted, land identified and plantation work

This has been further described in the Annexure 1 along with figures for better understanding. *e-green watch* forms the base of our quantitative analysis of the implementation of compensatory afforestation in India. The data from *e-green watch* has been extracted as per requirement and analysed to meet the objectives of the study.

b.   **Parivesh**

PARIVESH (Pro-Active and Responsive facilitation by Interactive, Virtuous, and Environmental Single Window Hub) has been developed by the MOEF&CC through NIC to ease the process of environmental clearance, forest clearance and wildlife clearance through a digital Single-Window Integrated Environmental Management System.

While *e-green watch* majorly deals with the utilisation of funds, *Parivesh* deals with the land diversion aspect of this program. All the projects that are seeking land diversion must be uploaded on Parivesh Portal. The proceedings and documentation thus required for final approval of the proposal is executed on the portal itself. Furthermore, it maintains database of the Annual Plan of Operation (APOs) of different states, along with the sanction letters mentioning the amount of funds sanctioned to each state for compensatory afforestation activities (Parivesh).

Systematic Review of Literature

Systematic Literature Review is an independent academic method that aims to identify and evaluate all relevant literature on a topic to derive conclusions on the subject. For this study, the systematic review approach was adopted using google search engine and Harzing data app for research papers and articles. Keywords such India, CAMPA, Compensatory Afforestation and Land Diversion were used in different combinations to identify the relevant literature.

Figure 3: Systematic Review of Literature
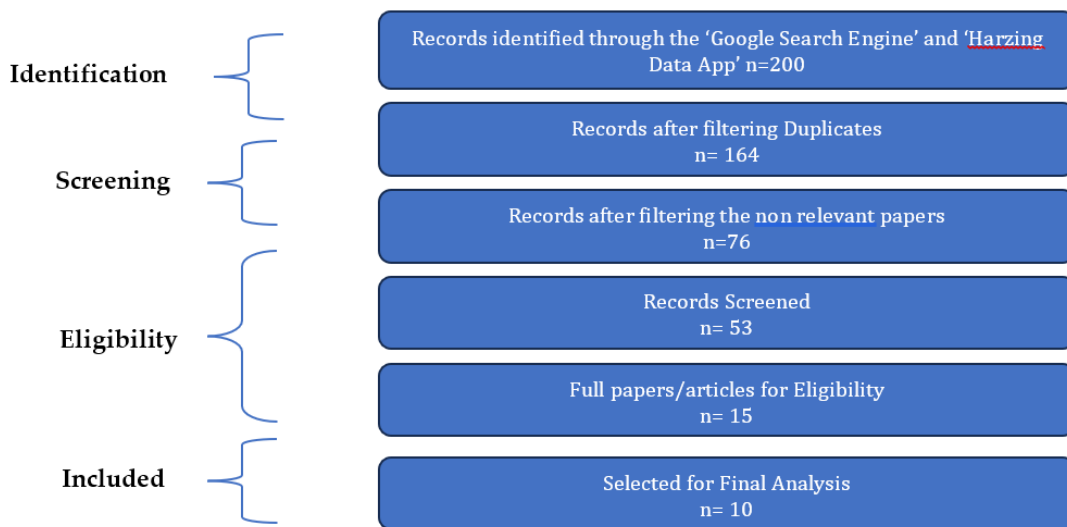
The research papers and articles selected for analysis have been reviewed and mentioned in Section 4.1.2 of the report.

State CAMPA Websites

The State specific CAMPA websites are available for most states in the country and contains information related to working of state CAMPA. It contains information such as details of CAMPA cell, APOs (Annual Plan of Operation), Annual Reports, M&E Reports (Monitoring and Evaluation Report), photographs of the activities and other relevant information.

2.1.2   Remote Sensing and GIS

To study the status of forest quality as well as land-use pattern in the CAMPA sites, machine learning based algorithm is developed for spatio-temporal variation in forest density and land use land cover pattern over the period of analysis. Spatio-temporal variation in Land Use Land Cover (LULC) as well as forest density of the CAMPA sites in the selected sites is assessed using cloud free (less than 20%) multi-temporal and multi-spectral satellite imageries. Machine-leaning based supervised classification algorithms such as Random Tree Classifier is used for temporal land cover analysis whereas linear spectral algorithm & forest canopy density model is used for the monitoring of forest cover variation.

Study Area

The RS GIS-based analysis to assess the tree cover and land use patterns of CAMPA sites has been conducted for selected circles of the states selected. The KML files for the CAMPA sites have been accessed from the e-Green Watch portal, primarily focusing on records after 2016. Forest Circles have been selected based on two key parameters: the maximum number of plantation work sites and the maximum number of Compensatory Afforestation (CA) work sites. Following this, districts in which these circles are located have been identified using the district shapefile of India (Survey of India) and corroborated with official documents of the respective state forest department. This approach provides a robust framework that may be replicated across India for a comprehensive assessment of plantation status within the CAMPA sites.

Methodology

Data Procurement

In this study, advanced GIS algorithms and remote sensing techniques have been employed to evaluate the forest quality and land-use patterns within selected CAMPA sites across India. The analysis focused on the period from 2016 to 2023, utilizing high-resolution multi-spectral Landsat 8 and Sentinel-2 satellite imagery to capture spatio-temporal variations in forest density and Land Use Land Cover (LULC) patterns.

Forest density has been assessed by calculating the Fractional Vegetation Cover (FVC) using a machine learning-based spectral un-mixing algorithm applied to NDVI imagery from Landsat 8, downscaled to 10m. This approach allows for the observation and quantification of changes in vegetative cover. For the Land Use Land Cover (LULC) assessment, the Random Tree Classification algorithm has been employed on High-Resolution Sentinel 2 satellite data. This method enables the precise identification and categorization of various land cover types, as well as a clear depiction of spatial distribution and temporal changes in land use (IPCC, 2003; Penman et al., 2003). Detailed Information on satellite imageries procured has been listed in Annexure 6.

To assess the Forest canopy cover within the CAMPA sites, change maps of Fractional Vegetation Cover (FVC) for the years 2016 and 2023 have been developed for the respective states. By comparing these FVC maps, the analysis monitors and highlights various trends, including afforestation, deforestation, degradation, and enhancement of forest density over the study period. These change maps provide a comprehensive view of how forest canopy cover has changed over time, pinpointing areas where tree canopy density has either improved or degraded.

The results derived from the analysis of Land Use and Land Cover (LULC) and Fractional Vegetation Cover (FVC) provide crucial observations into the spatio-temporal changes within the CAMPA sites across the selected states. Subsequently, detailed maps have been prepared to visualize these changes complemented by comprehensive statistical analyses quantifying the extent and nature of land cover transformations in the studied regions.

Temporal Variation of LULC of CAMPA sites

Land use and land cover (LULC) is a broad framework that combines terrain features and landscape activities, providing a systematic approach to examine and analyse changes over time (Areendran et.al., 2013). Comparing and analysing LULC across different periods is crucial for understanding spatio-temporal changes in the landscape (Badapalli et.al., 2023). Flowchart for the Land use land cover maps and change detection methodology have been shown in fig 15.

Figure 4: LULC Methodology
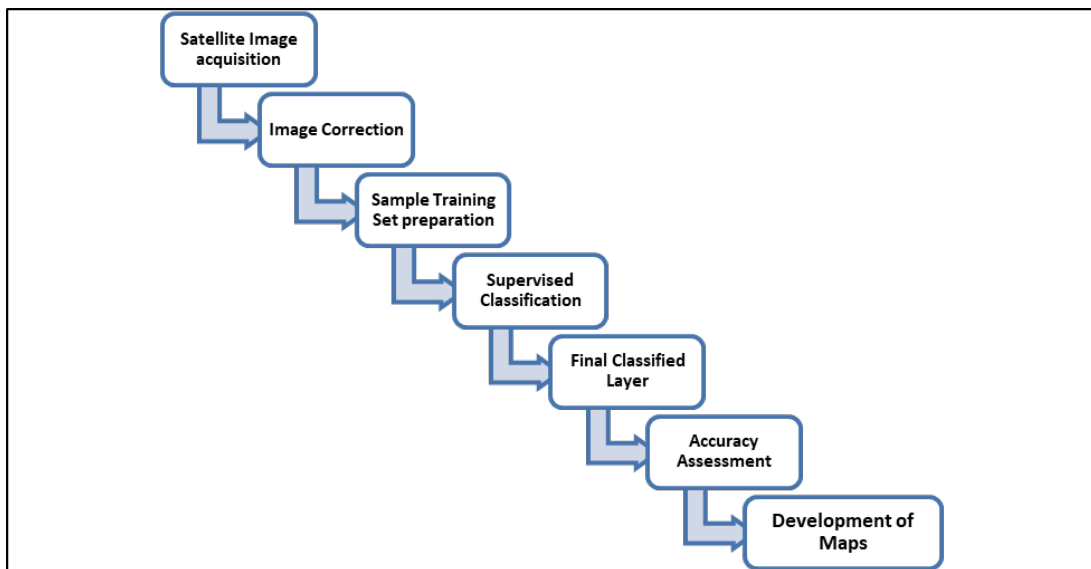
LULC has been developed for the districts for 2016 and 2023 using Sentinel-2 imagery with a resolution of 10 meters. Several distinct land cover classes have been identified, such as Tree cover, Agricultural land, Built-Up, Water bodies, Barren land, Other vegetation, and Snow/Ice. The proposed classification scheme offers consistency owing to the LULC distribution in the study region (Karra et.al., 2021).

Table 1: LULC Class Description

Class	Description
Agriculture	Refers to human-cultivated areas where cereals, grasses, and crops are grown, typically not reaching the height of trees
Other Vegetation	These open areas are predominantly covered in uniform grasses and low vegetation, including wild and human-planted fields. They often feature small, man-made plantations and sparse vegetation. Examples include natural meadows and fields with low to sparse tree cover, open savannas with few to no trees, and maintained spaces such as parks, lawns, and pastures.
Built-Up	Areas containing man-made structures and other homogenous impervious surfaces like buildings, housings, road and rail networks
Tree Cover	Areas with significant clustering of tall vegetation (trees) with a dense or closed canopy

Class	Description
Barren Land	Regions are characterized by exposed rock or soil with minimal to no vegetation throughout the year.
Snow/Ice	Extensive, uniform regions covered by permanent snow or ice
Water bodies	This includes the region where water is present predominantly throughout the year. It takes into account both natural and man-made water sources like rivers, ponds, and canals

Source: IPCC Good Practices Guidance

Temporal variation of Forest Density within CAMPA sites

The fractional vegetation cover (FVC) is the projected percentage of vegetated area in the total study area (Gitelson et al., 2002). This metric not only reflects plant photosynthetic surfaces and vegetative density but also indicates vegetation growth trends (Gao et al., 2017; Wen et al., 2013). FVC is crucial for assessing vegetation health and ecosystem dynamics. The advancement of geospatial technology has facilitated FVC calculation, with the Linear Spectral Un-Mixing (LSU) model being widely employed for estimation. The flowchart of the methodology adopted for the assessment of forest canopy cover has been described below:
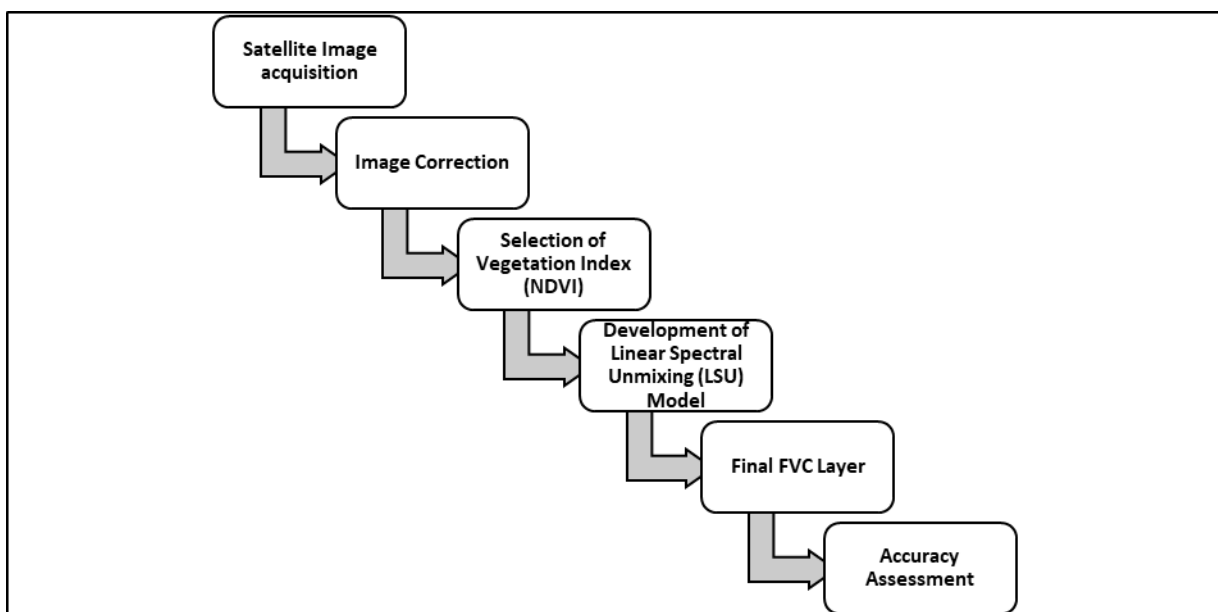
Figure 5: FVC Methodology

Here, the Normalized Difference Vegetation Index (NDVI) has been used to calculate FVC.

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

NDVI helps assess vegetation health and stress. The combination of NDVI with Red and NIR bands enhances the satellite data for differentiating vegetation classes from non-vegetation classes. The NDVI value ranges from -1 to +1. Higher values of NDVI indicate the

highest possibility of vegetation density. Bare soil is represented with NDVI values which are closest to 0 and water bodies are represented with negative NDVI values (Karaburun, 2010; Chouhan and Rao, 2011; Ramachandra and Kumar, 2004; Xie et al., 2010).

The NDVI (Normalized Difference Vegetation Index) has been used to calculate the Fractional Vegetation Cover (FVC) with the formula:

$$FVC = (NDVI - NDVI_{Baresoil} / NDVI_{canopy} - NDVI_{Baresoil}) * 100$$

Here, $NDVI_{canopy}$ has represented the endmember with 100% canopy cover (zero vegetation gap fraction), and $NDVI_{Baresoil}$ has indicated the endmember for bare soil where the vegetation gap fraction is 100%.

The final FVC (Fraction vegetation cover) layer for the years 2016 and 2023 has been developed using LSU model. Areas with FVC values below 20% have been removed and delineated as non-forest. Then the FVC values have been rescaled from 0 to 100% and categorized into forest classes (i.e., Very Dense, Moderate Dense, Open Forest, and Scrub) based on the ISFR (FSI, govt. of India) scheme of classification for forest cover assessment.

Table 2: Description of Forest Cover Class

Class	Description
Very Dense Forest	All Lands with tree cover of canopy density of 70% and above
Moderately Dense Forest	All lands with a tree cover of canopy density between 40% and 70% above
Open Forest	All lands with a tree cover of canopy density between 10% and 40%
Scrub	All forest lands with poor tree growth mainly of small or stunted trees having canopy density of less than 10 percent
Non-Forest	Any area not included in the above classes with negligible or no canopy cover

Source: Forest Survey of India (FSI)

Area statistics have been calculated for the FVC within the CAMPA sites for both years, allowing for a comparative analysis of vegetation changes over time. Additionally, maps and graphs have been created to illustrate and quantify the trends in FVC for each study period.

Forest Canopy Cover Change Detection within CAMPA Sites

Change detection quantifies the changes that are associated with Forest Cover (FC) changes in the landscape using geo-referenced multi-temporal remote sensing images acquired on the same geographical area between the considered acquisition dates (Ramachandra and Kumar 2004). An important aspect of change detection is to determine the change dynamics within the Forest Cover/ Density class (i.e., which FC type is changed to the other type of FC class). To clearly understand the source and destination of major FC changes, change matrix for each period would have to be analyzed. For

change analysis, change matrices would have to be generated for the different time periods to analyze changes in the area covered by different FC classes. This would be done by comparing the number of pixels falling into each category of FC in one time-period with the categorization of the same pixels in same/different class in the previous time-period.

Change in classes = MATRIX (time 1, time 2)

The data gathered from the generated matrix would be further rearranged to prepare the FC change matrix. Forest density change maps would be prepared for each of the two consecutive time periods by intersecting FC maps of two successive time periods. The description of the forest cover change classes is provided in Table 3.

Table 3: Description of the forest cover change class

Class	Definition
Afforestation	Afforestation is the direct human-induced conversion of land that has not been forested, for few decades, to forested land through planting, seeding, and/or the human-induced promotion of natural seed sources
Deforestation	It is the direct human-induced conversion of forested land to non-forested land. Deforestation is also marked as the drastic decrease in carbon forest carbon stock in forest strata
Enhancement	Increase in the density or average size of trees in a stand. Consequently, enhancement indicates the increase in the carbon stock in forest strata
Degradation	The direct human-induced long-term reduction of the overall potential supply of benefits from the forest, which includes carbon, wood, biodiversity, and other goods and services

Source: Forest Survey of India (FSI)

Change maps of FVC between 2016 and 2023 have been developed to provide a more detailed assessment of afforestation, deforestation, degradation, and enhancement within the CAMPA sites. These change maps offer a clear visual representation of how tree density has varied over the years, highlighting areas of significant change.

2.1.3   Key Personnel Interview

For a subject such as land diversion and compensatory afforestation, it becomes necessary to get insights and inputs from the officials that have been directly involved in the process. Thus, various experts have been identified at different levels to get a first-hand knowledge regarding the implementation of compensatory afforestation in India. The officials and staff shall be consulted, in a mere interactive interview for identification of challenges faced during the implementation and the changes that can be put forward to address the challenge. It shall include the authority of the CAMPA at the national level, the authority of State CAMPA, CEO CAMPA of selected states, DFOs and staff of the forest department at the ground level.

2.2   Approach for Assessing Gathered Data

The various data and information thus collated has been reviewed to understand the policies, laws and working of this entire process involving land diversion, compensatory afforestation and utilisation of funds. The review has been divided into following major sections:

• Review of the policy and legal framework: This sets the base for the history, concept and processes involved in the implementation of CA, and

• Review of the implementation of the program that will further deep dive into the actual working of the CA and identification of challenges. The second section is further divided into:

    • National analysis, and;

    • Analysis of selected states for addressing the specific issues pertaining to the execution of the program.

The type of analysis put forward, the broad method and data sources used for different sections of report has been summarized in the table below:

Table 4: Approach for assessment of the gathered data and information

S. No.	Section		Type of Analysis	Method	Data Sources Used
1.	Review of Policy and Legal Framework		Qualitative	Desk Review (Systematic Review of Literature) KPIs (Key Personnel Interviews)	• Acts, Policies and Guidelines • Published literature • Online Government portals • Grey literature
2.	Review of the Implementation of the Program	National Analysis	Qualitative and Quantitative	Desk Review (Systematic Review of Literature)	• Online Government portals and state CAMPA website • Published and Grey literature
		State Analysis	Qualitative and Quantitative	Desk Review (Systematic Review of Literature) KPIs (Key Personnel Interviews)	• Online Government portals and state CAMPA website • Published and Grey literature
				Remote Sensing Analysis	• e-Green Watch • USGS Earth Explorer

The different sections have been explained below in brief to highlight the insights that have been reflected in the report.

2.2.1 Review of the policy and legal framework

For a complex system such as this, it is very important to understand the legal framework abiding which the procedures are being executed. The section has the gist of the acts, rules and guidelines that have been enacted to set the process in place. It starts with the history and chronologically follows through the milestones to set the theme for further analysis. The articles and papers shortlisted through the systematic review of literature will be highlighting the different perceptions of experts on the policy and amendments undertaken in the course of time.

2.2.2 Review of the implementation of the program

The section focuses on the management and implementation of the program, the quantitative analysis of the states based on the data available and the subjective analysis through literature. It will further lead to identification of challenges and setting up of recommendations for improvement.

National Analysis

It includes both the quantitative analysis done through data extracted from online government portals, and qualitative analysis through review of literature. It also examines the implementation of the program in particular states through state CAMPA websites.

Selection of States

Further, the data examined during the national analysis helped to narrow down the in-depth analysis to three states. Seven parameters have been chosen to score each state/UT, further to which three states have been opted out. The details of the selection have been provided in the section 4.2.

Analysis of selected state

The states selected under the previous section have been thoroughly analysed using Systematic Review of Literature, reports available on state CAMPA websites, the data on e- green watch and Remote Sensing and GIS. An evaluation and grading framework has been developed and states have been analysed on the parameters set in the framework.

The analysis of selected states is a two-way approach. First, an indicator-based analysis and secondly, a Remote Sensing and GIS-Based Assessment of Forest Cover Quality and Land Use Pattern.

a) **Indicator Based Analysis of the state**

The focus remains on organization, the procedures involved, the project preparation and flow of funds involved in the compensatory afforestation. The different indicators used in the analysis have been described below:

- **Institutional Design -** This parameter shall assess the organisational structure in place for the smooth flow of funds received from the user agencies towards compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, net present value (NPV) of forest land, Catchment Area Treatment Plan Funds. It focuses on the establishment of State CAMPA, the efficiency of the governing body, steering committee and Executive Committee formed within and the effective implementation of the conservation activities with the State Forest Department.

- **Diversion of Forest land and Compensatory Levies -** This parameter shall assess that proper procedure and process are in place to seek approvals and the same are sought from the concerned authorities in case of diversion of a forest land for a non – forestry purpose and the considerations have been made in case forest land within the protected area and the kind of non – forestry purpose.

- **Utilization of funds -** This assesses the safe, secure and transparent utilization of funds and appropriate on – ground implementation of compensatory afforestation and other conservation activities. The State and Union territories are required to submit the Annual Plan of Operations (APO), prepared by State CAMPA in accordance with the provisions of CAF Act, 2016 and Rules and the APO shall be reviewed to obtain information regarding the details of plantations, the survival rate, allocation of land for compensatory afforestation and other activities. The parameter shall also assess that the funds collected from the user agency as per specific purpose are collected and utilised appropriately.

- **Monitoring and Evaluation (M&E) -** An independent system of concurrent monitoring and evaluation should be evolved and implemented through the Compensatory Afforestation Fund to ensure effective and proper utilisation of funds. Thus, the parameter shall assess that the internal M&E and external M&E through a third party. The reports and conclusions thus withdrawn will be assessed for the success of compensatory afforestation in the state.

b) **Remote Sensing and GIS-Based Assessment of Forest Cover Quality and Land Use Pattern**

The RS (Remote Sensing) and GIS (Geographic Information Systems) approach offers a comprehensive and efficient means to monitor forest resources over extensive areas and through different time periods (Soubry et al., 2021). Remote Sensing involves acquiring data about the Earth's surface via satellite or aerial sensors, capturing data in various spectral bands to analyse vegetation characteristics, forest canopy cover, and land use changes over time. GIS complements this by providing a framework to gather, manage, analyse, and visualize spatial data. When combined, RS and GIS provide a robust platform for mapping, monitoring, and managing forest ecosystems with high precision and accuracy.

The results obtained from the analysis of land use and land cover (LULC), fractional vegetation cover, as well as forest canopy cover change detection highlights significant insights into the dynamic changes that have occurred within CAMPA sites of the selected forest circles. Utilizing satellite datasets, the respective layouts have been prepared along with relevant area statistics. The detailed methodology has been explained in the section 2.1.2.

2.3   Challenges, Recommendations, and Stakeholder Validation

The information collected and its further analysis will be used for the identification of challenges that exist in the implementation of compensatory afforestation in India. Based on the challenges identified, recommendations will be put forward to further enhance the efficiency of the existing system. For further strengthening of the national and state specific inputs, challenges and recommendations, stakeholder consultation will be carried out comprising of government authorities, user agencies, individual experts, academic experts and third-party evaluators (people who have already been involved in third party monitoring and evaluation of the CAMPA activities of the state).

3. Review of the Policy and Legal Framework

The initiation of compensatory afforestation was after the enactment of Forest (Conservation) Act, 1980. However, there's a brief history attached to the enactment of this law. It dates back to 1972 when United Nations Conference on the Human Environment was held in Stockholm. Popularly known as, Stockholm Conference, 1972 was the first world conference to make environment a major issue. The participants adopted a series of principles for sound management of the environment including the Stockholm Declaration and Action Plan for the Human Environment among several other resolutions (United Nations).

The then Prime Minister of India, Smt. Indira Gandhi, got inspired by the discussions held and enacted the 42nd Amendment in 1976 which brought major changes to the Constitution of India. It added Article 48(A) to the Directive Principles of State Policy which states that the "The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country." Similarly, Article 51(A), clause (g) was also introduced which states that "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures" (Indian Bar Association).

One of the major changes in the 42nd Amendment was the transfer of five subjects from State list[1] to the Concurrent List[2]. These were Education, Forests, Weights & Measures, Protection of Wild Animals and Birds, and Administration of Justice. The transfer of Forests from the state list to the concurrent list emphasised the role of the central government in the management of forests.

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1 The State List is a list of 61 items given in the Seventh Schedule to the Constitution of India. It includes the power to be considered by state government.

2 The Concurrent List is a list of 52 items given in the Seventh Schedule to the Constitution of India. It includes the power to be considered by both the union and state government.

Despite the spreading of global consciousness and concurrent policy pronouncements, large scale denudations as well as encroachment of forest land continued across the country. This led to the enactment of the Forest (Conservation) Act, 1980. The Forest (Conservation) Act has been credited to some extent in retarding the process of deforestation in the country. From a legal perspective, the Forest (Conservation) Act, 1980 merely shifts the power for decisions concerning forest land use from the State to the Centre (Upadhyay & Upadhyay, 2002). There was no mention of the term "Compensatory Afforestation" in the Act. It was the Forest (Conservation) Rules, 1981 that introduced the term and the process for its execution. Ever since then, from time to time, various rules, amendments, guidelines, acts have been implemented to further strengthen the process of compensatory afforestation.

Conceptually, there are two aspects to this procedural framework, one being the diversion of forest land for non-forest use and collection of funds, while the other being the management and utilization of funds collected in lieu of the diversion. While land diversion and collection of funds was procedurally very well put forward in the Forest (Conservation) Rules, 1981, it was not until 2002 that the need for a system for utilization of funds was recognised.

As per the requirements, changes have been made in the system, both pertaining to land diversion and utilization of funds. This has been summarized in the timeline depicted below and explained in detail in further sections.

Figure 6: Brief timeline of the different acts and rules that were enacted along with major milestones

Land Diversion

Utilization of Funds

Forest (Conservation) Act, 1980 — **1980**

Forest (Conservation) Rules (FCR), 1981 — **1981**

Forest (Conservation) Amendment Act, 1988 — **1988**

2002
- SC directed that "Compensatory Afforestation fund" is to be Created
- Inclusion of Net Present Value

Forest Conservation Rules, 2003 — **2003**
* Superseded FCR, 1981

2004 — Notification of CAMPA

2006 — Operationalization of Ad-hoc CAMPA

2009 — Guidelines on State CAMPA

In 2013, CAG Audit Report was released

2016 — Compensatory Afforestation Fund Act, 2016

2018 — Compensatory Afforestation Fund Rules, 2018

Forest Conservation Rules, 2022 — **2022**
* Superseded FCR, 2003

Forest Conservation Amendment Act,2023 — **2023**

Forest Conservation Rules, 2023
* Superseded FCR, 2022

Legends

☐ Superseded /Inactive

☐ Functional/Active

43

As depicted in the figure above, the active legislatures pertaining to both the aspects are as follows:

- Land Diversion and Collection of Funds
  - Forest Conservation Act, 1980 with amendments in 1988 and 2023
  - Forest (Conservation) Rules, 2023

- Utilisation and Management of Funds
  - State CAMPA Guidelines, 2009
  - Compensatory Afforestation Fund Management Act, 2016
  - Compensatory Afforestation Fund Management Rules, 2018

The regulations, rules and guidelines mentioned in the legislature have been explained below in the following sub-section.

3.1   Land Diversion and Collection of Fund

Forest (Conservation) Act, 1980 is the principal act that mandated the approval of central authority for diversion of forest land for a non-forest purpose (GOI, 1980). It is not a prohibitory act but a regulatory act which implies that the act does not itself ban any non–forest activity or the de-reservation of forest land. All it requires is that the permission of the central government be secured for such actions. Under the Act, no state Government can authorize such conversion without securing the Central Government's approval (Upadhyay & Upadhyay, 2002).

Though the FC Act regulates the process of diversion, it rather came through as a shortcoming that only lands that were notified as reserve forest or protected forest came under the purview of this act. A major decision was taken against this in the *T.N. Godavarman Thirumalpad Etc v Union of India and ors* case that changed the concept of areas that come under the purview of this act and in described below.

> ### *T.N. Godavarman Thirumalpad Etc v Union of India and ors*
> Godavarman Thirumulpad, popularly known as "the green man" for his litigation efforts for conservation, filed a writ petition with the India Supreme Court in 1996 to halt illegal timber operations in the area out of concern for the destruction of the Sandalwood Forest and Sandalwood becoming an endangered species. Several series of orders were passed in the case and one of them was that the word 'forest' must be understood according to its dictionary meaning. The description covers all statutorily recognised forests, whether designated as reserved, protected or otherwise for the purpose of section 2 of the Forest (Conservation) Act. The term 'forest land' will not only include 'forest' as understood in the dictionary sense, but also any area recorded as forest in the government record, irrespective of the ownership. Thus, the provisions enacted in the Forest (Conservation) Act, 1980 for the conservation of forests and the matters concerned therewith must apply clearly to all the forests so understood, irrespective of the ownership or classification thereof (Upadhyay & Upadhyay, 2002).

The Forest (Conservation) Act, 1980 was first amended[3] in 1988 introducing penal provisions to the principal act (GOI, 1988) while The **Forest (Conservation) Amendment Act, 2023** amended few sections in the principal act in context to the land that come under the purview of this Act. Forest (Conservation) Act, 2023 gave importance to defense over forests and have been provided relaxation under the new act (GOI, 2023).

The following categories of land shall not be covered under the provisions of this Act, namely:

(a)   such forest land situated alongside a rail line or a public road maintained by the Government, which provides access to a habitation, or to a rail, and roadside amenity up to a maximum size of 0.10 hectare in each case;

(b)   such forest land,— (i) as is situated within a distance of one hundred kilometres along international borders or Line of Control or Line of Actual Control, as the case may be, proposed to be used for construction of strategic linear project of national importance and concerning national security; or (ii) up to ten hectares, proposed to be used for construction of security related infrastructure; or (iii) as is proposed to be used for construction of defence related project or a camp for paramilitary forces or public utility projects, as may be specified by the Central Government, the extent of which does not exceed five hectares in a Left Wing Extremism affected area as may be notified by the Central Government.

While the act just mentions the orders, its explanation in detail is mentioned in the **Forest (Conservation) Rules, 1981**. These rules explained in detail the procedures that must be followed for approval seeking land diversion and the requirements for compensation in terms of land and money that will be imposed against the land diverted. Forest (Conservation) Rules was revised in 2003 which superseded[4] the 1981 Rules which means that the 1981 Rules stand invalid from then on.

The **Forest Conservation Rules, 2003** went through amendments in the year 2004, 2014 and 2017 until it was superseded by **Forest (Conservation) Rules, 2022**. Further to the amendment of Forest (Conservation) Act in 2023, **Forest (Conservation) Rules, 2023** was enacted that superseded the Forest (Conservation) Rules, 2022. In compliance with the most updated procedural explanation and clarification as detailed in the Forest (Conservation) Rules, 2023, conditions required to be fulfilled and the process of approval of proposals is explained in the following paragraphs.

There are various conditions imposed on the user agency, based on the kind of project being undertaken. There are few general conditions in very proposal of land diversion such as legal status of forest land diverted to remain unchanged, compensatory afforestation (CA), transfer/mutation of land for CA, environmental clearance, etc. There are additional

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3   An amendment is a change or addition to the terms of a contract or document. An amendment is often an addition or correction that leaves the original document substantially intact.

4   Supersede means to take the place of, as reason of superior worth or right. A recently enacted statue that replaces an older law is said to supersede the prior legislation.

conditions imposed in few cases such as, there is provision of constructing a safety zone of 7.5 m around the boundary in case of a mining project to minimize the impact of construction on environment and residents. While road lines and railway lines are constructed in a way that minimum trees are felled, a catchment area treatment has to be constructed in a medium to major irrigation project. (Narendra, 2015). These conditions can be categorized under three broad headings which have been summarized in the table below:

Table 5: Conditions required for Forestry Clearance

Conditions Stipulated in Forest Clearances	
General Conditions	• Legal status of forest land to remain unchanged • Compensatory afforestation as per guidelines • Transfer/mutation of non-forest land to State Forest Department if applicable • Notification as RF/PF under Indian Forest Act,1972 • User Agency to provide Fuelwood/alt. fuel to labourers and staff on site • Specific use of land as specified in the proposal • Rehabilitation of project affected families, if any • Environmental clearance if required • Wildlife Clearance if required.
Standard Conditions	**Mining proposals** • Phased reclamation of mined area • Safety Zone area, its afforestation and fencing • Fencing for underground mines
	Hydel and irrigation proposals • Catchment Area Treatment plan for medium and major projects • Minimum requirement of forest land for canals • Free water for Forestry related projects
	Road proposals • Minimum trees to be felled • Strip plantation on sides and central verge
	Transmission line proposals • Minimum trees to be felled • Plantation of Dwarf Species (preferably medicinal plants in right of way under transmission lines
Specific Conditions	Tailored to project and case to case basis by the Central / State government

Source: (Narendran, 2015) Guidelines and Clarifications on Forest (Conservation) Act, 1980

The use of term "Compensatory Afforestation (CA)" as an umbrella term can be often misleading, as CA is just one of the conditions imposed on the user agency. Abiding by the conditions mentioned above in the table, funds are collected under different heads for execution of work under compensation specified under different kinds of project. However, the ecosystem services lost due to land diversion was never taken in account. Thus, in 2002, the inclusion of Net Present Value was put forward and committees were formed and directed to further work on its calculation. The concept of Net Present Value and its calculation is explained in detail in the Annexure 2. Thus, the funds collected specific to the project as per the rules and guidelines are as follows:

Compensatory Afforestation (CA)   Fund Collected for afforestation on land received by the user agency.

Net Present Value (NPV)   Fund collected to incorporate the tangible and intangible benefits that will be lost due to land diversion

Catchment Area Treatment (CAT)   To be provided in cases of medium and major irrigation projects for construction of catchment area

Additional Compensatory Afforestation (ACA)   To be provided by the user agency in case the non-forest land provided is unsuitable for CA.

Penal Compensatory Afforestation (PCA)   Funds collected as a penalty in case the compensatory afforestation activities are not undertaken as required

Protect Area Funds (PAF)   Funds taken for biodiversity conservation in case the diversion is taking place in a protected area

Safety Zone (SZ)   Considering the impact of mining in an area, fund collected for construction of safety zone.

The funds are decided based on the rates fixed by the State Forest Department which are site specific and varies according to the species, type of forest and site. The money received for Compensatory Afforestation, Additional Compensatory Afforestation etc. is to be used as per site specific schemes submitted by the State along with the approved proposals for diversion of forest land. Similarly, NPV has been recovered to compensate for the loss of tangible as well as intangible benefits from the forest lands which has been diverted for non-forest use. Thus, NPV funds are to be used for Assisted Natural Regeneration (ANR), forest management and protection, infrastructure development, wildlife protection and management and other allied activities in an attempt to incorporate the values of loss of ecosystem services due to the diversion of forest land. Whereas, CA funds are site-specific and mandatory for raising of compensatory afforestation, NPV funds are meant for improving the quality of forest cover, conservation of biodiversity and enhancement of ecosystem services

In Compensatory Afforestation, there is an additional requirement that a non-forest land is to be transferred/mutated in the name of state forest department to carry out the afforestation activities. It involves identification of non-forest land or degraded forest land, work schedule, cost structure of plantation, provision of funds, mechanism to ensure the utilization of funds and monitoring mechanism etc. Hence, it is one of the most important conditions stipulated by the Central Government while approving proposals for de-reservation or diversion of forest land for non-forest use. It is essential that with all such proposals, a comprehensive scheme for compensatory afforestation is formulated and submitted to the Central Government. The comprehensive scheme is to include the details of non-forest/ degraded forest area identified for compensatory afforestation, map of area to be taken up for compensatory afforestation, year wise phased forestry operations, details of species to be planted and a suitability certificate from afforestation/ management point of view along with the cost structure of various operations.

As per the Forest (Conservation) Act 1980, as far as possible, the non-forest land for Compensatory Afforestation (CA) was to be identified contiguous to or in the proximity of Reserved Forest or Protected Forest. In case, non-forest land of CA was not available in the same district, non-forest land for CA was to be identified anywhere else in the State/ Union Territory. If non forest land was unavailable in the entire State/ UT, funds for raising CA in double the area in extent of the forest land diverted had to be provided by the user agency. The non-availability of suitable non-forest land for CA in the State / Union Territory would be accepted by the Central Government only on the Certificate of the Chief Secretary to the State/Union Territory Government.

However, there are exceptions such as in cases of diversion involving area of less than one hectare, CA is not required. Similarly, there are few cases which do not require transfer of a non-forest land but can directly provide fund for afforestation over double degraded forest such as mulberry plantation, transmission lines, riverbed material extraction, etc. In case of central and state public undertakings, where non-forest land is not available in the state, the user agency can provide fund for afforestation over double the degraded forest land.

All these conditions have been summarized below in Figure 7.

Figure 7: Conditions for diversion of land
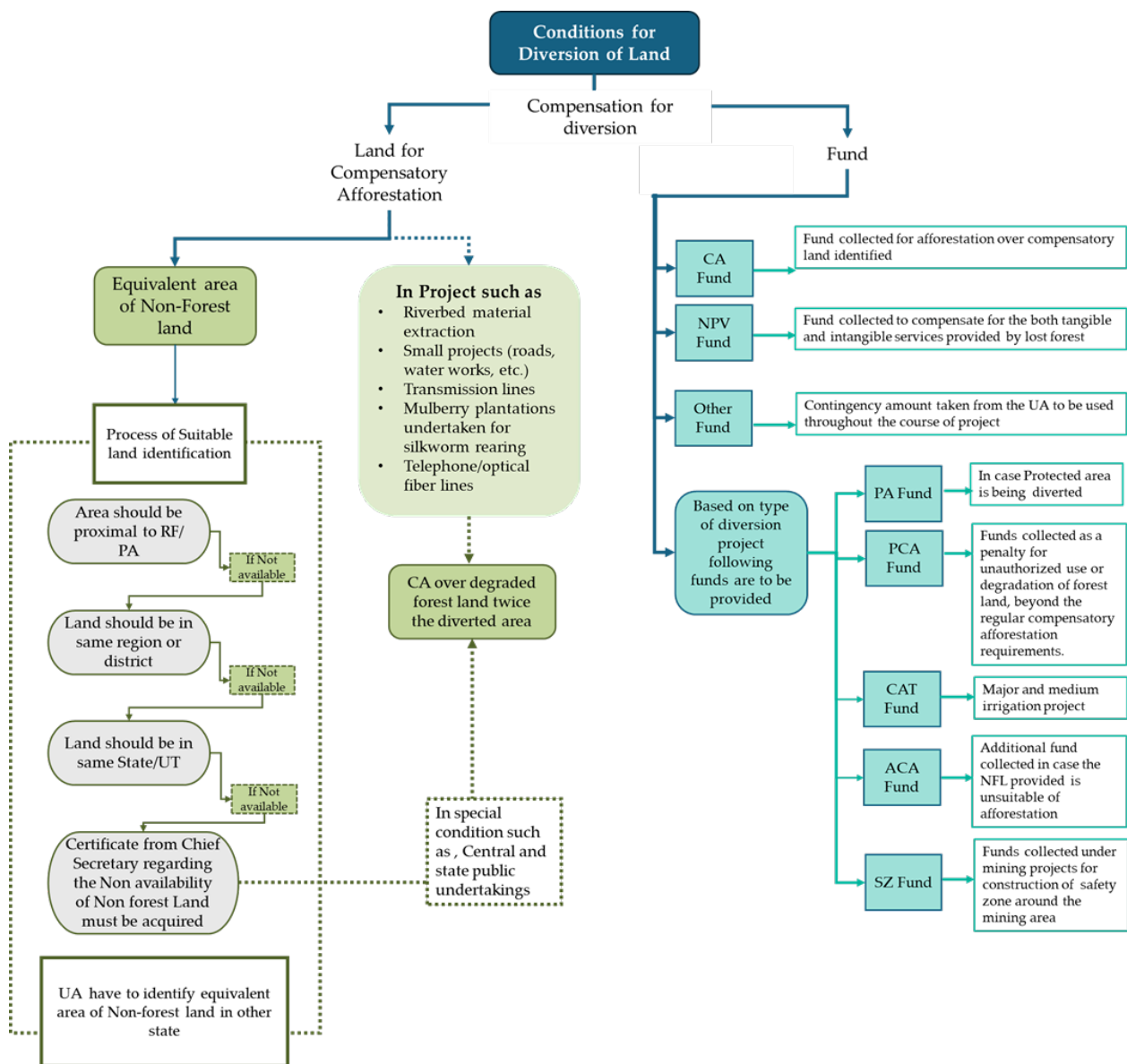
Source: Forest (Conservation) Rules, 2023

To make sure that all the requirements are met before approval, there is a process in place to verify the compliance of the proposed diversion project with all the conditions. There are three stages of approval which are as follows:

- In-Principle Approval

- Final Approval

- Final diversion order by the State

All the process of submission of proposal and documents by the user agency, submission of clearance documents by concerned departments and payment of amount by the user agency is executed on the web portal especially designed for this process of approval, Parivesh.

The process of submission of proposals and approval by the central Government has been summarized below in Figure 8.

Figure 8: Process of proposal submission and approval
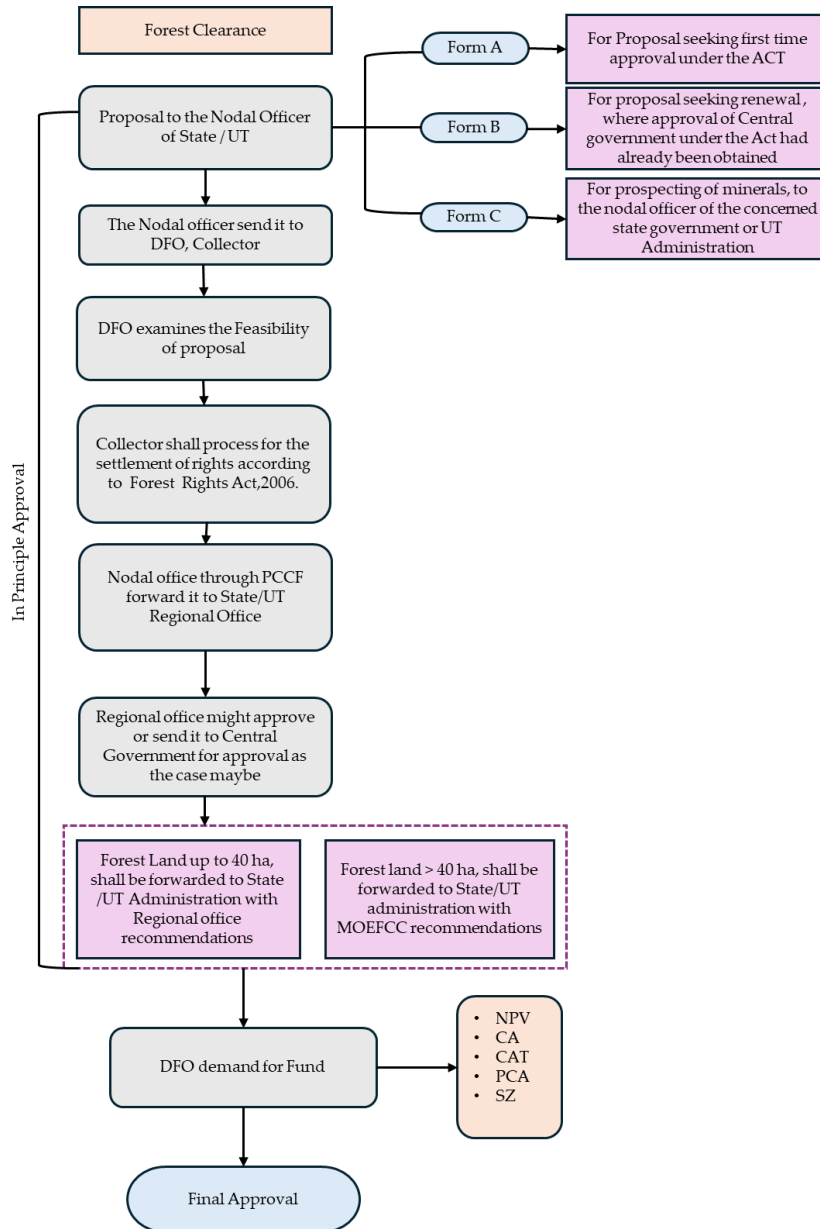
Source: Forest (Conservation) Rules, 2023

"Compensation" in its literal terms can be a false explanation for the design that exists in place as the forest with its entire natural habitat, biodiversity and ecosystem services can never be replicated with manual plantations.

Articles and paper have often compared this concept with rather "offsetting" or "greenwashing" that adds to environmental damage rather than mitigating it (Kohli et al., 2011; Ghosh, 2017). However, if exploitation or greenwashing was the dropdown essence of the act, there wouldn't have been explanations regarding non-forest purpose and the considerations taken under each kind of project. It must be made clear that this whole system is in place to work for the forest and not against the forest. The challenges, if any may exist not in the well thought policy and law, but in its execution, in an efficient manner.

There can be one more perspective to look at this whole concept of compensatory afforestation. If accepted that development had to take place at the expense of forest area, the land diversion can be seen as a mechanism to channelize money for further conservation and protection activities. So, even if we sacrifice a piece of forest for development, we can utilise the money collected for protection of existing forest, which are already subjected to various drivers of degradation provided we have an efficient mechanism to utilise the money collected. It also aligns with the polluter pay principle[5] and this existing concept of compensatory afforestation can be used to achieve a climate -resilient growth (PWC, 2020).

3.2   Utilisation and Management of funds

In beginning, when the process of land diversion was put in place, it for sure put a check on the illegal clearing and deforestation. Though the process of compensation was put in place with set rules for land identification and fund collection for plantation and forest conservation activities, the problem arose when the funds collected against land diversion was not wisely spent for forest conservation activities.

In the series of order passed by Supreme Court in T.N. Godavarman Thirumulpad Vs Union of India and Others [Writ Petition (Civil) No. 202 of 1995] dated 30th October 2002, The Hon'ble Supreme Court observed that a "Compensatory Afforestation Fund" be created in which all the monies received from the user agencies towards compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, net present value of the diverted forest land or catchment area treatment plan shall be deposited. It was further notified in 2004 that the body for the management of the fund will be known as **CAMPA i.e., Compensatory Afforestation Fund Management and Planning Authority**. It was constituted as a statutory body in India to manage funds collected for compensatory afforestation to

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5   In environmental law, the polluter pays principle is enacted to make the party responsible for producing pollution responsible for paying for the damage done to the natural environment.

be used for afforestation and reforestation activities, wildlife management, and forest conservation efforts across the country. However, until CAMPA comes in place, a proxy body known as **Ad-hoc CAMPA** was operationalised, and all the funds were collected within this body.

To decentralise the management of funds, **State CAMPA Guidelines** were issued in 2009, and all states were notified to establish State CAMPA for management and utilisation of funds. State CAMPA (Compensatory Afforestation Fund Management and Planning Authority) guidelines outline how funds collected from agencies that divert forest land for non-forest purposes are utilized for afforestation and related activities (GOI, 2009).

As per the guidelines, State CAMPA was mandated to promote:

- conservation, protection, regeneration and management of existing natural forests;
- conservation, protection and management of wildlife and its habitat within and outside protected areas including the consolidation of the protected areas;
- compensatory afforestation; and
- environmental services, research, training and capacity building.

It was to function through a three-tier committee hierarchy:

- **Governing Body** headed by the Chief Minister of the State, mandated to lay down the broad policy framework for functioning of State level CAMPA and review its working from time to time.
- **Steering Committee** headed by the Chief Secretary of the State, mandated to lay down and approve rules and procedures for the functioning of the body and its Executive Committee. Its responsibilities included monitoring utilisation of State CAMPA fund, approving the Annual Plan of Operation (APO), the annual reports and audited accounts of the State CAMPA.
- **Executive Committee** headed by the Principal Chief Conservator of Forests of the State mandated to prepare the APO of the State for various activities, submit it to the Steering Committee before end of December for each financial year, supervise the works being implemented out of funds released from the State CAMPA. It was also responsible for ensuring proper auditing of both receipt and expenditure of funds.

Even after the notification of State CAMPA Guidelines, the management of funds was not appropriate and lot of unspent funds were realized with Ad –hoc CAMPA. In 2013, the Comptroller and Auditor General of India (CAG) did an audit on compensatory afforestation in India and reported major irregularities including poor plantation survival rates, unmet objectives, and financial mismanagement. It emphasised the non-operationalisation of a permanent, independent authority for the management of funds as the major reason behind the irregularities noticed in the audit, details of which are described in the Annexure 3. The audit in 2013 brought out the necessity of strong constitutional and legal framework which led to the enactment of Compensatory Afforestation Fund Act in 2016 (GOI, 2016), rules of which were laid forward in Compensatory Afforestation Fund Rules, 2018 (GOI, 2018).

The key provisions of the Act and Rules are as follows:

1. **Establishment of Funds and Constitution of Authorities:**
   - **National Compensatory Afforestation Fund (NCAF):** Establishment of fund at the central level to manage the compensatory afforestation money.
   - **National Authority**: Establishment of The National Compensatory Afforestation Fund Management and Planning Authority (National CAMPA) to oversee the implementation of afforestation projects funded by NCAF.
   - **State Compensatory Afforestation Funds (SCAF):** Establishment of funds at the state level to manage the funds collected within each state.
   - **State Authorities:** State CAMPAs are responsible for overseeing projects funded by SCAF. Each authority has a Governing Body, Steering Committee and an executive committee.

2. **Disbursement of funds collected in Ad-hoc CAMPA**

   As Ad-Hoc CAMPA becomes non-operational after the enactment of the act, the money placed under Ad-hoc CAMPA and interest accrued thereon shall be disbursed in the following manner:
   - 90 % of the money shall be transferred to the State Fund established in the state.
   - the balance 10% shall be utilised for meeting—(i) the non-recurring and recurring expenditure for the management of the National Authority including the salary and allowances payable to its officers and other employees; (ii) the expenditure incurred on monitoring and evaluation of works executed by the National Authority and each State Authority; (iii) the expenditure incurred on specific schemes approved by governing body of the National Authority.

3. **Utilization of Funds**

   The manner of utilisation of funds can be divided into three ways as follows:

   - **Compensatory Afforestation/Site-Specific Activities** - the money received for compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, catchment area treatment plan and for any other site-specific scheme may be used as per site-specific schemes submitted by the State along with the approved proposals for diversion of forest land under the Forest (Conservation) Act, 1980.
   - **Net Present Value –** the monies received towards net present value shall be used for artificial regeneration (plantation), assisted natural regeneration, forest management, forest protection, forest and wildlife related infrastructure development, wildlife protection and management, supply of wood and other forest produce saving devices and other allied activities in the manner as may be prescribed. The manner of utilisation of NPV funds is explained in detail in the annexure 4.

- **Interest accrued –** the interest accrued on funds available in a State Fund and the interest accrued on all monies collected by the State Governments, which has been placed under the ad hoc Authority and deposited in the nationalised banks, shall be used for conservation and development of forest and wildlife in the manner as may be prescribed. The manner of utilisation of interest accrued on funds is explained in detail in the annexure 4.

4. Review of the Implementation of the Program

There are set rules that guide the process of compensatory afforestation in India, as explained in the previous sections. However, the proficiency with which the on-ground implementation has happened and the challenges that are faced, is something which this report has attempted to encapsulate. This has been done by studying different sources such as research papers, articles, data available on e-green watch, and remote sensing & GIS based assessment. This section is divided into two sub-sections, *National Analysis* and '*Analysis of the Selected States*'.

4.1   National analysis

There are two types of analysis done under the section,

Quantitative Analysis – It includes the analysis of data related to various parameters of compensatory afforestation to see the efficiency of the program and bring out the challenges.

Qualitative Analysis – It includes a thorough review of the research papers and articles included under the study to gain perspective on the existing challenges in the system.

4.1.1   National Analysis - Quantitative

Scope of Analysis

- The analysis includes all the state/UTs
- The analysis has been done based on data taken from e – Green Watch Portal

Before delving into the analysis of land diversion and the utilization of funds across various states, a preliminary exercise was conducted to assess the status of forest area

and forest cover. This initial evaluation was aimed to understand the significance and role of forest area and forest cover in the context of land diversion. This exercise provided a critical context for interpreting the data and understanding the implications of forest area diversion.

Type of Forest Area Diverted

With the information made available on e – green watch, the type of forest area diverted

Figure 9: Type of Forest Area Diverted
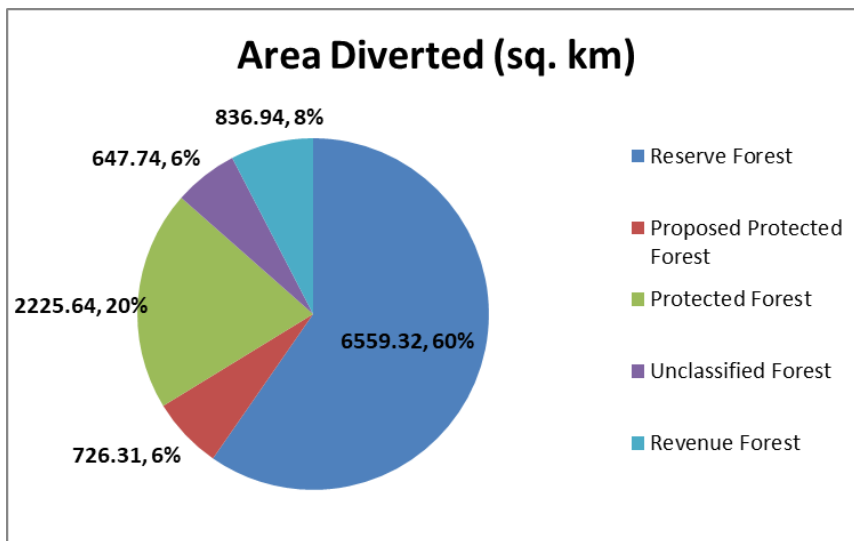
Source: e-Green Watch accessed in April, 2024

It can be seen from the graph that most diversion has been taking place in the reserve forests, followed by the protected forest. The protected forest receives the highest degree of protection in forests and the fact that it is only after reserve forest when it comes to diversion is unjustified. However, there are provisions of taking in account some extra fund (PAF) for conservation of conservation of wildlife when the diversion involves a protected area (National Park, Wildlife Sanctuaries, Tiger Reserves), no amount will be worth compensating the natural existing protected forests and the biodiversity they support.

Forest Area Diverted and Forest Cover

'Forest Area' generally refers to all the geographic areas recorded as forest in government records. 'Forest Cover' refers to all lands more than one hectare in area, having a tree canopy density of more than 10%. Thus, the term 'forest area' denotes the legal status of the land as per the government records, whereas the term 'forest cover' indicates presence of trees over any land. An area demarcated as forest area would not necessarily have forest cover over it, while forest cover is not necessarily located inside a forest area.

The land diversion takes place on the forest area irrespective of the forest cover present in the area. If it's a notified forest area in any of the government records, it comes under the purview of the Forest (Conservation) Act, 1980. However, forest cover plays a role in the calculation of Net Forest Value (NPV) as it takes into account the forest type and forest class into consideration as explained in Annexure 2.

Net Present Value (NPV) is a mandatory one-time payment that a user has to make for diverting forestland for non-forest use, under the Forest (Conservation) Act, 1980. When forest lands are diverted, a whole set of ecosystem services and goods from such forest lands are lost which are not immediately accounted for, by Compensatory Afforestation (CA). Benefits from CA increase slowly over the years and the rationale for NPV Collection is to balance the uncompensated benefits till the compensatory afforestation area starts providing benefits comparable to those from the originally diverted forest.

The Hon'ble Supreme Court ordered that the rates of NPV for forest diversion should be revised after 3 years. A committee was formed to work on the calculation of NPV. The latest NPV calculation is done by the method of calculation given by Dr. Madhu Verma, Professor, Indian Institute of Forest Management based on the type and density of forest land (Verma et al., 2014). The brief illustration explaining the calculation process of NPV is provided in Annexure 2.

If we look through the forest cover and forest area diverted in a particular state, there doesn't exist a relation between the two, but diversion has been taking place in states with significant forest cover. Analysing forest cover and land diversion across states shows that diversion has occurred in states such as Uttarakhand, Madhya Pradesh, and Odisha.

Apart from above mentioned states, Telangana, Andhra Pradesh, Gujarat and Karnataka also have considerable area of forest diverted with respect to the forest cover of the state.

We can also interpret from the graph that in the northeastern states, forest area has been less diverted as compared to other states of India. Contrastingly, Punjab with only 3.67 % of forest cover shows more diversion than any north-eastern state.

Figure 10: Forest cover and Forest Area Diverted
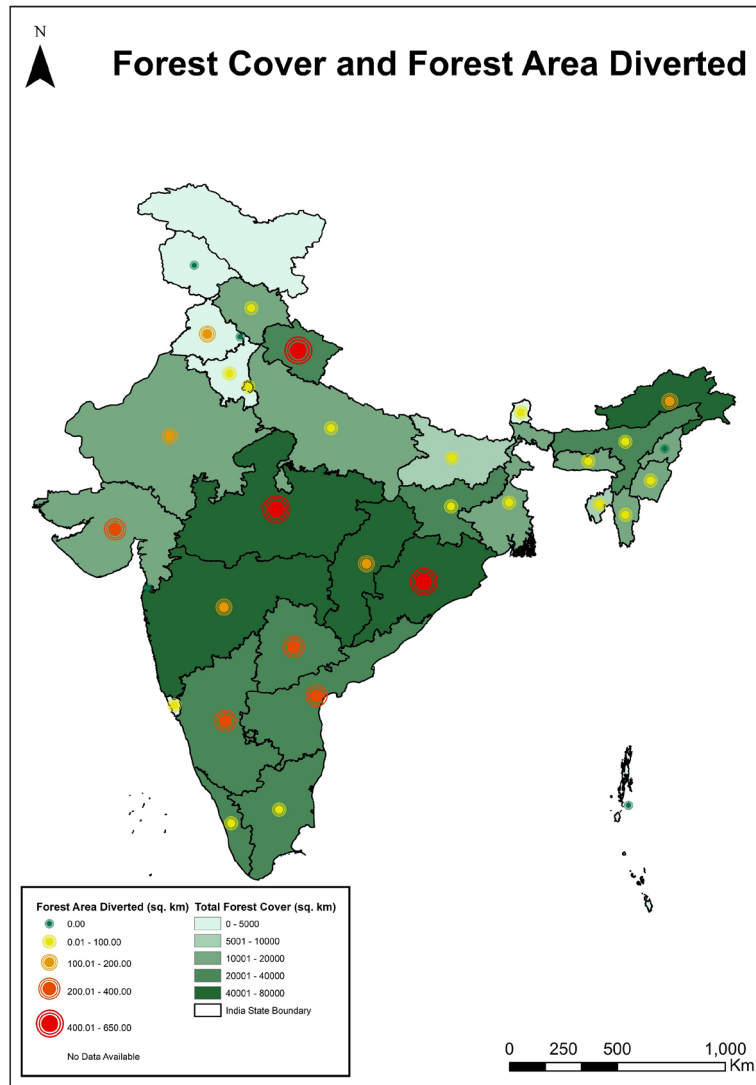
Source: e-Green Watch as accessed on April, 2024 (Forest Area Diverted) and ISFR, 2021 (Forest Cover)

Relation between land diverted, land identified for compensatory afforestation and plantation work done

Datasets under different categories were retrieved from e-Green Watch Portal to perform a comprehensive analysis of states. Specifically, the plantation work polygons for each state were downloaded to facilitate remote sensing and GIS-based assessments. The data on e-green watch is uploaded by the divisional officers of the forest department. So, it is important to understand the kind of data that is uploaded on the portal for its correct analysis.

There are three aspects to the data updation on portal, at first the details of the land diverted is registered on the portal along with its polygon, area and location. Second, the land identified for CA and work under different heads. When the stipulated work is

done on the land identified, it is then registered as site-specific work (plantation and non-plantation). All this data bifurcation has been explained in detail in the box (National Informatics Centre).

A) LAND DIVERSION

Diverted land is the land diverted from forest to a non – forestry purpose.

B) IDENTIFICATION OF SITES

There are three kinds of sites identified for utilization of funds, described below:

1. **CA Sites (Compensatory Afforestation Sites)**

   CA Sites is the land received from the user Agency for Compensatory Afforestation. Land for CA can either be an equivalent non – forest land or degraded forest land having double the area of diverted Land (as the case may be). **(Plantation on these lands is done through the funds received under the CA head)**

2. **Other Plantation Sites (Non – CA Sites)**

   The lands received / identified for CA has already been registered as CA sites. However, Division may also undertake plantation work on their existing lands using the **NPV funds**. Thus, these are the sites where plantation is to be carried out using **NPV funds** and **NOT using CA funds.**

3. **Asset Sites**

   It is also possible for the divisions to create infrastructures like buildings, roads etc using the NPV funds. Such sites are to be registered as asset sites. It can be either an existing asset such as building/guest house /roads etc. or a proposed asset.

(Note: It may be noted that the site – specific works will be registered on the portal only after the site has been registered)

C) SITE – SPECIFIC WORKS

1. **Plantation Work (CA & Non – CA)**

   It contains the details of plantation work done by the division through utilization of CAMPA funds. It contains two types of plantations,

   • Plantation work on a CA site received from any UA against approved diversion and using the CA funds.

   • Plantation work on any other site (non-CA) and using the funds received under NPV, SZ, CAT etc.

2. **Asset Works**

   The work done on the identified asset sites for creating any kind of asset for the protection and conservation of forest such as buildings, roads etc. using the NPV funds.

With this concept in place, the analysis primarily focuses on three parameters:

- **Land diverted under the Forest (Conservation) Act** - The area of diverted land is the forest area diverted under the Forest (Conservation) Act.

- **Land identified for compensatory afforestation** - The land identified for compensatory afforestation is the land mutated/transferred in the name of State Forest department in exchange of the forest land diverted.

- **Plantation work done against the funds collected from user agencies** - The plantation work done is the work done by the funds collected under CA, NPV, ACA, PCA, SZ, CAT, etc.

Each parameter thus assessed will be set for comparison between states while establishing a relation between the three parameters. Below is the map depicting the comparison of the states on the basis of land diverted while the graph states the quantitative data of 20 states with maximum forest area diversion.

Figure 11: Area of land diverted in different states
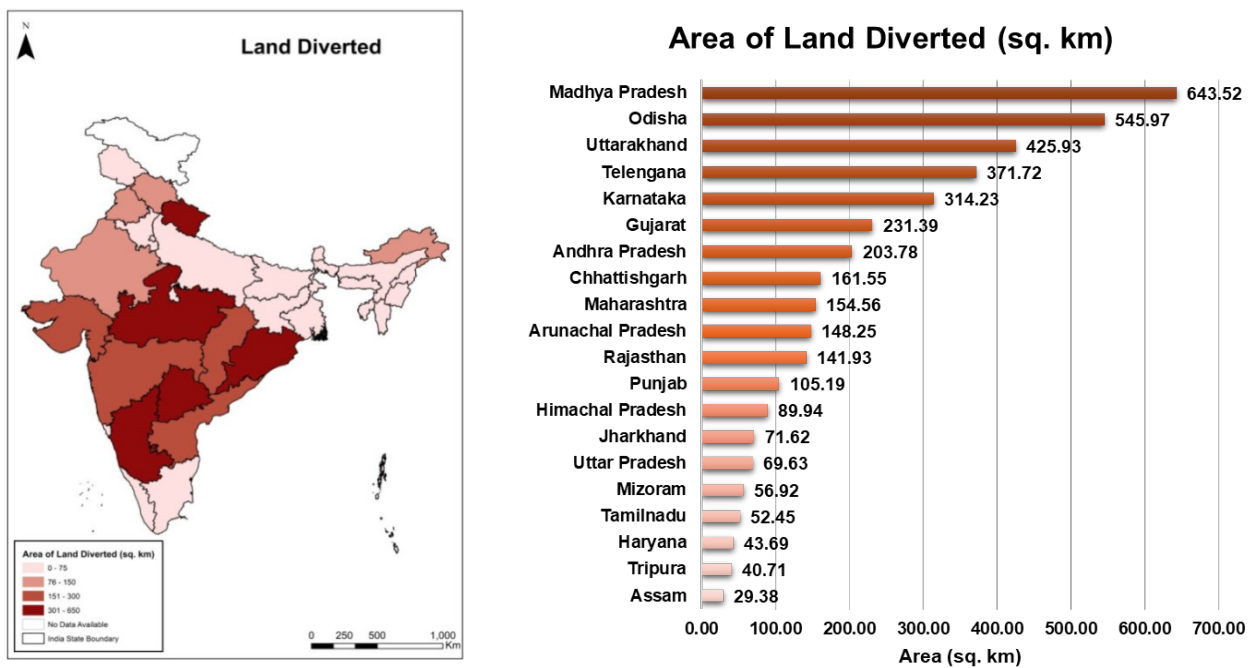
Source: e-Green Watch accessed in April 2024

The data clearly represents that the states Madhya Pradesh, Orissa, Uttarakhand and Telangana have forest area diverted to a greater extent as compared to other states. Madhya Pradesh has an area of 653.52 sq. km, quite high than any other state.

The map below represents the comparison of states based on the land identified for compensatory afforestation with graph stating the data of top 20 states.

Figure 12: Area of land identified for Compensatory Afforestation

Area of CA Land (sq.km)

State	Area
Odisha	1,043.52
Jharkhand	634.74
Madhya Pradesh	598.92
Gujarat	409.73
Chhattishgarh	393.00
Andhra Pradesh	388.64
Arunachal Pradesh	381.20
Maharashtra	319.02
Telengana	318.84
Karnataka	231.38
Uttar Pradesh	229.41
Haryana	228.57
Uttarakhand	223.01
Himachal Pradesh	191.71
Rajasthan	178.15
Punjab	164.58
Mizoram	102.75
Tripura	95.63
Manipur	53.40
Assam	50.90
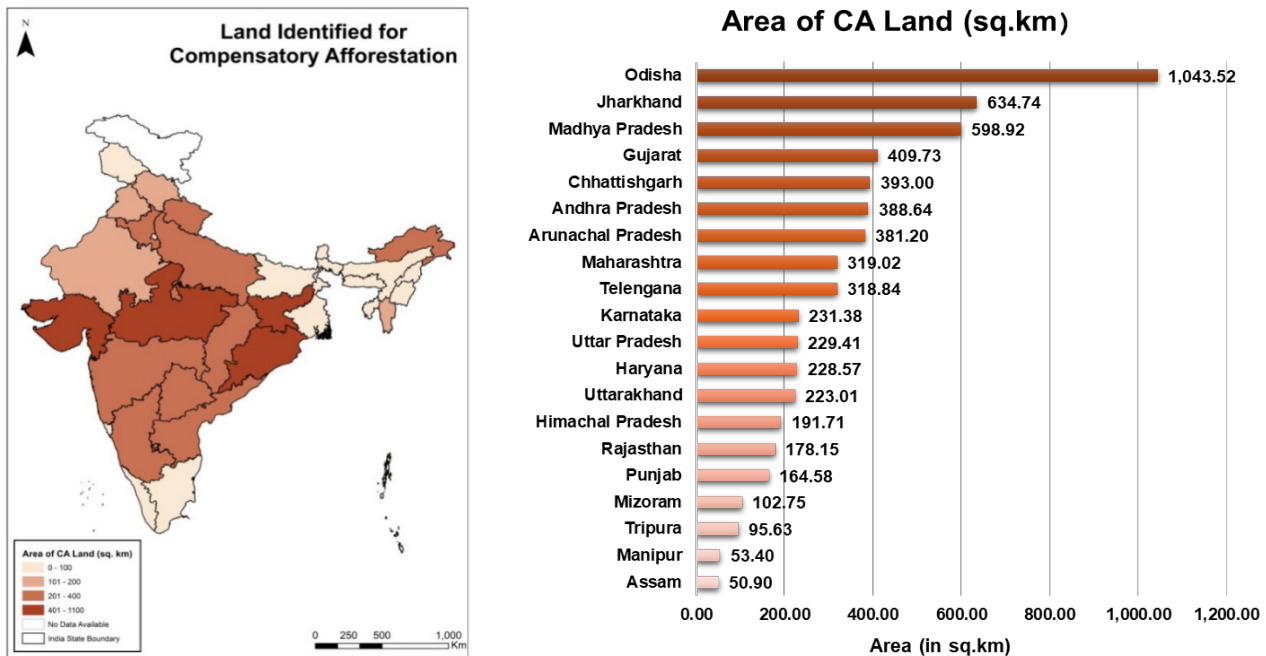
Source: e-Green Watch accessed in April 2024

The map depicts that maximum land identified for compensatory afforestation is in Odisha, Jharkhand, Madhya Pradesh and Gujarat.

In the above section of review of the policies, it is explained that the land for CA would be identified in a different state only on approval of the chief secretary for the non – availability of non – forest land in the state in a case where the forest area in a state is more than 50 % of the geographical area. However, on comparing the data of land diverted and land identified for compensatory afforestation, there exists no direct relation between the two which clearly states that the forest land diversion has been taking place in one state while the compensation of it is taking place in a different state which in long run can affect the micro – ecology of the area leading to loss of ecosystem services.

The land diverted and the land identified for CA just provides the quantification of the process involved when a land is diverted. The utilization of the funds collected can be seen only through the plantation work done which is depicted in the map and graph below.

Figure 13: Area of Plantation work done in different states
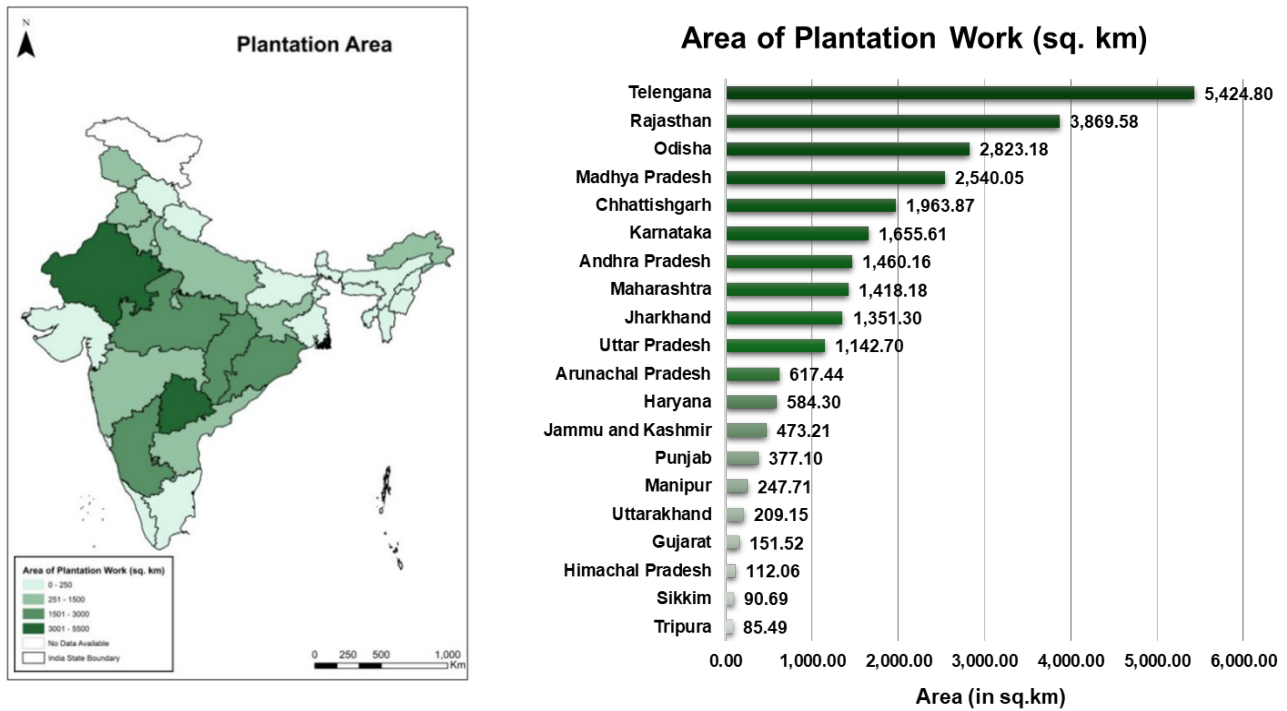
Source: e-Green Watch accessed in April 2024

The analysis of plantation work reveals that Telangana and Rajasthan have undertaken the most extensive plantation efforts. The plantation work done in Telangana is quite more than the land diverted in the state followed by Rajasthan despite the fact that there hasn't been much diversion in the state. There can be only one possible explanation that the availability of non – forest land was so high in Rajasthan that maximum funds have been utilised for plantation in the state. However, the climate and ecology of the Rajasthan is way different than states with maximum diversion such as Uttarakhand. The compensation for a land diverted in Uttarakhand in a state like Rajasthan wouldn't stand right in terms of ecology and ecosystem services.

4.1.2   National Analysis – Qualitative

Compensatory afforestation and the associated CAMPA initiatives in India have been implemented with the goal of restoring degraded lands and enhancing forest cover, aligning with the national objective to increase forest cover to 33%. These efforts are not only aimed at ecological restoration but also at mitigating global climate change by sequestering a significant amount of carbon—projected to be 1.99 gigatons by 2030, contributing an estimated $6.5 billion to the economy (Tambe et al., 2022) Moreover, the policy intends to support tribal livelihoods through the inclusion of indigenous fruit species in plantation plans, potentially enhancing local economic resilience.

However, these ambitious goals are marred by numerous challenges and negative impacts. The displacement of local communities and the disruption of their traditional agricultural practices, such as podu, have been significant concerns. The forest department's approach of enclosing these lands with barbed-wire fences and planting non-browsable species like teak has further strained relations with these communities (Tambe et al., 2022). Additionally, the implementation of afforestation projects often neglects the specific ecological conditions and social contexts of different regions. This oversight has led to ecological mismatches, such as the loss of native grasslands in the Western Ghats and high mortality rates in mangrove restoration efforts in Gujarat (Tambe et al., 2022) In a review done on the National Compensatory Afforestation Fund (CAMPA) Bill, 2016, it was pointed out that the state government is inefficient to spend the CAMPA funds and that the Bill should include specific guidelines for compensatory afforestation activities tailored to ground realities in the state and the development of adequate safeguards to minimize harm to forest cover and biodiversity (Bhan et al., 2016). In a study done in southern Odisha, several points were laid forward regarding the FCA's impact on local communities particularly related to their loss of rights. It also highlights that the FCA often results in monoculture plantations that lack the biodiversity and ecological resilience of natural forests, undermining conservation goals (Balaji, 2014). Centralizing funds with the forest department has sidelined the role of local communities and the gram sabha (village assembly), contradicting the empowerment goals of the Forest Rights Act, 2006 (Ghosh, 2017; Tambe et al., 2022).

In Odisha, for example, compensatory afforestation schemes often follow standardized templates that fail to address local ecological and social dynamics, leading to ineffective and sometimes detrimental outcomes. Review of articles has also revealed that despite official claims of community involvement, actual participation remains minimal, with the forest department's plans often misrepresenting public opinion and lacking meaningful engagement with affected communities (Ghosh, 2017; Valencia, 2019). This was also highlight in an article by (Bhattacharya & Saha, 2019) it was discussed how the Forest Department's plantation efforts have led to the fencing off of community forest resource areas, restricting people's access to traditional lands and resources.

(Ghosh, 2017) further critiques the concept and implementation of compensatory afforestation. It questions whether the practice genuinely mitigates environmental damage or merely serves as a facade for further deforestation and environmental degradation. The paper highlights issues such as land grabs, the encroachment of community lands, and the misuse of CAMPA funds.

Another study by (Saxena, 2019) critically evaluates the implications of the CAF Act and its rules on tribal rights, forest resources, and the environment. The author highlights the potential for conflict, particularly in tribal areas affected by deprivation of livelihoods, relocation of settlements, land grab, and enclosures. In Maharashtra, compensatory afforestation plantations established on lands used for pasture and nistar have curtailed or denied local people's legal rights under the FRA. The forest department-imposed restrictions without consulting the villagers, affecting their access to essential resources (Ghosh, 2017).

Implementation of compensatory afforestation faces several challenges including the lack of credible data on compensatory afforestation, with government agencies failing to maintain systematic records beyond what is posted on the e-Green Watch portal. The identification and allocation of land often ignore existing users and the physical characteristics of the land. For instance, the Polavaram Multipurpose Project in Andhra Pradesh has led to significant displacement and environmental damage. Many compensatory afforestation sites are on podu lands, historically used by local people, who have not been consulted or compensated adequately (Ghosh, 2017) The process of forest valuation under Net Present Value (NPV) reduces unique natural systems to mere numerical values, disregarding biological, spatial, and social distinctions. The funds collected through NPV are not effectively used to benefit affected communities, and community involvement in the valuation process is negligible. In Sikkim, the Teesta Hydroelectric Project has caused displacement and loss of biodiversity, leading to further alienation of local communities (Ghosh, 2017).

In few areas of India, CAMPA funds have been utilised effectively to uplift the biodiversity and mitigate the ill practices of the area. For example, In Manipur, M&E was conducted in Tamenglong and Noney Forest Division at 48 plantation sites against compensation of forest land diverted for Loktak downstream hydroelectric project (Silchar-Imphal 400 KV T/L) and Jiribam-Tupul-Imphal Railway Line (Tupul Bishnupur Road). During monitoring work in Tamenglong Forest Division, the team visited all the locations of CAMPA plantation sites and found that plantation at Phalong (Bhalok) village raised in the year 2017-18 was very much well managed by the farmer. The plantation work was undertaken in community land (particularly in jhum lands) and maintained by the farmers/plantation owners for compensation of diverted forest land under various developmental works. Planting material, funds for plantation and maintenance was provided by the Forest Department to each farmer as well as group of landowners (Giri et al., 2020).

Time and again, newspapers and articles have highlighted few major points related to underutilisation of funds, issue of land unavailability for plantation and unauthorised usage of CAMPA funds. One of which is that on 19th August, 2020, a top forest officer wrote that 70 % of the data with the ministry is incorrect. Similarly, other article published in 2023 reveals that only 27% of allocated funds were used between 2019-20 and 2021-22, highlighting a significant underutilization issue. The report notes that various states received substantial funds, but most did not utilize even half of their allocations. The newspapers and articles have also highlighted that there has been delay in preparation of annual plan of operations and thus funds have not been released on time for its utilisation.

An article published in The Economic Times in 2022 highlights severe land scarcity in Delhi. The article discusses the Delhi Development Authority's (DDA) appeal to the Union Environment Ministry to relax the guidelines under the Forest Conservation Act, allowing compensatory afforestation (CA) to be conducted in neighbouring states due to land

scarcity in Delhi. The DDA emphasizes that despite Delhi's Master Plan allocating 15% of its area for recreational green use, the city has already achieved over 23% forest and tree cover. The limited remaining land is needed for essential development projects, making it challenging to allocate additional land for CA.

In a very recent article by Amitabh Sinha, he stated that over 1,611 square kilometres of forest have been cleared in the last decade, but new plantations cannot immediately match the ecological value of mature forests leading to loss of ecosystem services. Similarly, other articles have also criticised the concept of compensatory afforestation by claiming that the plantations can never replace a forest.

The review of the cited literatures has revealed that though the compensatory afforestation and CAMPA policies in India have been designed with an aim to offer ecological and economic benefits, and compensate the losses incurred by the community due to forest land diversion but the implementation of the policy and CA is fraught with significant challenges. The challenges observed and derived from the qualitative and quantitative analysis is discussed in the succeeding section.

4.2   Selection of States

The states for analysis have been selected by scoring each of the state and Union Territories against seven parameters related to the efficiency of State CAMPA, the state in terms of forest area, land diversion, compensatory afforestation and plantation work.

The seven parameters are listed below:

a.   Year of Notification of State CAMPA

b.   Public transparency of documents and information

c.   Percentage of Target Achieved from 2016 to 2023

d.   Percentage of Forest Area in a State

e.   Land Diverted in a State

f.   CA Land Identified in a State

g.   Plantation work done in a State

The scores against each parameter and the category used for scoring has been detailed in Annexure 5. The combined score against each parameter and the final score for each state/UT is summarised in the table below.

Table 6: Scoring of each state/UTs based on the seven parameters

State	A	B	C	D	E	F	G	Total Score
Telangana	3	7	3	2	1	3	4	23
Odisha	3	6	2	2	1	4	4	22
Uttarakhand	3	7	3	4	1	3	1	22
Haryana	2	8	1	1	4	3	3	22
Chhattisgarh	3	5	1	3	2	3	4	21
Jharkhand	3	4	1	2	4	4	3	21
Arunachal Pradesh	3	3	0	4	3	3	3	19
Goa	2	5	4	2	4	1	1	19
Rajasthan	3	5	1	1	3	2	4	19
Tamil Nadu	3	4	5	1	4	1	1	19
Andhra Pradesh	3	3	2	2	2	3	3	18
Jammu and Kashmir	1	7	2	0	4	1	2	17
Himachal Pradesh	3	5	1	2	3	2	1	17
Meghalaya	3	1	3	3	4	1	1	16
Mizoram	3	2	0	4	4	2	1	16
Tripura	3	1	3	3	4	1	1	16
Uttar Pradesh	2	3	0	1	4	3	3	16
Assam	4	2	1	2	4	1	1	15
Madhya Pradesh	0	2	2	2	1	4	4	15
Maharashtra	3	2	1	1	2	3	3	15
Manipur	3	1	1	4	4	1	1	15
West Bengal	3	2	3	1	4	1	1	15
Gujarat	3	2	1	1	2	4	1	14
Karnataka	2	2	1	1	1	3	4	14
Punjab	3	2	1	1	3	2	2	14
Sikkim	3	1	1	3	4	1	1	14
Delhi	3	4	0	1	4	1	0	13
Kerala	3	1	1	2	4	1	1	13
Bihar	2	1	0	1	4	1	1	10

State	A	B	C	D	E	F	G	Total Score
Andaman & Nicobar	3	1	0	0	4	1	0	9
Chandigarh	3	1	0	1	4	0	0	9
Nagaland	0	0	0	3	4	0	0	7
Daman and Diu and Dadra and Nagar Haveli	0	0	0	0	4	0	0	4
Ladakh	1	0	0	0	0	0	0	1
Lakshadweep	0	0	0	0	0	0	0	0
Puducherry	0	0	0	0	0	0	0	0

The three states selected for the analysis according to the scorecard are as follows:

1. **Haryana**

   Haryana State has been chosen to showcase that the forest diverted from other states with good forest cover has been compensated in a less forested state. As forest area in Haryana is less, the state can be very well utilised for the execution of activities due to availability of land. The presence of 70.49 % open forest within the forest area also adds to the reason of utilisation of CAMPA funds in the state. The plantations have been majorly done on the sides of road, railways, i.e., majorly in running kilometres. It will be insightful to discuss this form of compensation of large forest patches diverted across India.

2. **Odisha**

   Odisha is a good balance of forest and non-forest areas as well as diversion and compensation. It's the suitability of Odisha for mining that drives maximum diversion in the state. It is also ahead in terms of plantation work. The State CAMPA has been effectively implementing CAMPA activities in the state and is also a good example for divergence of schemes and involvement of local communities in the execution of activities.

3. **Uttarakhand**

   Uttarakhand is a rich repository of forest and biodiversity. It has 71.27 % of forest area which makes the compensation for any forest diverted in the state difficult due to non- availability of non-forest land. The compensation is thus done in other states which leads to loss in micro ecology of the states and loss in habitat for wildlife. Uttarakhand has been thus chosen to highlight the issue of loss of good quality forest for development works.

   The status of every state based on the parameters has been represented below in the Map along with descriptions for the selected states.

Figure 14: Selection of States

Haryana, with its limited forest cover and 70.49% open forest, is strategically suited for the allocation of CAMPA funds to compensate for forest diversion from states with higher forest cover.

Uttarakhand, with 71.27% of its area covered by forests, faces challenges in compensating for land diverted to development due to limited non-forest land. Analyzing the impact on high-quality forests and the difficulties in compensating for their loss would be insightful

Odisha maintains a good balance between forest and non-forest areas, as well as between land diversion and plantation. The state's CAMPA is effectively managing these aspects, and this will be explored further in our analysis.

Most of the UTs have very less participation or representation in CAMPA implementation.

Score

🟥	0 - 10
🟧	11 - 15
🟨	16 - 20
🟩	Above 20

0   175   350   700   1,050   1,400
Km

4.3   Analysis of Selected States

This chapter presents an in-depth analysis of the CAMPA implementation in the three selected states of India, i.e. Odisha, Haryana and Uttarakhand. Each state-specific analysis is a case in itself and tries to encapsulate the peculiarities around CAMPA in that respective state. The criteria for shortlisting these states are explained in Chapter 2. The analysis of each case is structured under the following heads:

Indicator Based Analysis	Remote Sensing and GIS-Based Assessment of Forest Cover Quality and Land Use Pattern
This section assesses the selected states based on four indicators described above in Chapter 2: Institutional Design, Land Diversion and Compensatory Levy, Utilisation of Funds, and Monitoring and Evaluation.	RS and GIS-based assessment of forest density and land cover in CAMPA sites across three forest circles in Haryana, Odisha, & Uttarakhand. CAMPA sites have been selected based on the forest circles with the maximum number of Compensatory Afforestation (CA) and plantation activities since 2016.

4.3.1   Odisha

To gain insight into the working and implementation of the institutional design of Odisha State CAMPA, a thorough review was conducted of the State Forest Department's reports, as well as the official CAMPA website. This review focused on the organizational structure, the composition of committees, their members, and the minutes of their meetings. Indicator Based Analysis of Odisha.

Indicator Based Analysis of Odisha

a)   **Institutional design**

The Odisha State CAMPA, established in 2009 and reconstituted in 2018, functions under the governance framework provided by the Compensatory Afforestation Fund (CAF) Act, 2016. The institution is marked by a well-structured organizational setup that enhances both operational efficiency and transparency. Central to this structure is the Steering Committee, which has been actively involved since its inception in 2018 (Odisha CAMPA). This committee is responsible for approving APOs and ensuring that funds are allocated according to CAMPA guidelines. The committee meets annually, and the detailed documentation of these meetings ensures accountability, with decisions being well-recorded and easily traceable.

Complementing the Steering Committee is the Executive Committee, which is tasked with the implementation of the decisions and plans approved by the Steering Committee. This committee plays a crucial role in the on-ground execution of CAMPA activities, ensuring that the approved plans are effectively translated into practice.

The organizational clarity within the Odisha State CAMPA, evidenced by the clear roles and responsibilities of its committees and the availability of comprehensive documentation, underpins its effective management. This structured approach facilitates efficient oversight, transparent fund management, and the successful execution of conservation activities, thereby contributing to the overall effectiveness of CAMPA in Odisha.

b)   **Forest Diversion and Compensatory Levies**

To gain a comprehensive understanding of the trend of forest area diverted in Odisha and the compensatory afforestation efforts undertaken to mitigate this loss, a detailed review was conducted using data from previous years' Annual Plans of Operations (APOs), the e-Green Watch portal, and the latest Indian State of Forest Report (ISFR). This analysis revealed both the scale of forest land diverted for non-forestry purposes and the efforts undertaken to restore lost forest cover.

According to State CAMPA-APO 2024-25, an area 601.90 sq.km of forest land had been diverted from year 1980 to 2022 under the provisions Sec 2 of FC Act, 1980. However, the e-Green Watch portal presents a different picture, indicating that forest diversion for non-forest purposes in Odisha has reached 546.39 sq. km by 2023. e-Green Watch data also reveals that 596 diversion projects have been sanctioned, affecting approximately 1,399.91 sq.km. of forest land. This discrepancy between different data sources highlights challenges in accurately tracking forest land diversion, underscoring the complexities involved in managing and reporting such data.

Figure 15: Category of Projects
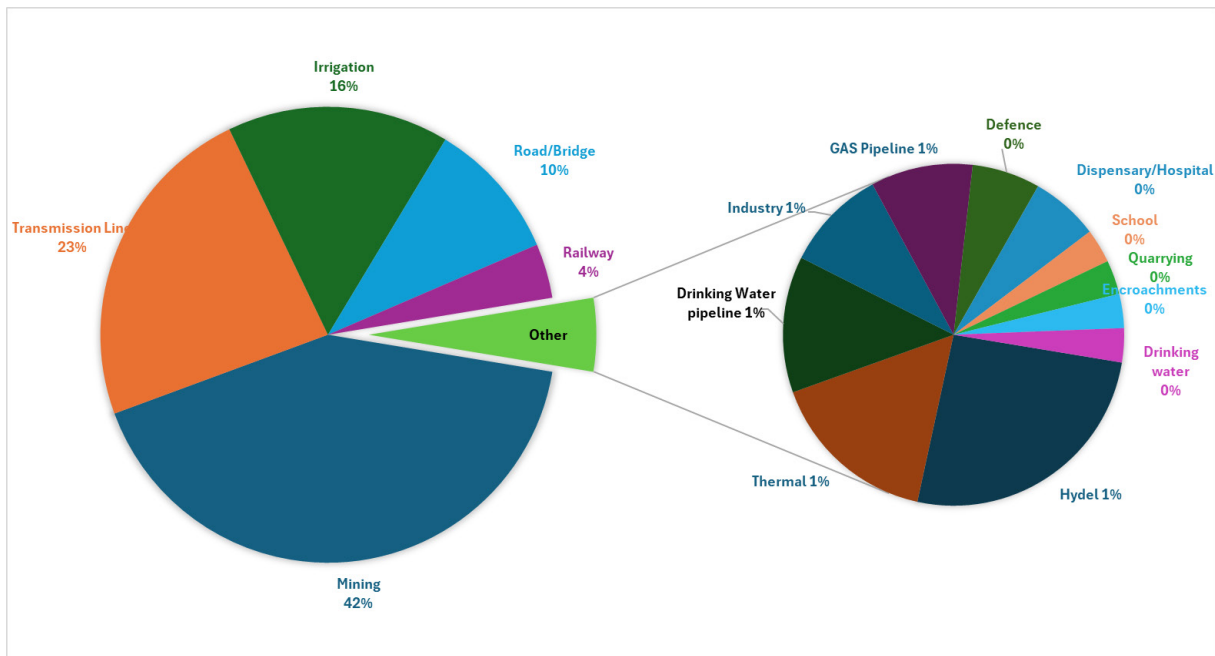
Source: e-Green Watch

The majority of the land diversion projects are related to mining, followed by transmission lines, irrigation, roadways, and railway construction. In contrast, projects aimed at social

development, such as schools, hospitals, and drinking water pipelines, constitutes less proportion, reflecting the state's focus on industrial and infrastructural expansion. Other than 596 projects, 83 unspecified projects with an area of 42.22 sq. km were also sanctioned by the department. These projects does not fall into any other category of projects and thus terms as unclassified projects.

Figure 16: Type of Land Diverted and Land identified for CA
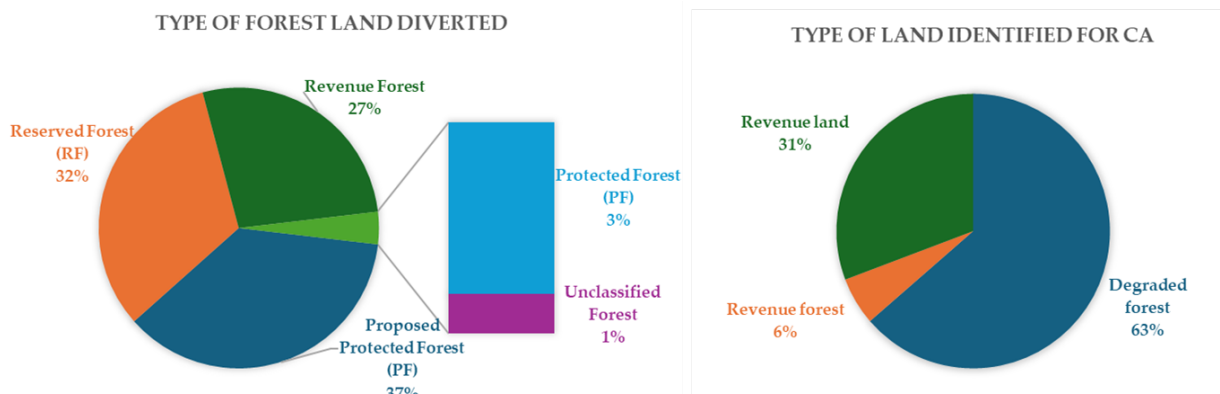
Source: e-Green Watch

An analysis was also conducted to assess the major forest type being diverted for non-forest purposes; it was observed that major forest is being diverted from the proposed protected forest (37%) followed by Reserved Forest (32%). While the land identified for the CA activities was majorly done in degraded notified forest.

Further analysis of e-green watch data to understand the efforts undertaken to restore lost forest cover reveals total of 1044.04 sq. km area have been identified for CA which is nearly twice the area of land diverted for non-forest purposes as depicted in the graph below.

Figure 17: Area of land diverted, CA land identified and Plantation work
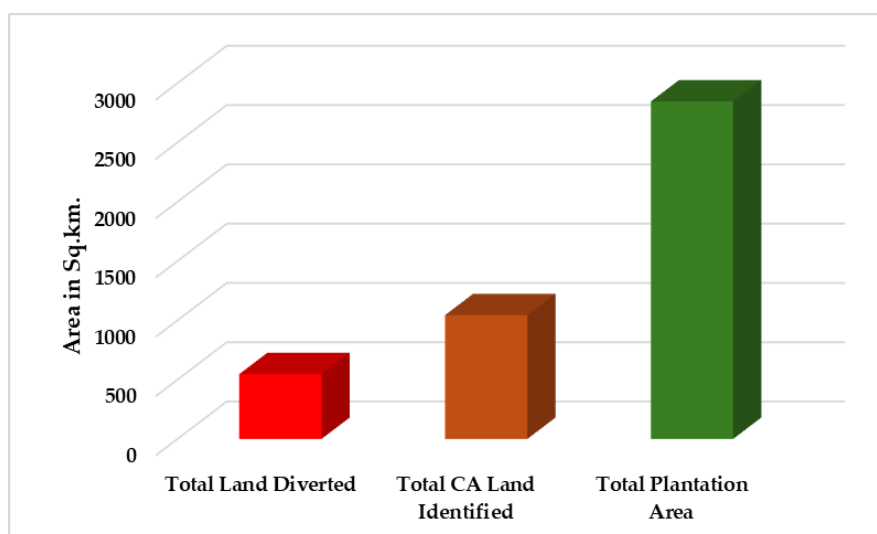
Source: e-Green Watch

This suggests that plantation activities are being carried out on a scale that exceeds the original area diverted, indicating an extensive afforestation effort. This expansion in plantation activities is further supported by the state's practice of levying funds under the NPV for plantation purposes, as detailed in the Fund Utilization section. The combined financial support from both CA and NPV funds has resulted in a substantial increase in the area under plantation, making it the most significant component of the state's afforestation initiatives.

c)   Utilization of Funds

Since the implementation of CAMPA in Odisha in 2009-10, various activities have been undertaken to preserve and develop natural forests, afforest degraded areas, protect forests, manage forest fires, conserve wildlife, build capacity, and support research, infrastructure development, and other related initiatives.

These efforts are guided by the APOs and are classified into core and non-core activities. Core activities funded by CAMPA include plantation activities, the creation of soil and moisture conservation (SMC) measures, forest protection, wildlife management, the Ama Jungle Yojana, and the preservation of sacred groves. Non-core activities funded by CAMPA encompass research and development, capacity building, infrastructure development, forest IT and working plan exercises, as well as monitoring, evaluation, and accounting.

Since its inception, CAMPA Odisha has formulated and implemented ten Annual Plans of Operations (APOs), with the latest being APO 2023-24, currently in effect. Odisha has been notably successful in meeting its physical and financial targets each year, positioning it as one of the leading states in CAMPA implementation. From 2009-10 to 2022-23, the Government of India has released Rs. 186,576.72 to Odisha for the implementation of CAMPA activities (CAMPA APO 2019-2024). These funds have been pivotal in driving a wide range of forest protection and wildlife conservation initiatives, which are further detailed in the subsequent sections.

Financial and Physical Progress of Plantation Activities:

To evaluate the effectiveness of CAMPA fund utilization in compensating for lost forest land, the analysis focused solely on the physical and financial targets related to plantation activities. Other activities related to forest protection and conservation were not included. The purpose of this analysis was to assess whether the funds collected in exchange for diverted forest land were being fully and effectively utilized.

The analysis involved comparing the physical and financial targets of the past five years with the achievements of the Odisha Forest Department in meeting these targets. APOs, monitoring and evaluation (M&E) reports, and sanction letters from previous years were reviewed to gain insights into the trends of fund allocation and utilization.

Figure 18: Physical and Financial Achievement for plantation activities under CA and NPV funds
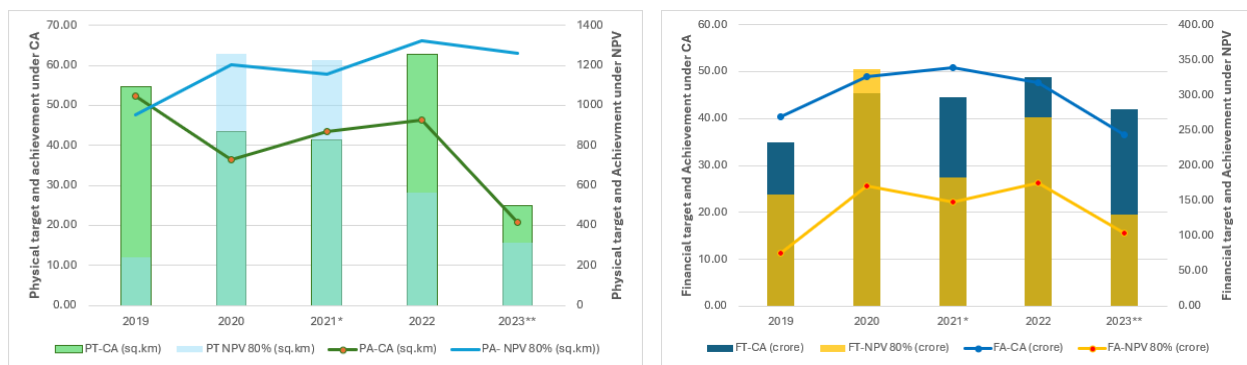
* Overachievement, **Under progress

Source: Odisha CAMPA APO 2019-2023, M&E reports (2017-18 to 2019-2021)

The analysis conducted assessed the plantation work carried out by the state forest department under different funding heads, including Compensatory Afforestation (CA) funds, 80% of Net Present Value (NPV) funds, 20% of NPV funds, and interest funds. The state has been doing various types of plantation activity such as Block plantation, bald-hill plantation, Assisted Natural Regeneration (ANR) using CA fund. From year 2019-2023, approximately 199.12 sq.km. have been planted out of 227.08 sq.km of CA land.

NPV funds were utilized for activities such as Artificial Regeneration (AR), avenue plantations, and the maintenance of old plantations. Out of a total target of 3,599.51 Sq.km, the department successfully planted 5,897.91 sq.km. As depicted in above graph, Under the NPV 80% category, the state has consistently exceeded its physical targets, this trend has been observed in each year from 2019-2023. No physical or financial targets were set under other funding heads for plantation activities, as these funds (20% of NPV, Interest funds) were used for non-core activities. The state has also been utilizing CAMPA funds in Conservation, Regeneration and Management (CRM), silvicultural operation, wildlife conservation initiatives.

While the Odisha Forest Department has met its physical targets, it has struggled to fully utilize the allocated funds. From 2019 to 2023, a total of Rs. 215.75 crore under CA funds and Rs. 1,078.20 crore under NPV 80% funds were allocated for plantation activities. However, only 60% of the allocated NPV funds were utilized by the department for the plantation activities. This analysis stipulates the overestimation of the financial target set by department, as the department is able to achieve its physical goals with lesser budget.

A total amount of Rs.148365.0 lakhs (Rs.1483.65 crores) have been incurred for all the plantation activities during the period 2009- 10 to 2016-17 and out of the total expenditure on plantation, maximum proportion i.e. about 77.8 percent have been spent on block plantation. About 11.7 percent of the overall spending is on compensatory afforestation and 9.0 percent is on the creation of ANR activities. Expenses on bald hills plantation and avenue plantation as a percentage to the overall plantation expenditure stand at 1.3 and 0.2 percent respectively (CAMPA -APO 2016-17).

Utilization of funds for non-core activities:

During the period 2009-10 to 2020-21, a total of Rs.2481.75 lakh has been sanctioned under CAMPA for development of Nandankanan biological park. Out of the sanctioned amount a sum total of Rs.2278.52 lakh accounting for **91.81 percent** of the sanctioned amount is spent for different activities (Third party M&E 2009 -10 to 2016-17, 2017-18 to 2020-21). Initially, until 2014-15, CAMPA activities were not fully streamlined, resulting in suboptimal utilization of funds. However, post-2014-15, a more focused approach has been adopted, leading to the utilization of approximately 90 percent of the sanctioned amount.

The interventions for habitat improvement, protection, and anti-depredation measures have been noteworthy. For instance, in the Ghumsur North Division, an initiative involved the provision of water troughs and the construction and repair of existing water holes as part of the conservation efforts for Black Bucks. While these measures were generally implemented outside forest areas, they proved to be quite effective. Similarly, in Satkosia and Simlipal Tiger Reserves, the construction and maintenance of water holes were strategically located, as evidenced by the presence of hoof marks of Gaurs in Simlipal and traces of elephant movement in both Satkosia and Simlipal. Given that water holes attract wildlife, they are also considered vulnerable from a protection perspective. In Simlipal, anti-poaching squads were strategically stationed near these water holes, ensuring that their presence did not disturb the wildlife.

Forest protection remains a critical component of overall forest management, yet it faces significant challenges. Two major destructive factors—biotic interference through illegal removal of forest produce by anti-social elements and the widespread occurrence of forest fires—pose substantial obstacles to effective forest protection. The protection of forest resources is often hampered by the lack of adequate manpower, infrastructure, and funding. The APOs formulated and implemented by the state CAMPA have made provisions to address some of these challenges, including the augmentation of manpower and the strengthening of infrastructure, equipment, and mobility. These measures, as highlighted in the APOs, reflect the ongoing efforts to enhance forest protection in Odisha. (Third party M&E 2009 -10 to 2016-17, 2017-18 to 2020-21).

a)   **Monitoring and evaluation**

Monitoring and evaluation is an important aspect in the judging the on-ground implementation of CAMPA guidelines and utilization of funds. AS per CAMPA guidelines each state has to carry out Internal and External audit of the implemented activities. The Odisha state since the initiation of CAMPA in 2009 has diligently carried out its M&E. External M&E has been completed for the year 2009-2010 to 2016-2017 and 2017-18 to 2020-21. While audit for succeeding years is still in inception (Odisha CAMPA Website).

Performance of Plantations:

Overall tree survival and causality in ANR Plantation is found at 86.9 and 13.1 percent respectively (all circle combines). Highest plant survival is reported in Sambalpur (93.1 percent) forest circle followed by Rourkela (91.3 percent) and Baripada (91.0 percent).

Plant Survival Rate in Bhubaneswar and Berhampur circle is relatively less due to damage of plantation sites in the cyclonic storm. (Third party M&E 2017-18 to 2020-21). As per third party audit reports, the survival and growth of plantations was found to be satisfactory.

Ama Jangala Yojana is another initiative of the Government of Odisha to continue the efforts of engaging communities in forest management. Communities participating in this activity are organised as Vana Samrakshyana Samitis (VSS) and are assisted in micro planning and in further forest management. Each community identified is allotted certain forest area near about their village/hamlet and assistance is provided for planning and implementation of forest improvement activities focusing on improvement of natural regeneration. Due to CAMPA support, survival and growth of plantation have improved in all the VSS areas, and frequency of forest fire incidences is rarely witnessed. Third part audit reports revealed that more than 80% funds under ANR have been utilized in creating wage employment (for the VSS members).

Remote Sensing and GIS-Based Assessment of Forest Cover Quality and Land Use Pattern in Odisha

Study Area

Based on the parameters explained in the methodology, Rourkela Forest Circle in Odisha has been selected for RS-GIS assessment. The table below (Table 7) outlines the names of the states, circles, and their corresponding districts.

Figure 19: Study Area Odisha
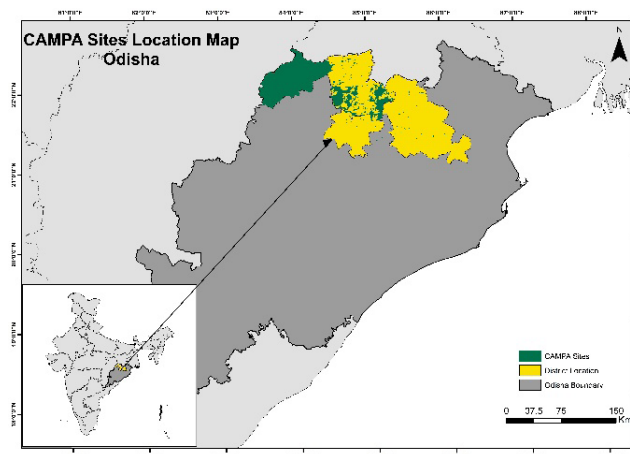
The study site map reveals that the entire Sundargarh district is marked with inaccurate polygons of CAMPA sites, suggesting an overestimation of plantation areas far exceeding actual coverage within the district. Consequently, analysis based on these mapped CAMPA sites could yield incorrect and exaggerated results. To ensure accuracy and reliability, Sundargarh district has been removed from the analysis reducing the count to 82 sites with a total coverage area of 44.22 sq. km.

Table 7: Selected Districts

State	Circle	Number of KMLs uploaded in E-Green Watch portal since 2016	Districts	Total area (sq. km)
Odisha	Rourkela	82	Debagarh Kendujhar	44.22

Temporal Variation of LULC of CAMPA sites

The status of LULC for CAMPA sites has been extracted from district-wide maps for both years. Area statistics for each class have been calculated, enabling a comparative analysis of land cover changes.

Figure 20: Odisha LULC 2016 and 2023
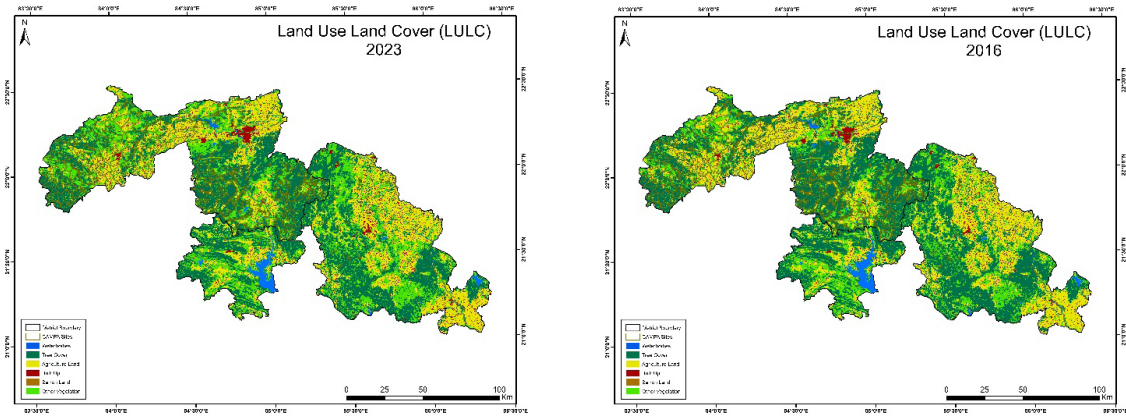
Table 8: Odisha LULC CAMPA Sites Status

Odisha LULC CAMPA Sites Status		
Classes	2016 (Area in sq. km)	2023 (Area in sq. km)
Waterbodies	0.04	0.02
Tree Cover	36.89	35.34
Agriculture Land	1.85	0.53
Built-Up	0.02	0.01
Other Vegetation	5.62	8.32
Total	**44.22**	**44.22**

The analysis of temporal variation in LULC within the CAMPA sites of Rourkela circle from 2016 to 2023 indicates a decline in Tree Cover, reducing from 36.89 sq. km to 35.34 sq. km. Inversely, the Other Vegetation category, potentially representing newly planted areas, has increased from 5.32 sq. km to 8.32 sq. km. This change highlights that while there has been a decline in forest cover in some regions, there is an increase in areas with sparsely distributed trees and new plantations.

Temporal variation of Forest Density within CAMPA sites

Fractional Vegetation Cover (FVC) for the districts has been analyzed for 2016 and 2023 using Landsat 8 imagery. A comparative analysis of vegetation changes over these years has been performed by calculating area statistics for the CAMPA sites. Maps and graphs have also been created to visualize and quantify the FVC trends during this period.

Figure 21: Odisha FVC 2016 and 2023
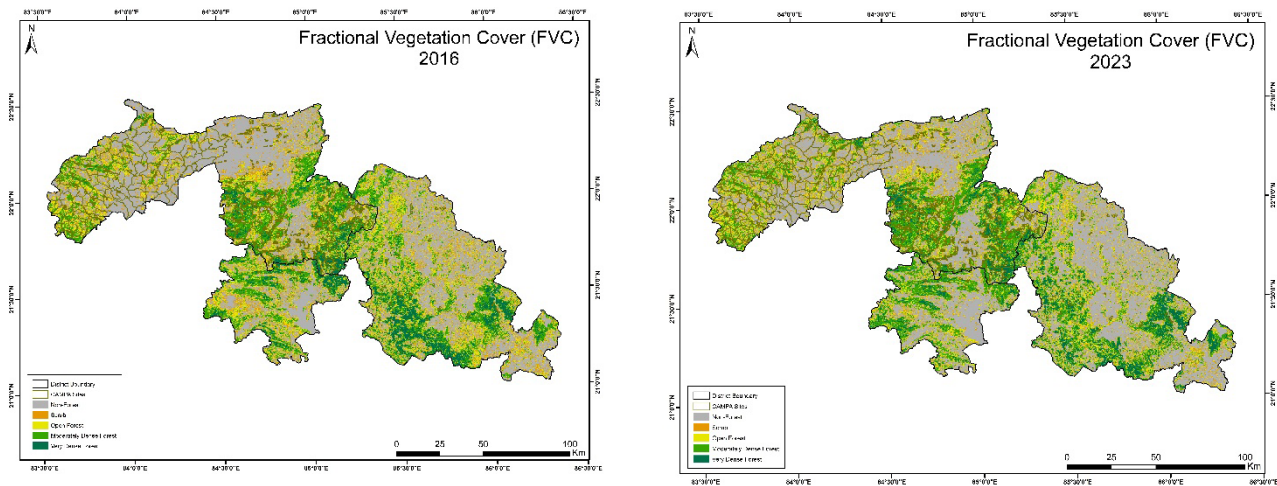
Table 9: Odisha FVC 2016 and 2023 Statistics

Fractional Vegetation Cover (FVC)		
Class	**2016 (Area in sq. km)**	**2023 (Area in sq. km)**
Non-Forest	2.05	3.10
Scrub	2.40	3.09
Open Forest	7.32	8.82
Moderately Dense Forest	22.50	19.48
Very Dense Forest	9.95	9.73
Total Area	**44.22**	**44.22**

The analysis of temporal variation in Forest Density (FVC) within the selected CAMPA sites from 2016 to 2023 shows significant changes in forest quality. The non-forest area has increased from 2.05 sq. km in 2016 to 3.10 sq. km in 2023, reflecting a moderate decrease in vegetation. The Scrub class has also experienced growth, increasing from 2.40 sq. km to 3.08 sq. km during the same period. Similarly, The Open Forest (OF) class has also seen an increase of 1.05 sq. km from 7.32 sq. km to 8.82 sq. km, which aligns with the trends in the Other Vegetation class identified in the LULC analysis, suggesting the presence of sparse vegetation or small plants. Total Dense Forest cover has seen a marginal decrease, with the Moderate Dense Forest (MDF) decreasing from 22.50 sq. km to 19.48 sq. km and the Very Dense Forest (VDF) decreasing from 9.95 sq. km to 9.73 sq. km.

Forest Cover Change Detection within CAMPA Sites

Following the analysis of Fractional Vegetation Cover, a change map from 2016 to 2023 has been produced to monitor the forest quality and land use scenario within the CAMPA sites. The change map highlights a detailed assessment of afforestation, deforestation, degradation, and enhancement.

Figure 22: Odisha FVC Change 2016-23
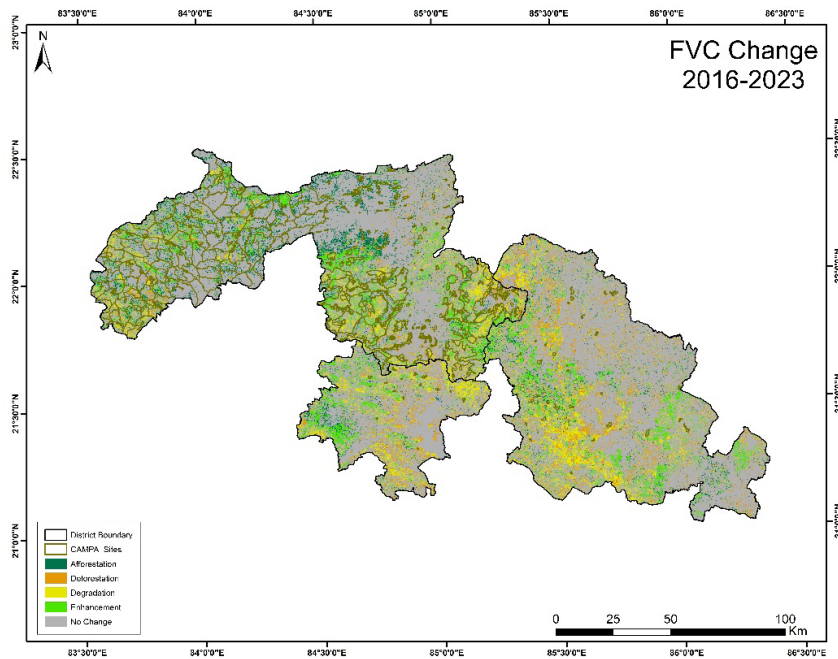
Table 10: Odisha FVC Change CAMPA Site Statistics

FVC Change CAMPA Sites	
Status	**Area (sq. km)**
No Change	25.79
Afforestation	0.66
Deforestation	2.41
Enhancement	6.23
Degradation	9.12

In the CAMPA sites of Odisha, there has been afforestation of 0.66 sq. km, deforestation of 2.41 sq. km, enhancement of 6.23 sq. km and degradation of 9.12 sq. km. An area of 25.79 sq. km experienced no change. This explains that while a significant area within the CAMPA site remains unchanged over 7 years, there has been a consistent decline in both the quantity and quality of forest cover. The table below presents data regarding the FVC Change matrix of CAMPA sites in Rourkela circle for the years 2016 and 2023, offering insights into the changes over 7 years.

Table 11: Odisha FVC Change Matrix for CAMPA sites (2016-23)

FVC Change (Area in sq km)	2023					
	Non-Forest	Scrub	Open Forest	Moderately Dense Forest	Very Dense Forest	Grand Total
2016 Non-Forest	**1.68**	0.24	0.10	0.02	0.00	2.05
Scrub	0.95	**0.90**	0.46	0.08	0.00	2.40
Open Forest	0.43	1.50	**3.51**	1.74	0.15	7.32
Moderately Dense Forest	0.03	0.44	4.42	**13.27**	4.34	22.50
Very Dense Forest	0.00	0.01	0.33	4.37	**5.24**	9.95
Grand Total	3.10	3.09	8.82	19.48	9.73	**44.22**

From 2016 to 2023, only 5.24 sq. km of Very Dense Forest has remained unchanged. (highlighted in bold). During this period, 4.37 sq. km of Very Dense Forest has transitioned to Moderately Dense Forest, while 0.33 sq. km has been degraded to Open Forest. A smaller portion, 0.01 sq. km, has changed from Very Dense Forest to Scrub, and 3.10 sq. km. has been converted from Very Dense Forest to Non-Forest land Similarly, 4.34 sq. km of land has enhanced from a Moderately Dense Forest to a Very Dense Forest. Additionally, 0.15 sq. km of Open Forest has transitioned to Very Dense Forest. There has been no conversion from Scrub and Non-Forest to Very Dense Forest within the same timeframe.

Conclusion

Assessing the spatio-temporal variation of land use and forest cover within the CAMPA sites using the RS & GIS technique has provided several key findings of land use & forest cover dynamics in the Rourkela Forest Circle of Odisha:

• As per the polygons uploaded on the e-Green Watch portal, the overall tree cover has decreased by 1.55 sq. km from 2016 to 2023.

• Conversely, Other Vegetation, which includes sparse trees and newly planted areas, has grown from 5.62 sq. km to 8.32 sq. km.

• According to the FVC analysis, the Rourkela Forest Circle has experienced a decrease in total forest cover (including OF, MDF, and VDF) of 1.74 sq. km over the past seven years.

• Despite afforestation efforts contributing 0.66 sq. km and forest quality enhancement covering 6.23 sq. km, the CAMPA sites have experienced an overall loss in vegetation. This is primarily due to 2.41 sq. km of vegetation loss from deforestation and 9.12 sq. km from degradation, resulting in a net decrease in overall vegetation cover.

4.3.2 Haryana

Haryana, with relatively less geographical area and limited forest cover experiences fewer diversions as compared to other states. However, the state's utilization of CAMPA funds for compensation and conservation activities makes it a significant case for studying the implementation of compensatory afforestation.

Indicator Based Analysis of Haryana

a) Institutional Design

Haryana State Compensatory Afforestation Fund Management and Planning Authority (Haryana CAMPA) was constituted in 2010 to inculcate into a holistic framework that ensures safety, security and timely yet transparent utilization of funds collected from the user agencies for the diversion of forest land for non-forestry purposes. It was reconstituted in 2018 in accordance with the provisions of Compensatory Afforestation Fund Act, 2016 and notification of Compensatory Afforestation Fund Rules, 2018. The organization of Haryana CAMPA is as follows:

- **Governing Body** headed by Hon'ble Chief Minister, Haryana
- **Steering Committee** headed by the Chief Secretary to Government of Haryana
- **Executive Committee** headed by Principal Chief Conservator of Forests (Head of the Forest Force)

All the three committees have been meeting consistently as per the guidelines of State CAMPA while also regularly uploading the minutes of the meeting on the website to maintain the transparent nature of the authority.

b) Land Diversion and Compensatory Levies

The State has reported extent of Recorded Forest Area (RFA) as 1,559 sq. km which is 3.53% of its geographical area. Consequently, the forest area diverted in Haryana is 43.69 sq. km, comparatively less than other states. Having compared the diversion, compensation and plantation work done in the state, it can be observed that the area under compensation and plantation is much more than the area under diversion, which is a clear indication that the forest area diverted in other states are also compensated in Haryana due to availability of land. The statistics of the three parameters can be seen in the graph below.

Figure 23: Land Diverted, CA Land Identified and Plantation Area in Haryana
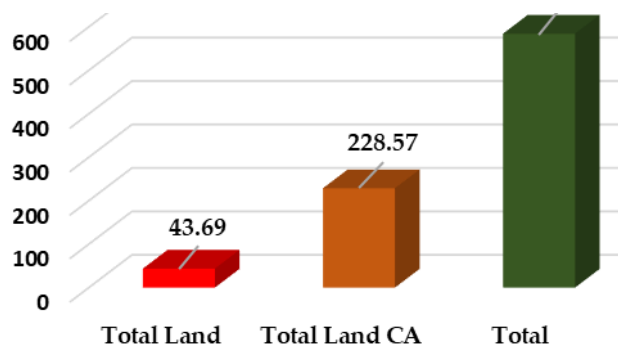
Source: e-Green Watch

The land diverted in the state has not been diverted for a specific purpose, in fact there are small areas of diversion for different activities. With the data made available on e-Green Watch. there are 4934 different projects uploaded on the portal out of which 2600 are unspecified projects i.e., small areas of diversion not necessarily falling into a particular category. There are 2334 specified projects out of which maximum projects belong to the building of roads, bridges and creating approach access to areas. The entire bifurcation of the 2334 projects can be seen in the graph below.

Figure 24: Category of Projects in Haryana

CATEGORY OF PROJECTS
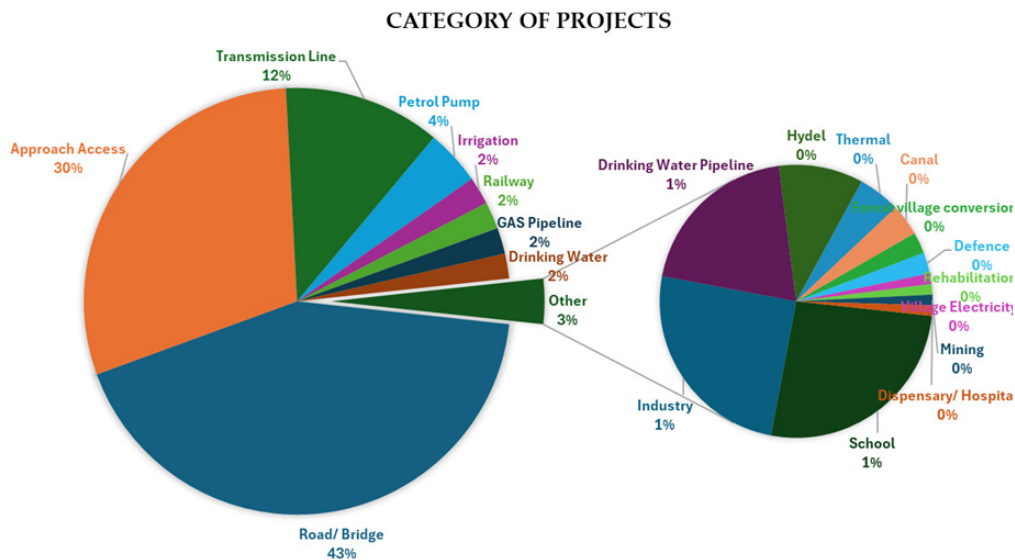
Source: e-Green Watch

The reserved, protected and unclassed forests are 15.97%, 74.28% and 9.75% of the forest area in the state respectively while the maximum diversion has taken place from protected forest. As per the recent ISFR, the forest cover in the state is 1,602.44 sq km which is 3.62% of the State's geographical area. In terms of forest canopy density classes, the State has 28.00 sq km under Very Dense Forest (VDF), 450.90 sq km under Moderately Dense Forest (MDF) and 1,123.54 sq km under Open Forest (OF). As evident from the statistics, Haryana has 70.11% of open forest i.e., less than 40 % canopy cover in the area. The graph below depicts that maximum compensation has taken place in degraded forest.

Figure 25: Type of land diverted and CA land identified
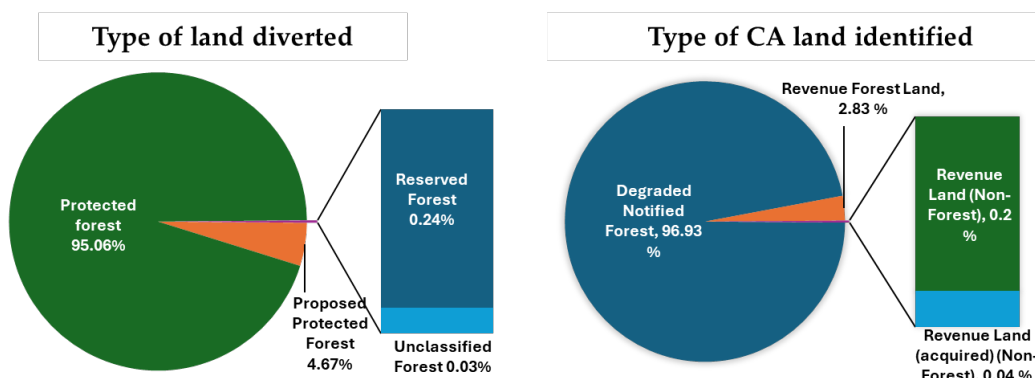
Source: e-Green Watch

As explained in Chapter 3, that a non-forest land must be mutated/transferred in the name of State Forest Department whenever a forest area is diverted for a non-forestry purpose, however only in few cases of central and state undertakings, the CA shall be carried out on a degraded notified forest. Interestingly, in a state like Haryana which has good availability of degraded notified forest, maximum compensation has been carried out on degraded notified forest.

c) **Utilisation of Funds**

Over the decade from 2010 to 2020, the department successfully planted approximately 182,923.48 plants across an area spanning 238.76 sq. km. A diverse array of plantation activities have been implemented, which includes tall plantations, ridge plantations, avenue plantations, Assisted Natural Regeneration (ANR), urban forestry, and herbal forestry. Emphasis was placed on cultivating native species to promote ecological balance and sustainability. According to third-party M&E reports from 2010 to 2020, the overall survival rate of these plantation activities across all circles stands at an impressive 67%. These reports have consistently rated the performance of plantation initiatives as satisfactory to excellent, reflecting effective planning and execution by the department.

Figure 26: Physical Achievements under CA and NPV funds
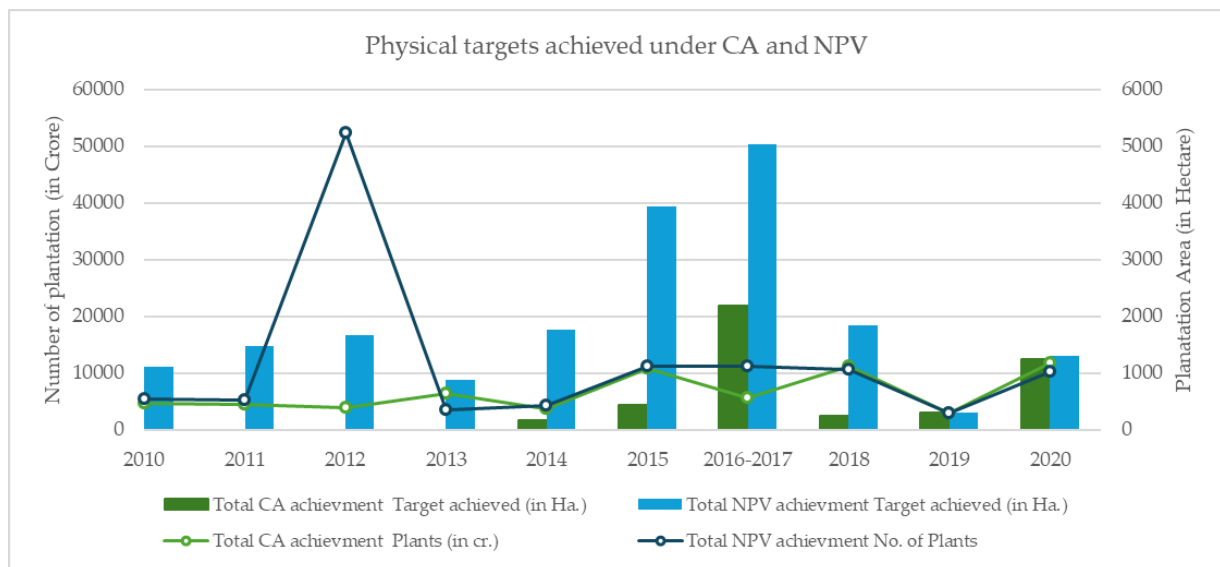
Source: State CAMPA Website accessed on 26th August 2024

Wildlife Conservation and Management Efforts

The Haryana Forest Department's dedicated Wildlife Wing has undertaken numerous initiatives aimed at wildlife conservation and management. Key activities include the establishment, expansion, and upgrading of wildlife facilities; procurement of wildlife rescue equipment; and the construction of boundary walls, protection centers, offices, residential facilities for staff, shelters, water ponds, and habitat restoration projects. (2020-21 third-party M&E report).

In addition to infrastructural developments the NPV funds have also been utilized by department to conduct various training programs and workshops focusing on critical areas such as patrolling, human-wildlife conflict resolution, and legal issues related to conservation. These programs cover topics like anti-poaching strategies, crime control, wildlife forensics, and efficient patrolling methodologies, enhancing the skills and preparedness of personnel involved in conservation efforts. (Third-party M&E 2019-20).

Community Involvement and Development Initiatives

Recognizing the importance of community engagement in sustainable forest management, all divisions have actively worked towards involving local communities and facilitating their development. Efforts have been made to reduce the dependence of village populations on forest resources, particularly fuelwood. Initiatives include the introduction of alternative energy sources such as biogas systems, which not only provide clean energy but also promote practices like stall-feeding cattle, enabling efficient dung collection for biogas production. These measures contribute to environmental conservation while supporting the livelihoods and well-being of local communities (Third-party M&E 2019-20).

d)   Monitoring and Evaluation (M&E)

Since the establishment of the State CAMPA in 2010, the state has consistently prioritized the monitoring and evaluation (M&E) of its activities through both internal and external audits. All M&E reports are readily accessible on the state's dedicated CAMPA website, demonstrating a commitment to transparency.

The internal monitoring mechanism operates on two levels across all divisions. Firstly, inter-range checks are conducted within each division by different ranges to ensure comprehensive oversight. Secondly, inter-division checks involve random site inspections by one division of another, promoting accountability and thorough evaluation. Complementing these efforts, the Haryana Forest Department maintains a specialized Monitoring and Evaluation Division responsible for the periodic assessment of both plantation and non-plantation activities across divisions. To date, internal monitoring has been completed in 16 out of 22 (73%) territorial divisions, while the process remains ongoing in the remaining 6 (27%) divisions. Beyond regular monitoring, the State Authority commissioned third-party independent evaluations covering works undertaken between 2010 and 2020, providing an objective analysis of progress and effectiveness. The results of external and internal M&E conducted is highlighted in the table below.

Table 12: Results of External M&E (2020-21)

S. No	Parameter	Remarks
1	Survival Rate	North Circle: 76 % survival rate in 133 evaluated sites. Central Circle: 79 % survival rate in 77 sites evaluated. West Circle: 74% survival rate in 100 evaluated sites. South Circle: 83% survival rate in 55 evaluated sites.
2	Plantation Target	22 territorial divisions achieved their physical plantation goals.

S. No	Parameter	Remarks
3	Plantation Record	According to the M&E report, 11 of the 22 territorial divisions did not maintain a plantation journal. Seven divisions had partially prepared journals, while the rest had well-maintained records.
4	Data Management	The M&E report notes that the data on e-green watch is either not updated regularly or is incorrect.

Table 13: Results of External M&E (2019-20)

S. No	Parameter	Remarks
1	Survival Rate	**CA-TP:** The target of 2.79 hectares was met precisely, with 2,789 plants planted and 2,176 surviving, resulting in a survival rate of 78%. **NPV-TP:** The target of 40 RKM was achieved, with 10,000 plants planted and 8,150 surviving, leading to a survival rate of 81.5%. **Overall Survival Rate:** For the year 2019-2020, the overall survival rate stands at 80.7%.
2	Division Performance	The report indicates that the CAMPA initiatives in the Bhiwani division and CFP were satisfactory.
3	Plantation Records	The plantation journal was reviewed and deemed satisfactory.
4	Data Management	The report emphasizes the need for timely fund releases, improved allocation processes, and early communication of target plantation work to field officers to ensure adequate preparations.

The results of the internal M&E conducted by the monitoring and evaluation wing of Forest Department in 2020-21 is highlighted in the table below.

Table 14: Results of Internal M&E

S. No	Circle	Number of Plants planted	Number of plants survived	Survival Rate (%)
1	North Circle	4,05,536	2,98,547	73.62
2	Central Circle	2,35,217	1,42,225	60.47
3	West Circle	3,83,798	2,50,310	65.22
4	South Circle	39,671	1,81,295	45.70

Remote Sensing and GIS-Based Assessment of Forest Cover Quality and Land Use Pattern in Haryana

Study Area

Based on the data from the E-Green Watch portal, the West Circle Hisar in Haryana has been selected for analysis. The table below (Table 15) outlines the names of the states, circles, and their corresponding districts.

Figure 27: Study Area Haryana
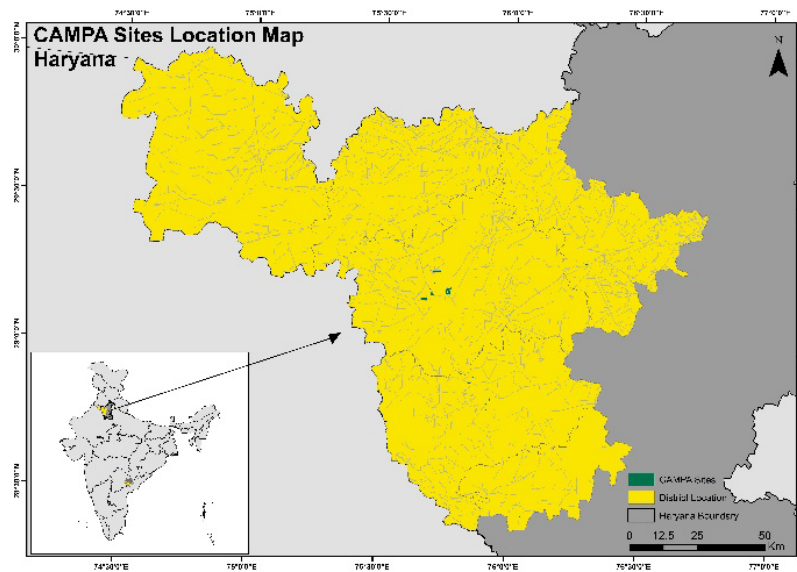
Table 15: Selected Districts

State	Circle	Number of KMLs uploaded in E-Green Watch portal since 2016	Districts	Total area (sq. km)
Haryana	West Circle Hisar	5307	Bhiwani Charkhi Dadri Fatehabad Hisar Jind Sirsa	99.05

Temporal Variation of LULC of CAMPA sites

From the district-wide LULC layers, the LULC status for the CAMPA sites has been extracted for both years. Area statistics for each class within the CAMPA sites have been calculated, and a comparative analysis of the changes in land cover types over the period has been assessed.

Figure 28: Haryana LULC 2016 and 2023
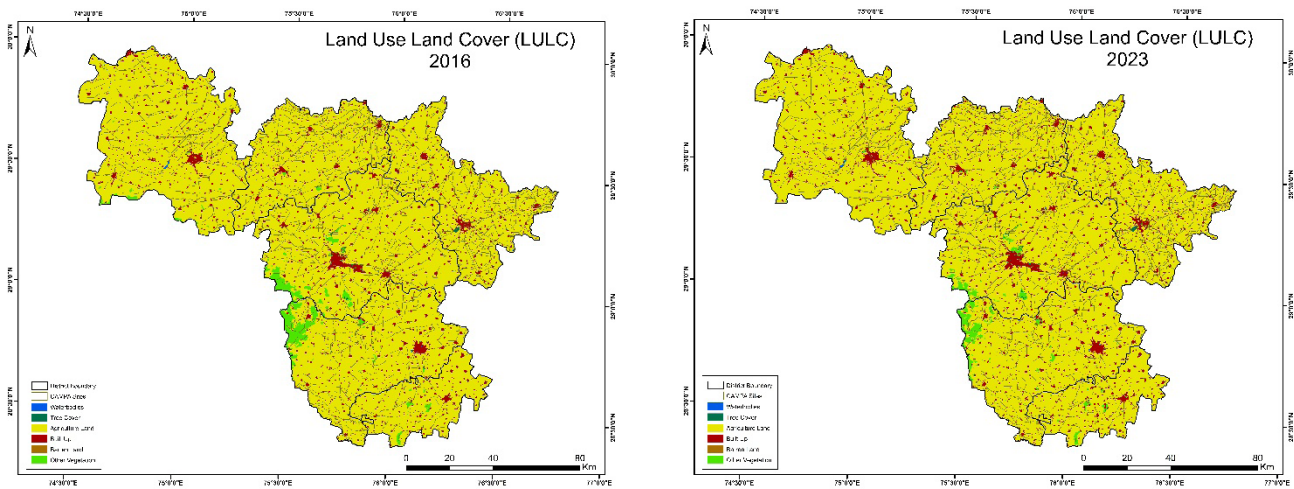
Table 16: Haryana CAMPA Site Statistics

Haryana CAMPA Sites Status		
Classes	**2016 (Area in sq. km)**	**2023 (Area in sq. km)**
Waterbodies	0.22	0.21
Tree Cover	2.74	2.66
Agriculture Land	83.30	79.67
Built up	8.70	11.52
Barren Land	0.29	0.09
Other Vegetation	3.80	4.88
Total	**99.03**	**99.03**

The analysis of temporal variation in LULC within CAMPA sites of West Circle Hisar in Haryana from 2016 to 2023 reveals a very marginal decrease in Tree Cover, with the area declining by 0.08 sq. km (8 hectares) from 2.74 sq. km to 2.66 sq. km. There has been an increase in the Other Vegetation class, which may include newly planted sites, with the area expanding by 1.08 sq. km which is roughly 108 hectares from 3.80 sq. km to 4.88 sq. km. This reflects successful efforts to expand the overall green cover in the area.

Temporal variation of Forest Density within CAMPA sites

Fractional Vegetation Cover (FVC) has been assessed for the districts in 2016 and 2023 using Landsat 8 imagery. Area statistics have been calculated for the FVC within the CAMPA sites for both years, allowing for a comparative analysis of vegetation changes over time.

Figure 29: Haryana FVC 2016 and 2023
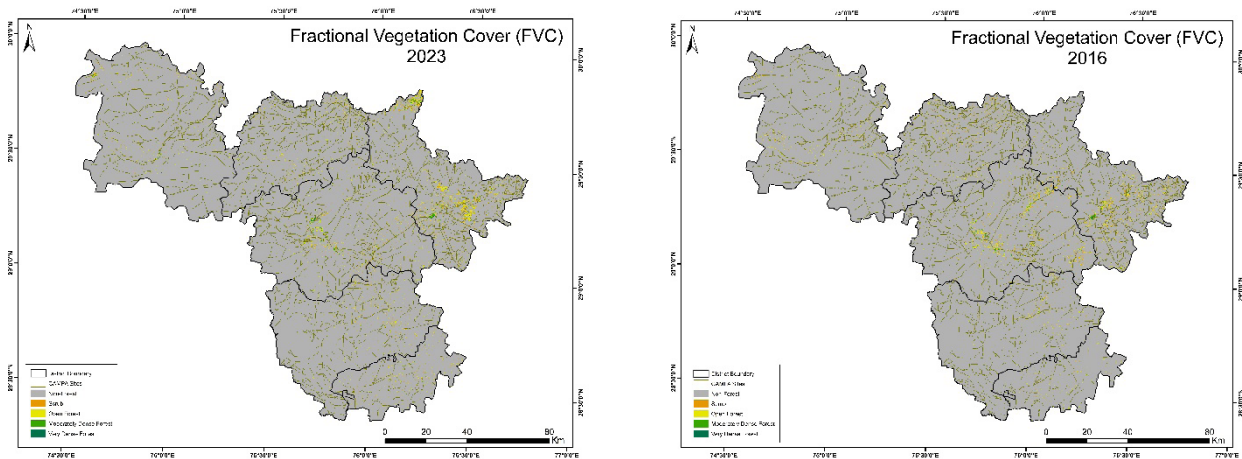
Table 17: Haryana FVC 2016 and 2023Statistics

Fractional Vegetation Cover (FVC)		
Class	2016 (Area in sq. km)	2023 (Area in sq. km)
Non-Forest	91.03	87.50
Scrub	2.32	4.68
OF	3.97	4.64
MDF	1.47	1.79
VDF	0.26	0.44
Total	99.05	99.05

The analysis of temporal variation in Forest Density (FVC) within the selected CAMPA sites from 2016 to 2023 reveals notable changes in vegetation composition. The non-forest class has decreased from 91.03 sq. km in 2016 to 87.50 sq. km in 2023, indicating a growth in vegetation within the CAMPA sites of the selected districts. The Scrub class has shown a significant increase, expanding from 2.32 sq. km to 4.68 sq. km over the same period. The Open Forest (OF) class has been increased from 3.97 sq. km to 4.64 sq. km resembling the growth observed in the Other Vegetation class in the LULC analysis, which includes sparse vegetation and small plants. There has been a marginal increase in the areas classified as dense forests, with the Moderate Dense Forest (MDF) increasing from 1.47 sq. km to 1.79 sq. km and the Very Dense Forest (VDF) rising from 0.26 sq. km to 0.44 sq. km. This suggests an overall improvement in the quality of forest area in the region.

Forest Cover Change Detection within CAMPA Sites

Based on the Fractional Vegetation Cover, a change map has been generated for the years 2016 to 2023 to monitor forest quality and land use patterns within the CAMPA sites. This facilitates a detailed evaluation of afforestation, deforestation, degradation, and enhancement.

Figure 30: Haryana FVC Change Map 2016-23
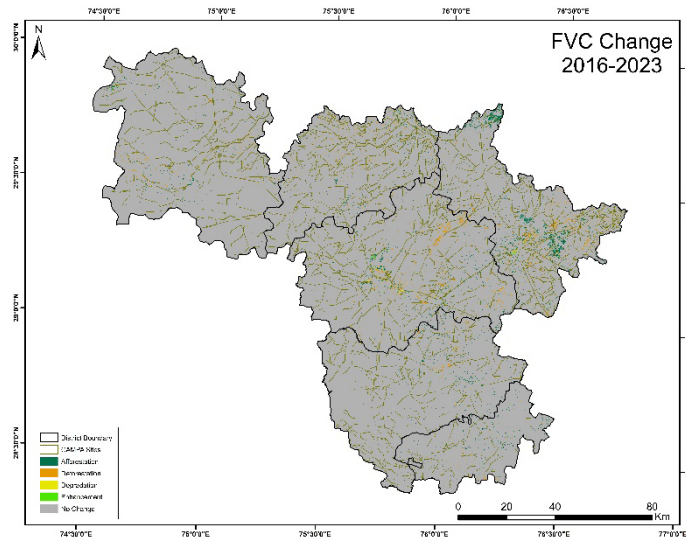
Table 18: Haryana FVC Change Statistics

FVC Change for CAMPA sites	
Status	**Area (sq. km)**
No Change	91.59
Afforestation	3.63
Deforestation	2.47
Enhancement	0.69
Degradation	0.67

In CAMPA sites of West Circle Hisar of Haryana, there has been afforestation of 3.63 sq. km, deforestation of 2.47 sq. km, enhancement of 0.69 sq. km. and degradation of 0.67 sq. km. An area of 91.59 sq. km experienced no change. This indicates that although a significant portion of the region remains unchanged, there is an overall improvement in the quality and quantity of forest cover.

The following change matrix explains the change in fractional vegetation cover from 2016 to 2023 precisely. Bold diagonal cells in the matrix indicate areas that remain unchanged over time, while other cells indicate where changes occurred.

Table 19: Haryana FVC Change matrix for CAMPA sites (2016-23)

	FVC Change (Area in sq km)	2023					
		Non-Forest	Scrub	Open Forest	Moderately Dense Forest	Very Dense Forest	Grand Total
2016	**Non-Forest**	**84.33**	3.63	2.57	0.38	0.13	91.03
	Scrub	1.37	**0.39**	0.43	0.09	0.03	2.32
	Open Forest	1.61	0.58	**1.19**	0.43	0.16	3.97
	Moderately Dense Forest	0.19	0.08	0.43	**0.67**	0.10	1.47
	Very Dense Forest	0.01	0.01	0.02	0.22	**0.01**	0.26
	Grand Total	87.50	4.68	4.64	1.79	0.44	**99.05**

From 2016 to 2023, only 0.01 sq. km of Very Dense Forest has remained unchanged (highlighted in bold). An area of 0.22 sq. km (22 ha) has transformed from a Very Dense Forest to a Moderately Dense Forest while only 0.02 sq. km of the area has degraded to an Open Forest from a Very Dense Forest. 0.01 sq. km of Very Dense Forest has transformed into Scrub, and 0.01 sq. km (1 ha) of the area has been converted to Non-Forest from a Very Dense Forest.

Likewise, an area of 0.10 sq. km has changed from a Moderately Dense Forest to a Very Dense Forest. The change in area from Open Forest to Very Dense Forest has been 0.16 sq. km. An area of 0.03 sq. km has transformed from Scrub to Very Dense Forest and 0.13 sq. km of non-forest has been converted to Very Dense Forest during the period of assessment.

Conclusion

Assessing the spatio-temporal variation of land use and forest cover within the CAMPA sites using RS & GIS technique has provided several key findings of land use & forest cover dynamics in the West Circle Hisar of Haryana:

- Most CAMPA sites are represented as linear polygons, reflecting that a significant portion of the plantations are along agricultural field boundaries and roadsides

- From 2016 to 2023, a reduction of 0.08 sq. km (8 hectares) in tree cover has been observed.

- Concurrently, Other Vegetation (including sparse trees and new plantation activities) has increased by 1.08 sq. km (108 hectares).

- The FVC analysis indicates a significant growth of 0.67 sq. km (67 ha) in Open Forest (OF), contributing to an overall increase of 1.17 sq. km which is roughly 117 hectares in the total forest area (OF + MDF + VDF).

- An overall improvement in both forest quantity and quality has been observed.

4.3.3 Uttarakhand

Uttarakhand is well endowed with biological resources; however, the past decades have seen an increase in pressure on the state's natural ecosystems. The major wealth of the state is its forests with very rich biodiversity, but the state has limited non-forest areas, with majority of the landscape being mountainous. These mountains are ecologically fragile and highly susceptible to earthquakes and landslides. Thus, this case study will emphasise the fact that for a state like Uttarakhand, compensation for the forest area lost comes across as a real challenge in the implementation of compensatory afforestation.

Indicator Based Analysis of Uttarakhand

a)   **Institutional Design**

The Uttarakhand Compensatory Afforestation Fund Management and Planning Authority (Uttarakhand CAMPA) was constituted on 10 November 2009. It was registered on 18 September 2010 as a Society under the Societies Registration Act 1860. However, Uttarakhand CAMPA was later reconstituted as an authority in follow up of the directions issued in the ad hoc CAMPA on 15 February 2012. Further, as per the new development under the provisions of CAF Act, 2016, Uttarakhand CAMPA was again reconstituted on 14 August 2018.

There are three committees constituted under Uttarakhand CAMPA for its overall management. These committees were earlier constituted as per the guidelines formulated by the MoEF&CC in 2009. Now these committees have been reconstituted as per the provisions of the Compensatory Afforestation Fund (CAF) Act, 2016.

The structure and constitution of these committees is as given below:

- The Governing Body of Uttarakhand CAMPA has been constituted under the chairmanship of Hon. Chief Minister of Uttarakhand with a total membership of 15 members.

- The Steering Committee of Uttarakhand CAMPA has been constituted under the chairmanship of Chief Secretary, Govt. of Uttarakhand with a total membership of 18 members. Chief Executive Officer, Uttarakhand CAMPA is the ex officio member secretary of this committee.

- The Executive Committee of Uttarakhand CAMPA has been constituted under the chairmanship of Principal Chief Conservator of Forests (HoFF), Uttarakhand. This committee has 21 members in all.

b)   **Land Diversion and Compensatory Levies**

The State has reported extent of Recorded Forest Area (RFA) as 38,120 sq. km which is 71.20% of its geographical area. The state ranks sixth among the other states in terms of percentage of recorded forest area. Having compared the diversion, compensation and plantation work done in the state, it can be observed that the area under diversion is

much more than the area under compensation and plantation, which is a clear indication that the forest area diverted in Uttarkhand has not been compensated in the state highlighting the issue of non-availability of non- forest land in the state. The statistics of the three parameters can be seen in the graph below.

Figure 31: Land Diverted, CA Land Identified and Plantation Area in Uttarakhand
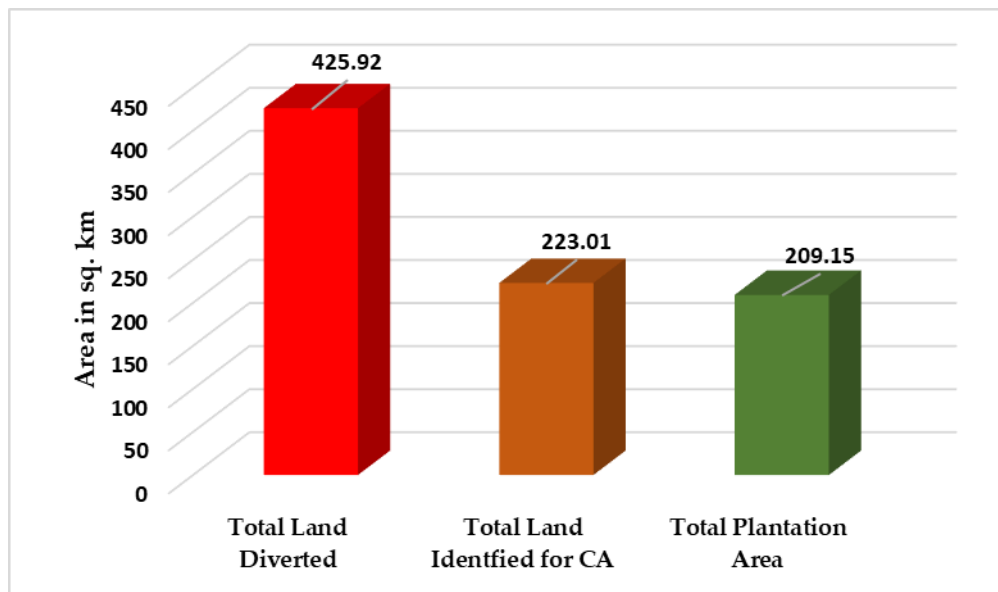
Source: e-Green Watch

It is also indicative of the fact that high-quality forests in Uttarakhand have been diverted for non-forest purposes. These diversions may have been compensated in areas where the soil quality, land conditions, climate, and ecological value are not as favourable as those in Uttarakhand.

With the data made available on e-Green Watch. there are 1675 different projects uploaded on the portal out of which 131 are unspecified projects i.e., small areas of diversion not necessarily falling into a particular category. There are 1544 specified projects out of which maximum projects belong to the construction of roads and bridges followed by projects sanctioned for drinking water, hydel projects, transmission lines and creating irrigation facilities.

The construction of roads and bridges forms 81 % of the projects with 116.93 sq. km s forest area diverted under the projects. While the roads and bridges promote connectivity, the linear nature of such construction serves as one of the major reasons for forest fragmentation. In a State like Uttarakhand, which has lot of National Parks and Wildlife Sanctuaries providing habitat to large variety of native species and wildlife, such forest fragmentation leads to loss in habitat, loss in biodiversity and increase in human-wildlife conflicts and vehicular collisions of small species found in the area.

The entire bifurcation of the 1557 projects can be seen in the graph below.

Figure 32: Category of Projects in Uttarakhand
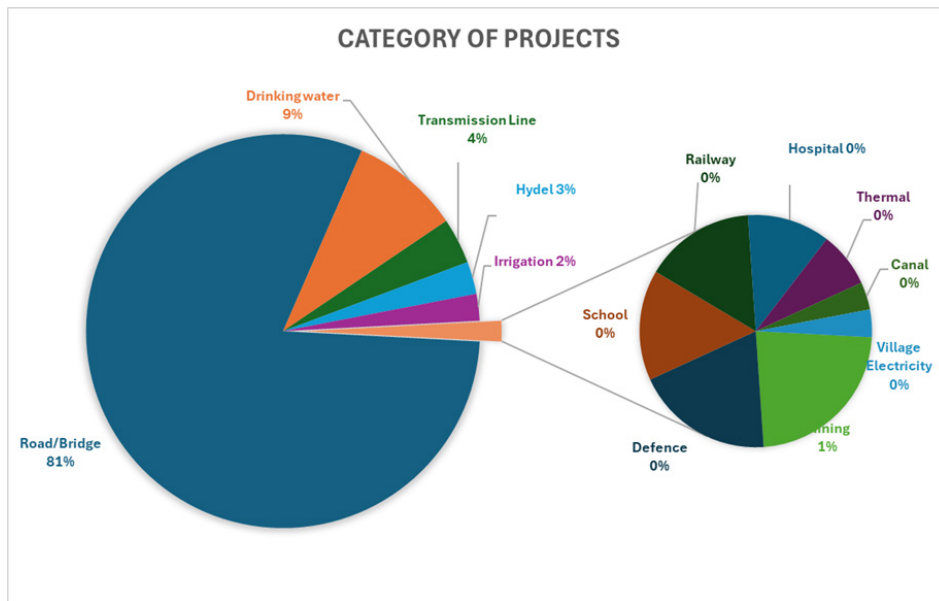
Source: e-Green Watch

As per the recent ISFR, the forest cover in the state is 24,305 sq km which is 45.44% of the State's geographical area. In terms of forest canopy density classes, the State has 9.45 % under Very Dense Forest (VDF), 23.87 % under Moderately Dense Forest (MDF) and 12.12 % under Open Forest (OF).

The graph below depicts that maximum diversion has taken place in reserve forest which can also be attributed to the presence of forest fringe villages and their dependence on the forest which drives diversion. It is fortunate that not much diversion has happened in the protected areas which serves as a habitat for major wildlife species. Uttarakhand has struggled to adequately compensate for the forest diversions that have occurred in the state. The limited compensation that has taken place has largely been within degraded notified forests, highlighting the issue of non-availability of non-forest land in the region.

Figure 33: Type of land diverted and CA land identified
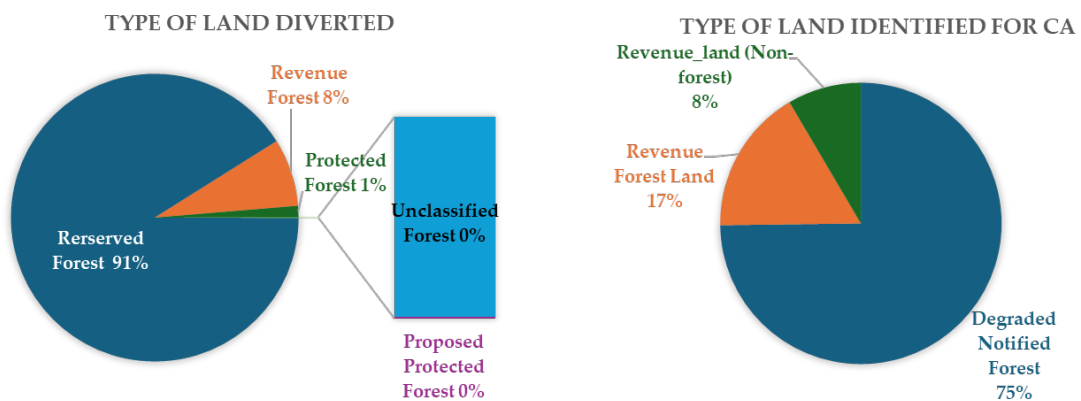
Source: e-Green Watch

c)   **Fund Utilisation**

Since the implementation of CAMPA in Uttarakhand in 2009-10, the state has undertaken a range of activities aimed at preserving natural forests, afforesting degraded areas, protecting forest resources, water management, managing forest fires, conserving wildlife, and supporting infrastructure development, research, and capacity building. These activities have been systematically guided by the Annual Plans of Operation (APOs), prepared by the Uttarakhand Forest Department in accordance with CAMPA guidelines.

From 2009-10 to 2021-22, the Government of India provided financial support of an amount of 24,890.73 crore to Uttarakhand for the implementation of CAMPA activities. This financial assistance has been essential in advancing the state's efforts in afforestation, conservation, and sustainable forest management, thereby reinforcing CAMPA's role as a critical component of the state's environmental strategy. In 2019-20, the National Authority (CAMPA) released 2,675.09 crore as Uttarakhand's 90% share under the Compensatory Afforestation Fund (CAF) Act, 2016. This release brought the total funds allocated to Uttarakhand CAMPA to 3,83,147.93 lakh as of March 2019. These funds were allocated across various budget heads in line with the CAF Act, 2016, and the CAF Accounting Procedure, 2018.

During the 2019-20 period, Uttarakhand CAMPA made notable progress in its compensatory afforestation and forest management initiatives. A total of 105,354 hectares of forest area was covered under compensatory afforestation, contributing significantly to the state's ecological balance. The state utilized funds collected under various compensatory levies, including Compensatory Afforestation (CA) and Net Present Value (NPV), to finance these activities. These efforts resulted in an increase of 1,035 Sq. km in forest cover since the state's formation.

The funds were effectively allocated to various activities, including forest protection, infrastructure development, and wildlife management. Key investments were made in the construction of fire lines, check posts, and inspection paths, which have strengthened forest protection. Despite challenges, Uttarakhand CAMPA achieved approximately 85.2% of its physical targets and 77.6% of its financial targets from FY 2011-2021, reflecting a consistent commitment to the objectives set forth in the Annual Plans of Operation.

Figure 34: Physical and Financial Target Achieved
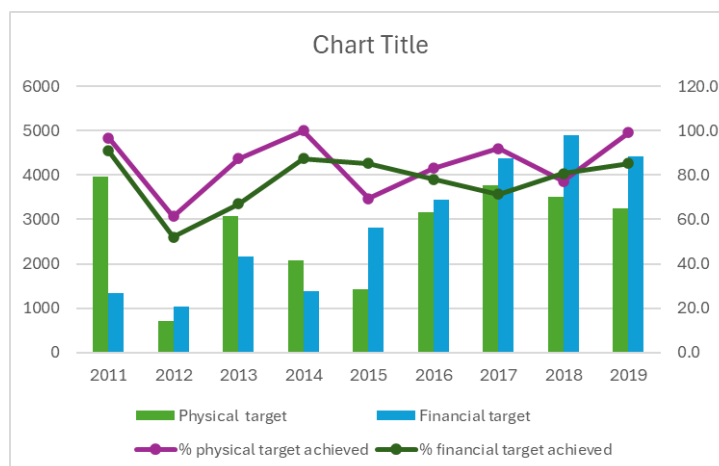
Source: CAMPA Annual report 2020-21

d)   Monitoring and Evaluation

Uttarakhand CAMPA has not conducted the internal and external monitoring and evaluation of their activities undertaken from the CAMPA funds. There are no reports available on the dedicated site of Uttarakhand CAMPA that would indicate the M&E being done in the state.

Remote Sensing and GIS-Based Assessment of Forest Cover Quality and Land Use Pattern in Uttarakhand

Study Area

Based on the data from the E-Green Watch portal, Pauri Garhwal Forest Circle in Uttarakhand has been selected for analysis. The table below (Table 17) outlines the names of the states, circles, and their corresponding within the CAMPA sites.

Figure 35: Study Area Uttarakhand
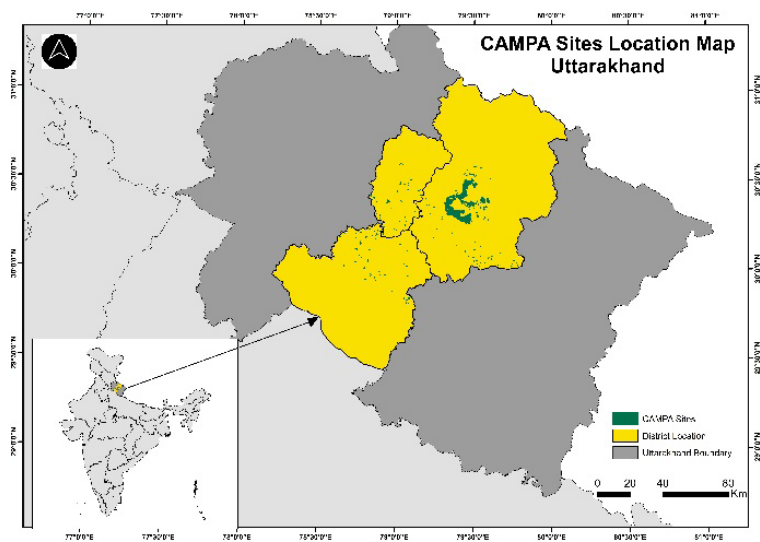
Table 20: Selected Districts

State	Circle	Number of KMLs uploaded in E-Green Watch portal since 2016	Districts	Total area (sq. km)
Uttarakhand	CF Garhwal, Pauri	486	Chamoli Pauri Garhwal Rudraprayag	160.25

Temporal Variation of LULC of CAMPA sites

The LULC area for CAMPA sites has been extracted for both years from district-wide maps. Area statistics for each class have been calculated, and a comparative analysis of land cover changes over time has been performed.

Figure 36: Uttarakhand LULC 2016 and 2023
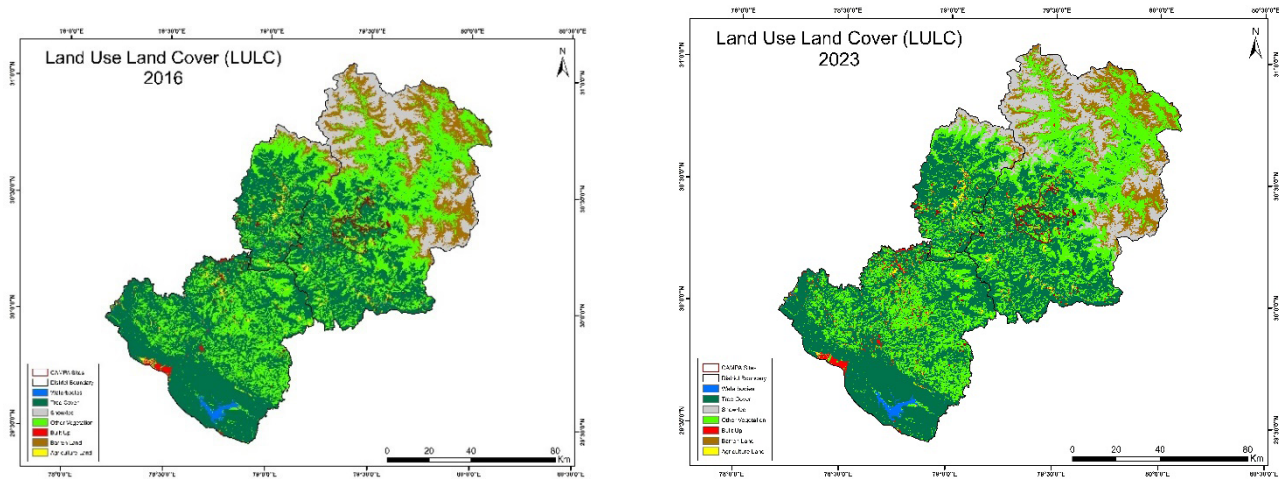
Table 21: Uttarakhand CAMPA Site Statistics

Uttarakhand CAMPA Sites Status		
Classes	**2016 (Area in sq. km)**	**2023 (Area in sq. km)**
Waterbodies	1.45	1.46
Tree Cover	65.86	65.27
Agriculture Land	4.48	4.00
Built up	0.88	1.53
Barren Land	3.81	2.32
Other Vegetation	76.58	78.48
Total	**153.07**	**153.07**

The analysis of temporal variation in LULC within CAMPA sites of Garhwal Circle in Uttarakhand from 2016 to 2023 reveals a slight decrease in Tree Cover, with the area declining by 0.59 sq. km (59 hectares) from 65.86 sq. km to 65.27 sq. km. There has been a notable increase in the Other Vegetation class, which may include newly planted sites, with the area expanding by 1.9 sq. km which is roughly 190 hectares from 76.58 sq. km to 78.48 sq. km. This reflects successful efforts to improve the overall green cover in the area.

Temporal variation of Forest Density within CAMPA sites

Following the analysis of Fractional Vegetation Cover, a change map from 2016 to 2023 has been produced to monitor the forest quality and land use scenario within the CAMPA sites. The change map highlights a detailed assessment of afforestation, deforestation, degradation, and enhancement.

Figure 37: Uttarakhand FVC 2016 and 2023
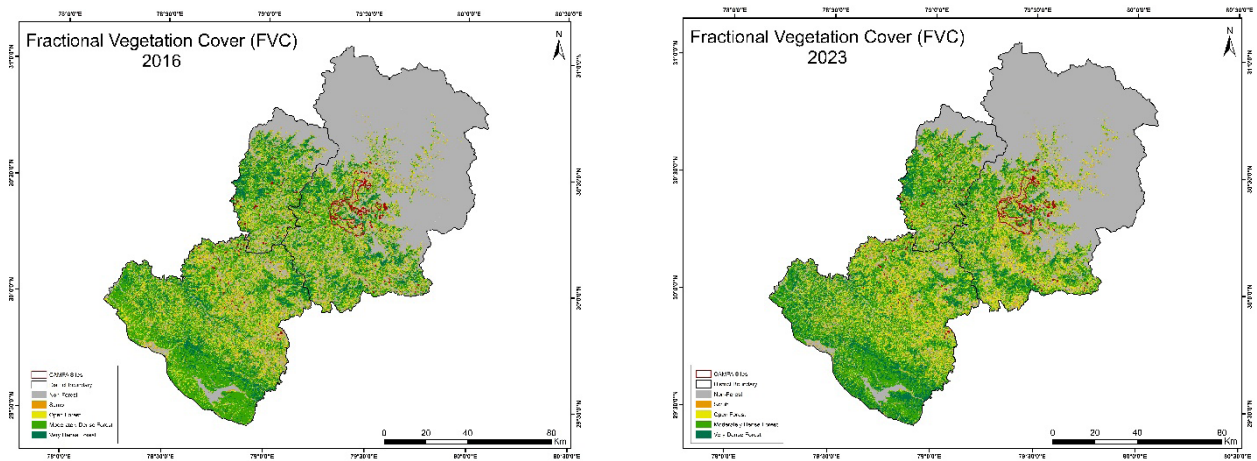
Table 22: Uttarakhand FVC 2016 and 2023 Statistics

Fractional Vegetation Cover (FVC)		
Class	2016 (Area in sq. km)	2023 (Area in sq. km)
Non-Forest	28.06	26.56
Scrub	27.72	27.92
OF	46.37	58.16
MDF	44.60	41.04
VDF	13.51	6.57
Total	160.2	160.2

The analysis of temporal variation in Forest Density (FVC) within the selected CAMPA sites from 2016 to 2023 shows significant changes in vegetation composition. The non-forest area has decreased from 28.06 sq. km in 2016 to 26.56 sq. km in 2023, reflecting a moderate increase in vegetation region. The Scrub class has also experienced a very slight growth, increasing from 27.72 sq. km to 27.92 sq. km during the same period. The Open Forest (OF) class has seen a significant increase, from 46.37 sq. km to 58.16 sq. km (11.79 km. On the other hand, total forest cover has seen a marginal decline, with the Moderate Dense Forest (MDF) reducing from 44.6 sq. km to 41.04 sq. km and the Very Dense Forest (VDF) decreasing from 13.51 sq. km to 6.57 sq. km .

Forest Cover Change Detection within CAMPA Sites

Following the analysis of Fractional Vegetation Cover, a change map from 2016 to 2023 has been produced to monitor the forest quality and land use scenario within the CAMPA sites. The change map highlights a detailed assessment of afforestation, deforestation, degradation, and enhancement.

Figure 38: Uttarakhand FVC Change 2016-23
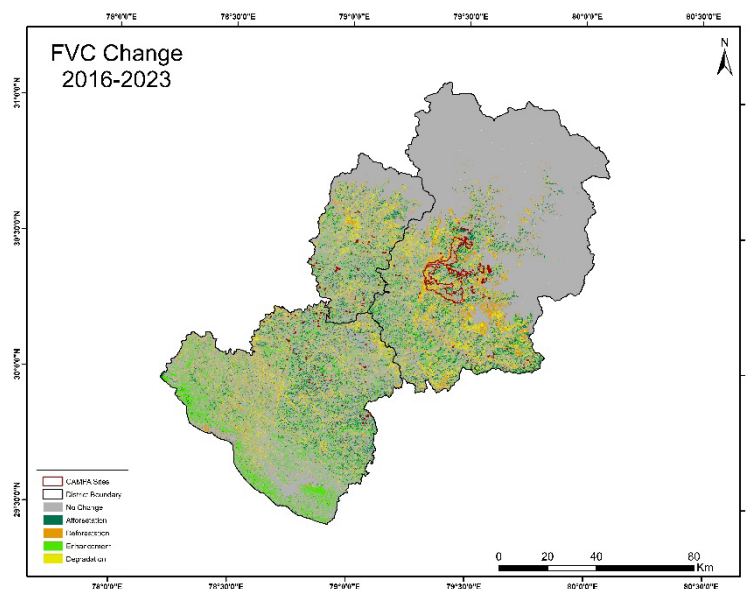
Table 23: Uttarakhand FVC Change CAMPA statistics

FVC Change CAMPA Sites	
Status	**Area (sq. km)**
No Change	88.57
Afforestation	17.43
Deforestation	16.14
Enhancement	10.82
Degradation	27.29

In the CAMPA sites of Uttarakhand, there has been afforestation of 17.43 sq. km, deforestation of 16.14 sq. km, enhancement of 10.82 sq. km and degradation of 27.29 sq. km . An area of 88.57 sq. km experienced no change. This explains that while a significant area within the CAMPA sites remains unchanged over 7 years, there has been a moderate decline in both the quantity and quality of forest cover. The table below presents data regarding the FVC Change matrix of CAMPA sites in Pauri Garhwal Circle for the years 2016 and 2023, offering insights into the changes over 7 years.

Table 24: Uttarakhand FVC Change matrix for CAMPA sites (2016-23)

FVC Change Matrix for CAMPA Sites (2016-2023)						
	FVC Change (Area in sq km)	2023				
		Non-Forest	Scrub	Open Forest	Moderately Dense Forest	Very Dense Forest	Grand Total
2016	**Non-Forest**	**15.46**	6.19	4.90	1.46	0.05	28.06
	Scrub	6.81	**9.89**	9.16	1.82	0.05	27.72
	Open Forest	3.31	9.67	**24.70**	8.41	0.28	46.37
	Moderately Dense Forest	0.84	2.09	18.08	**21.46**	2.12	44.60
	Very Dense Forest	0.15	0.09	1.31	7.89	**4.07**	13.51
	Grand Total	26.56	27.92	58.16	41.04	6.57	**160.25**

In the CF Pauri Garhwal circle, from 2016 to 2023 From 2016 to 2023, only 4.07 sq. km of Very Dense Forest has remained unchanged. (highlighted in bold). During this period, 7.89 sq. km of Very Dense Forest has transitioned to Moderately Dense Forest, while 1.31 sq. km has shifted to Open Forest. A smaller portion, 0.09 sq. km, has changed from Very Dense Forest to Scrub, and 0.15 sq. km. has been converted from Very Dense Forest to Non-Forest.

Similarly, 2.12 sq. km of land has changed from a Moderately Dense Forest to a Very Dense Forest. Additionally, 0.28 sq. km of Open Forest has transitioned to Very Dense Forest. There has also been a conversion of 0.05 sq. km from Scrub to Very Dense Forest, and 0.05 sq. km of non-forest area has transitioned to Very Dense Forest within the same timeframe.

Conclusion

Assessing the spatio-temporal variation of land use and forest cover within the CAMPA sites using RS & GIS technique has provided several key findings of land use & forest cover dynamics in the CF Garhwal, Pauri Circle of Uttarakhand:

- There has been a total decrease of 0.59 sq. km (59 ha) in tree cover from 2016 to 2023 (within CAMPA sites).

- Conversely, the Other Vegetation class, has increased by 1.9 sq. km (190 ha) over the same period, which indicates a shift towards scattered as well as newly planted vegetation areas.

- It has been further observed that the OF has increased by around 11.79 sq. km, while the MDF and VDF have reduced by 3.56 sq. km and 6.94 sq. km, respectively.

- This suggests that while new plantations are evident, there is a broader trend of forest degradation within the CAMPA sites.

Summary of State Analysis

Indicator Based analysis of states - Summary

Table 25: Summary of Indicator Based Analysis

Parameters	Odisha	Haryana	Uttarakhand
Geographical Area (sq. km)	1,55,707 sq. km	44,212 sq. km	53,483 sq. km
Forest Area (sq. km)	58,140 sq. km	360 sq. km	38,120 sq. km
Forest Cover (sq. km)	52,156 sq. km	1,603 sq. km	24,305 sq. km
Documents available in the public domain	Annual Plan of Operation (APOs) External Monitoring & Evaluation Reports Details of Meeting of Committees Sanction Letters	Annual Plan of Operation (APOs) External Monitoring & Evaluation Reports Internal Monitoring & Evaluation Reports Audit Reports Details of Meeting of Committees Sanction Letters	Annual Plan of Operation (APOs) Audit Reports Details of Meeting of Committees Sanction Letters
Target achieved from 2016 to 2023 (e-Green Watch)	15.11 %	1.71 %	28.08 %
Year of Notification of State CAMPA	2009	2010	2009
Institutional Design	Governing Body Steering Committee Executive Committee	Governing Body Steering Committee Executive Committee	Governing Body Steering Committee Executive Committee
Land Diverted	545.97 sq. km	43.69 sq. km	425.93 sq. km
Land identified for compensation	1,043.52 sq. km	228.57 sq. km	223.01 sq. km
Plantation work done	2,823.18 sq. km	584.30 sq. km	209.15 sq. km
Kind of projects	Total 596 projects of diversion, covering an area of 1,399.91 sq. The major activities for which forest land has been diverted is mining (42%), transmission lines (23%), irrigation (16%), roads/bridges (10%) followed by other activities such as railways, industry, quarrying, defence, school, etc.	In Haryana, there are 4934 different projects uploaded on the portal out of which 2600 are unspecified projects i.e., small areas of diversion not necessarily falling into a particular category. There are 2334 specified projects out of which maximum projects belong to the building of roads, bridges and creating approach access to areas	There are 1544 specified projects out of which maximum projects belong to the construction of roads and bridges followed by projects sanctioned for drinking water, hydel projects, transmission lines and creating irrigation facilities. The construction of roads and bridges forms 81 % of the projects with 116.93 sq. km s forest area diverted under the projects.

Parameters	Odisha	Haryana	Uttarakhand
Type of forest land diverted	Major diversion has taken place in proposed protected forest (37%), reserved forest (32%), revenue forest (27%) followed by protected forest (3%) and unclassified forest (1%)	Major diversion has taken place in protected forest (95.06%) followed by proposed protected forest (4.67%), reserved forest (0.24%) and unclassified forest (0.03%)	Major diversion has taken place in reserved forest (91%) followed by revenue forest (8%) and protected forest (1%)
Type of forest land identified for compensation	The lands for CA are majorly identified in degraded forest (63%) followed by revenue land (31%) and revenue forest (6%)	The lands for CA are majorly identified in degraded notified forest (96.93%) followed by revenue forest land (2.83%), non-forest (0.2%) and acquired non-forest land (0.04%)	The lands for CA are majorly identified in degraded notified forest (73%) followed by revenue forest land (17%) and non-forest
Monitoring and Evaluation	The Odisha state since the initiation of CAMPA in 2009 has diligently carried out its M&E. External M&E has been completed for the year 2009-2010 to 2016-2017 and 2017-18 to 2020-21	Since the establishment of the State CAMPA in 2010, the state has consistently prioritized the monitoring and evaluation (M&E) of its activities through both internal and external audits. External M&E has been conducted annually from 2011 to 2021	Uttarakhand CAMPA has not been diligent in carrying out the internal and external monitoring and evaluation of their activities undertaken from the CAMPA funds. There are no reports available on the dedicated site of Uttarakhand CAMPA that would indicate the M&E being done in the state.

Remote Sensing and GIS-Based Assessment of CAMPA sites - Summary

Results of the RS-GIS based assessment in the selected districts

- In Odisha, despite afforestation efforts contributing 0.66 sq. km and forest quality enhancement covering 6.23 sq. km, the CAMPA sites have experienced an overall loss in vegetation.

- In Haryana, an overall improvement in both quantity and quality has been observed with an overall increase of 1.08 sq.km area under plantation.

- In Uttarakhand, the quality of plantation is poor as broader trend of degradation within CAMPA sites has been observed.

5. Challenges in the implementation of Compensatory Afforestation

Progress from the CAG Audit in 2013

The challenges in the implementation of compensatory afforestation was last identified in the CAG audit conducted in 2013 details of which are mentioned in Annexure 3. Issues such as underutilisation of funds, accumulation of funds and unauthorised usage of funds were highlighted in the report. All these challenges were attributed to the absence of a concurrent institution and monitoring system in place for utilisation of funds.

Following this, CAF Act and CAF Rules were notified in 2016 and 2018 wherein centralisation of funds and establishment of dedicated accounts within centre and state was mandated. It also notified rules for correct utilisation of funds realised from user agencies under different heads. E-Green Watch and Parivesh were an additional effort to monitor the progress of activities and digitalize the process of diversion to minimise faults and increase transparency.

Thus, the implementation of compensatory afforestation in India as compared to 2013 is in a better position. However, few challenges are still persistent and have been discussed below.

5.1 Land related challenges

5.1.1 Land Scarcity

India has already moved out of the forest area and introduced the concept of "Forest Cover Outside Forest" to meet the NDC target, now, to further compensate the land diverted; we

need more lands in a place where land is supporting a huge population. The graph below represents the comparison of land diverted and CA land identified in a particular state.

Figure 39: Difference in area of land diverted and land identified for CA
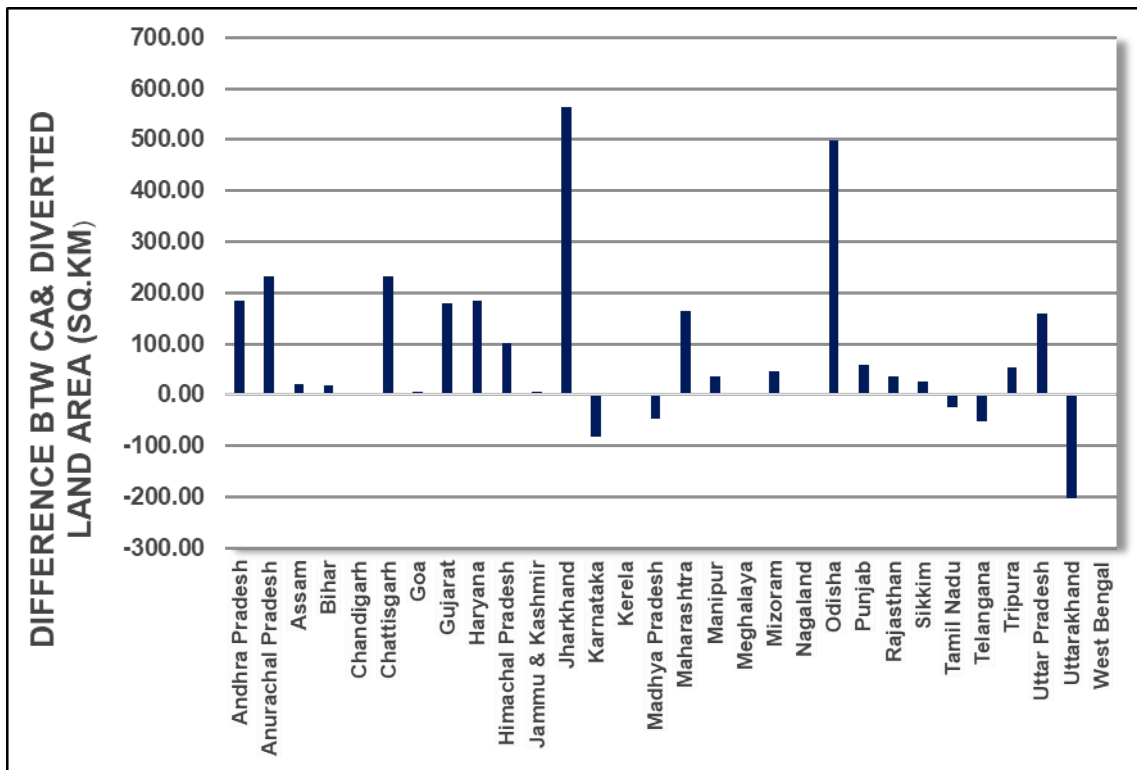
The graph emphasises the issue of non – forest land unavailability in a state. The difference between the lands diverted can go up to more than 500 sq. km as in the case of Jharkhand where the land identified for CA is so much more than the land diverted. Opposite is the case with Uttarakhand where the land identified for CA is 200 sq. km less than the land diverted.

5.1.2 Land Fragmentation

Another major issue related to land is the land fragmentation. Suppose if 10 sq. km of forest land is diverted at one place, and the land identified for mutated/transferred in exchange of that is split into different parcels, where 5 sq. km is at one place and other land is identified at some other place. This leads to forest fragmentation.

In e-Green watch, along with data of the area diverted, there's data on the land parcels included in the area. On comparing the land parcels of the land diverted and land identified for compensatory afforestation, there stood a difference of 10,568 parcels in the national analysis. Same can be observed in the state analysis as well.

Figure 40: Difference in land parcels of diversion and CA

National

Haryana

Uttarakhand
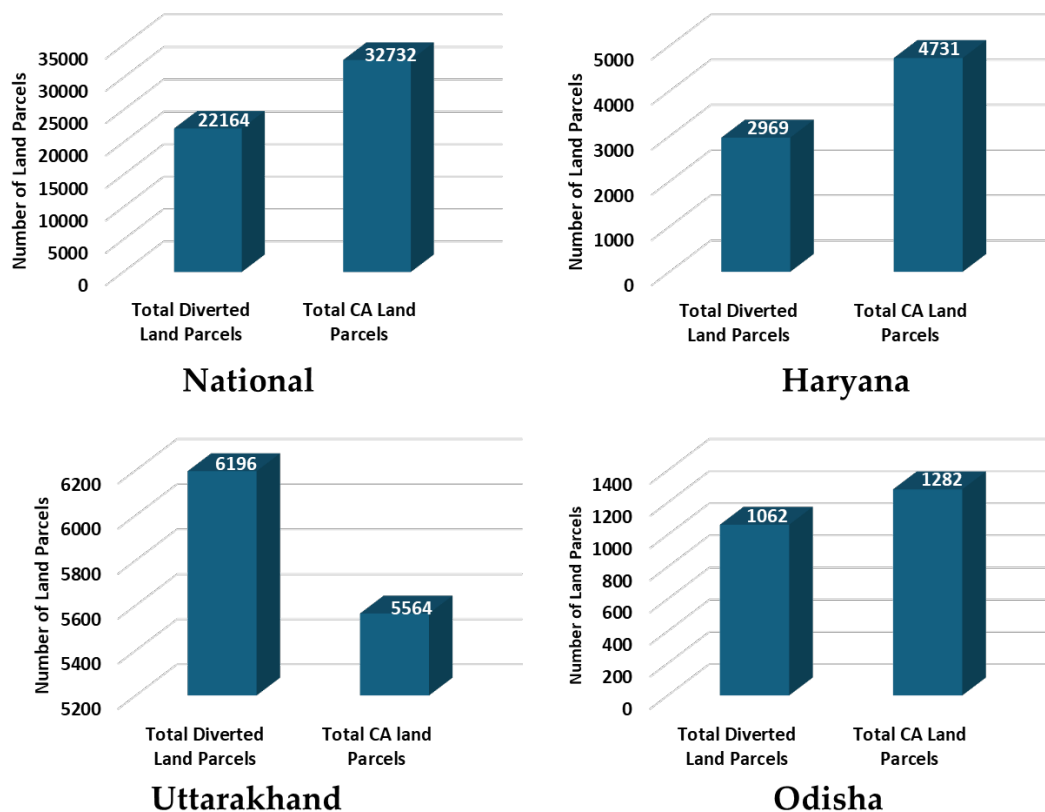
Odisha

Source: e-Green Watch accessed in April 2024

Haryana and Odisha also show difference in the parcels of diverted land and land identified for compensatory afforestation. A similar illustration cannot be observed in the case of Uttarakhand as the compensation done in Uttarakhand is far less than diversion taken place in the state.

With problems like land scarcity and land fragmentation in existence, it becomes very difficult to cultivate a forest in exchange for a forest land diverted, and thus compensation in forms of avenue plantations will never be able to offer the same kind of ecosystem services as a forest would. This not only leads to loss of microecology but also leads to loss of habitat thus leading to loss of biodiversity.

One such example of land fragmentation as observed in Hisar Forest circle of Haryana state, Majority of the CAMPA sites are line polygons which indicate that maximum plantations have been done in running kilometers on the sides of roads and railways in the form of avenue plantations.

Figure 41: CAMPA sites of Hisar Circle, Haryana
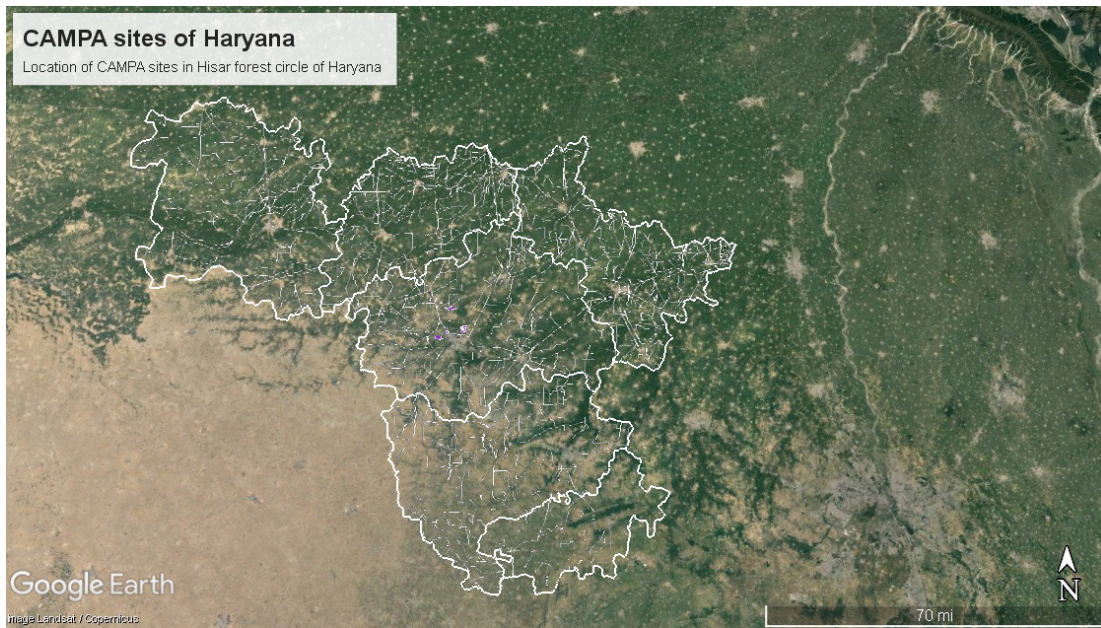
Source: e-Green Watch

5.2   Underutilisation of Funds

On analysis of the financial target of the states and the target achieved by the state from 2016 to 2024, underutilisation of funds emerged as one of the biggest challenge. The target is given every year under schemes such as NPV, CA, CAT, SZ, etc.

The year wise target 2016 to 2024 has been depicted in the graph below.

Figure 42: Year wise % target achieved from 2016 to 2024
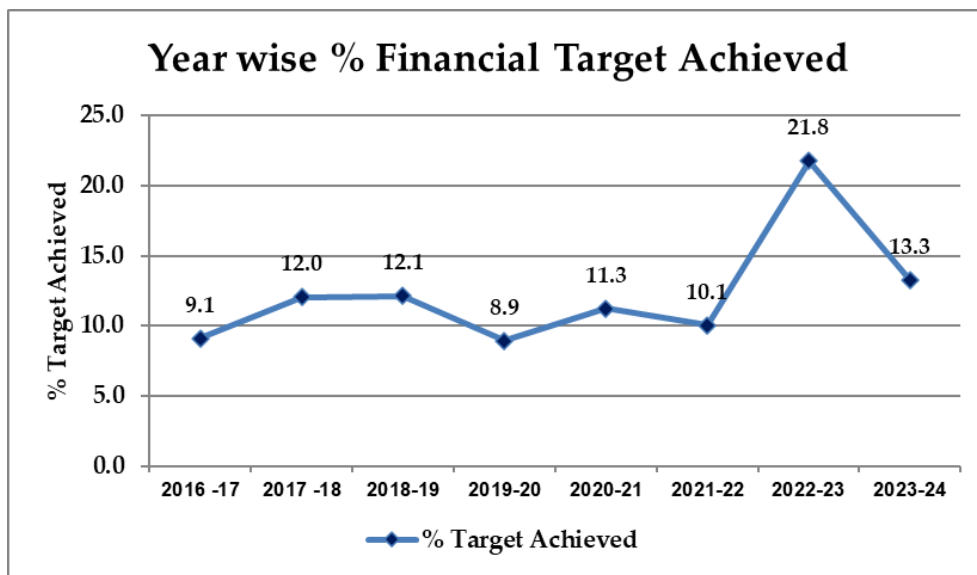
Source: e-Green Watch accessed in April, 2024

It can be seen from the graph that in maximum financial years, target achieved is lower than 20 %. Only exception is the financial year 2022 – 23, where target achieved is 21.8 % which itself is low but better than other financial years. Similarly, the target achievement under each scheme from 2016 to 2024 was analysed and depicted in the graph below.

Figure 43: Scheme wise % Target Achieved from 2016 to 2024
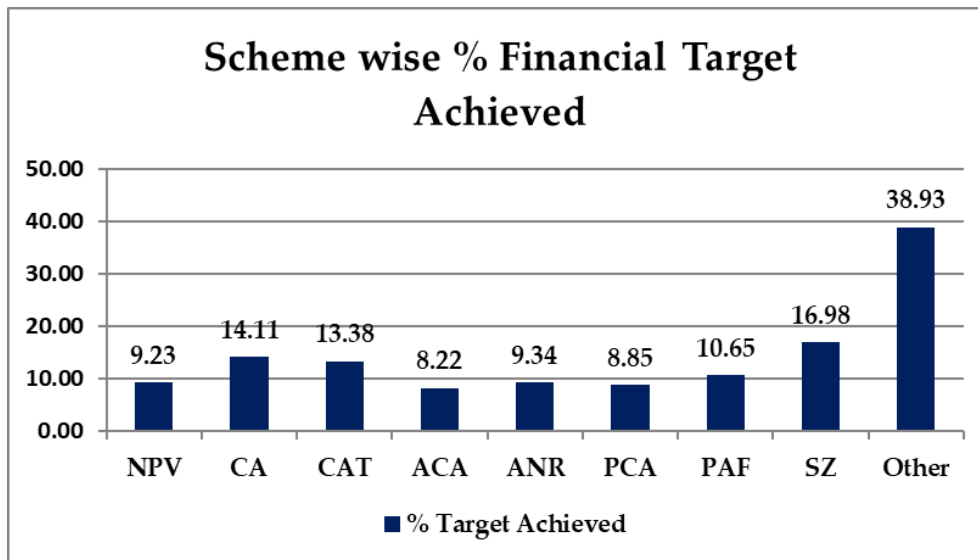
Source: e-Green Watch accessed in April, 2024

The graph clearly depicts that the maximum target achieved (38.93 %) is from the amounts collected under others heads which is the contingency amount taken from the user agencies. Under other schemes, the target achieved is not more than 20 %.

The target achieved by a particular state from 2016 to 2014 under all schemes is depicted in the graph below.

Figure 44: State wise % target achieved from 2016 to 2024
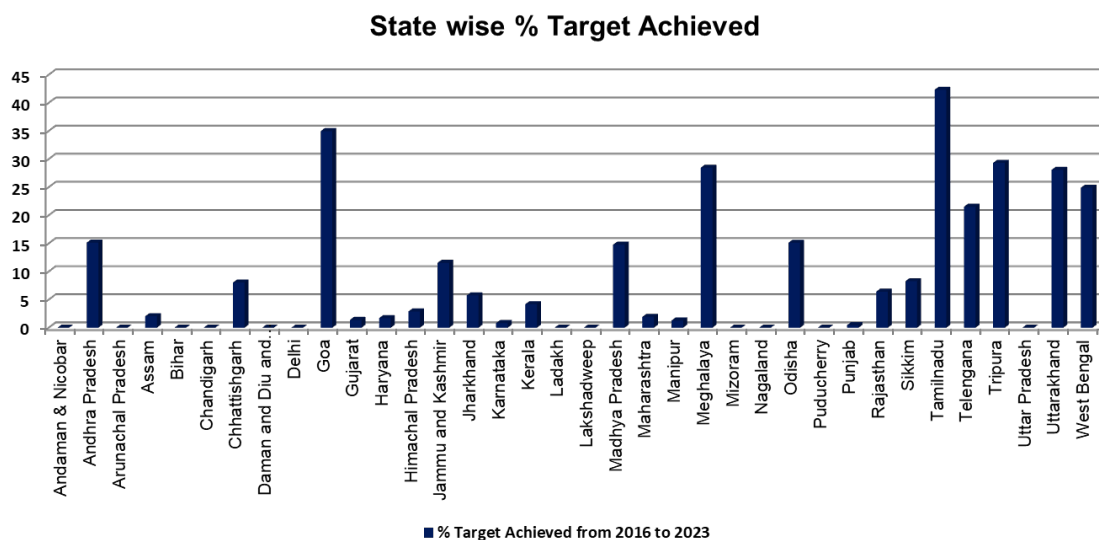
Source: e-Green Watch accessed in April, 2024

The graph depicts that not even 50 % target has been achieved by any state with maximum target achieved by the Tamil Nadu (40.8 %). For few states/UTs, the target achieved is exceptionally low such as Bihar, Delhi, Mizoram, Nagaland, etc.

5.3 Non-maintenance of records on dedicated websites

A well-designed site can enhance credibility, provide updates and transparency which is crucial for success in the implementation of compensatory afforestation in India. The website of National CAMPA has been inaccessible throughout the duration of project which hinders correct analysis of the fund utilization in the country due to unavailability of documents.

The state CAMPA websites of respective state/UTs were analysed on parameters such as,

1. Maintenance of a dedicated website for CAMPA or maintenance of a head under forest department website.

2. Annual Plan of Operations (APOs)

3. Regular Monitoring and Evaluation (M&E Reports)

4. Annual Report/Progress Report

5. Expenditure Reports/Audit Reports

6. Details of meeting of Committees (Governing Body, Steering Committee and Executive Committee)

The summary of the findings is summarised in the table below.

Table 26: Summary of analysis of State/UTs CAMPA websites1

State/UTs	Website	Under forest department website	Annual Plan of Operation (APOs)	Third Party M&E reports	Annual Report/ Progress Report	Expenditure Reports/Audit Reports	Details of Meeting of Committees
Andaman & Nicobar	X	X	X	X	X	X	X
Andhra Pradesh	X	✓	X	✓	X	X	X
Arunachal Pradesh	X	✓	✓	X	X	X	X
Assam	X	✓	X	X	X	X	X
Bihar	X	X	X	X	X	X	X
Chandigarh	X	X	X	X	X	X	X
Chhattisgarh	X	✓	X	X	✓	X	✓

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1 ✓- Available
  × – Not available

State/UTs	Website	Under forest department website	Annual Plan of Operation (APOs)	Third Party M&E reports	Annual Report/ Progress Report	Expenditure Reports/Audit Reports	Details of Meeting of Committees
Daman and Diu and Dadra and Nagar Haveli	X	X	X	X	X	X	X
Delhi	✓	X	X	✓	X	X	X
Goa	X	✓	✓	✓	X	✓	✓
Gujarat	X	✓	X	X	X	X	X
Haryana	✓	X	✓	✓	X	X	✓
Himachal Pradesh	X	✓	✓	X	✓	X	✓
Jammu and Kashmir	✓	X	✓	✓	X	X	✓
Jharkhand	X	✓	✓	X	X	X	X
Karnataka	X	✓	X	X	X	X	X
Kerala	X	X	X	X	X	X	X
Ladakh	X	X	X	X	X	X	X
Lakshadweep	X	X	X	X	X	X	X
Madhya Pradesh	X	✓	X	X	X	X	X
Maharashtra	X	✓	X	X	X	X	X
Manipur	X	X	X	X	X	X	X
Meghalaya	X	X	X	X	X	X	X
Mizoram	X	✓	X	X	X	X	X
Nagaland	X	X	X	X	X	X	X
Odisha	✓	X	✓	✓	X	X	✓
Puducherry	X	X	X	X	X	X	X
Punjab	X	✓	X	X	X	X	X
Rajasthan	X	✓	✓	X	✓	✓	✓
Sikkim	X	X	X	X	X	X	X
Tamil Nadu	X	✓	✓	X	X	X	✓
Telangana	✓	X	✓	✓	X	✓	✓
Tripura	X	X	X	X	X	X	X
Uttar Pradesh	✓	X	X	X	X	X	X
Uttarakhand	✓	X	✓	X	✓	X	✓
West Bengal	X	✓	X	X	X	X	X

The analysis showed that only 6 states/UTs i.e., Uttarakhand, Uttar Pradesh, Telangana, Odisha, Jammu & Kashmir, Delhi and Haryana have dedicated websites for maintenance of records. Few states have maintained good records under the forest department website

such as Chhattisgarh, Goa and Himachal Pradesh. Telangana has the most advanced site by maintain district based performa. However, maximum of states have failed to maintain records of their CAMPA activities. Few states such as Bihar, Kerela, Punjab and maximum of UTs have no presence in terms of CAMPA.

5.4 Discrepancy in the data uploaded on the portal

During the analysis of land diversion and fund utilization for CAMPA activities, a significant issue was identified that the data uploaded across various platforms, such as e-Green Watch, Parivesh Portal, Annual Plan of Operations (APO), Annual reports, and Monitoring and Evaluation (M&E) documents, do not align. While each data source represents key metrics such as the total area diverted, the area identified for Compensatory Afforestation (CA), or areas earmarked for plantation work, these figures fail to triangulate accurately. This discrepancy presents a considerable challenge in determining the current on-ground status of land diversion, the implementation of CAMPA activities, and the effective utilization of CAMPA funds.

Further complicating the situation is the inaccuracy observed in the KML polygons representing CAMPA sites. In the case of Odisha, for instance, nearly the entire Sundargarh district is inaccurately marked as CAMPA sites, leading to an overestimation of the area under plantation activities. This creates confusion regarding the extent of land genuinely allocated for the plantation initiatives.

Figure 45: CAMPA Sites of Rourkela Circle, Odisha
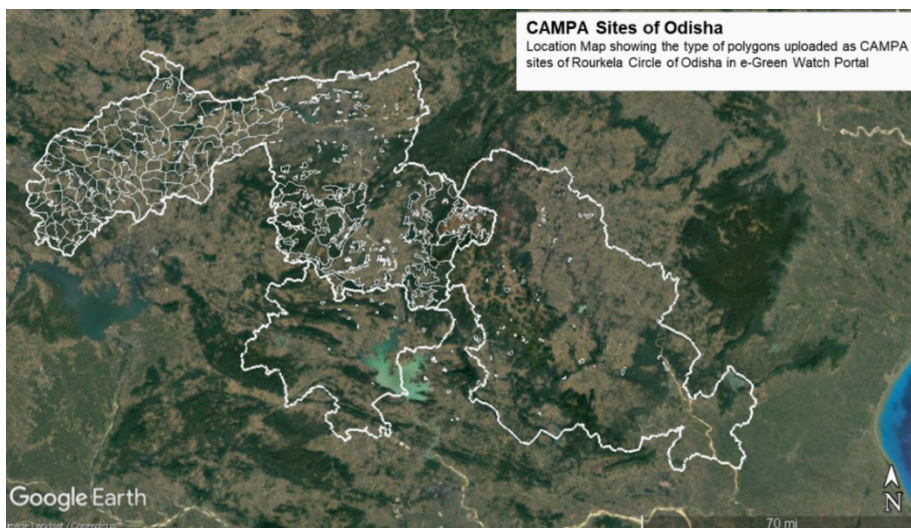
Source: e-Green Watch

A similar issue was observed in Haryana, where the KML polygons for a CAMPA site as of May 22 observed from Google earth pro include non-plantation areas within their boundaries. The plantation was conducted along the sides of agricultural fields, which should have

been recorded as line polygons rather than area polygons. This misrepresentation inflates the reported area under plantation work, leading to a false portrayal of the extent of CAMPA activities.

Figure 46: A particular CAMPA site in Hisar Circle, Haryana
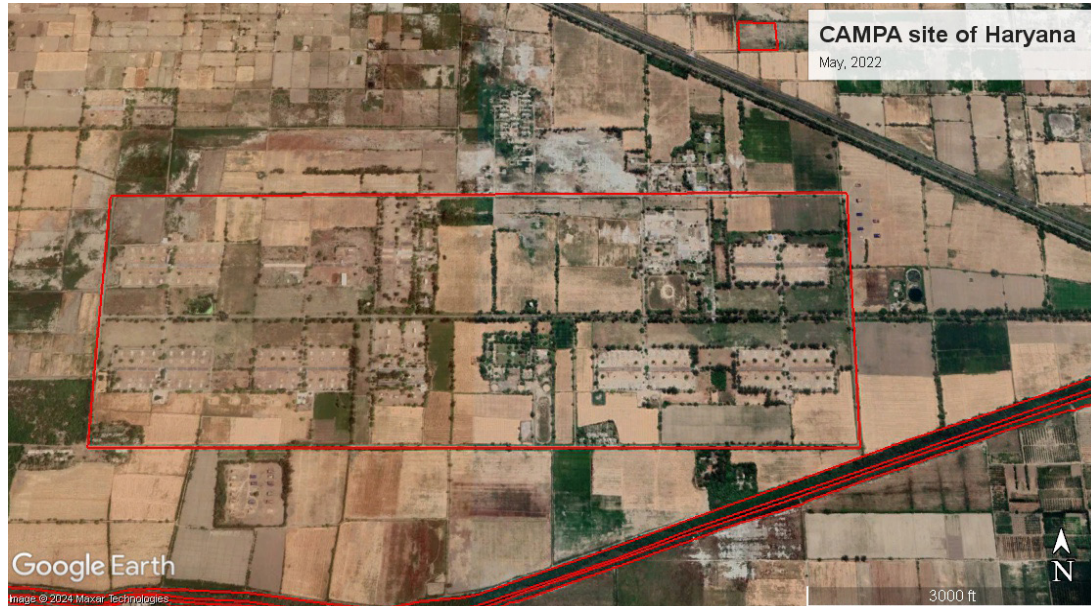
Source: e-Green Watch

These discrepancies in data and mapping are critical issues that need to be addressed to ensure accurate tracking of CAMPA activities. The inconsistency in data not only hinders effective monitoring and evaluation but also raises concerns about the transparency and accountability of CAMPA's implementation across states. Without accurate data, it becomes challenging to assess the real impact of these initiatives and to make informed decisions for future planning and fund allocation.

6. Suggestions

1. Improving Data Transparency and Accessibility

- **State CAMPA Websites:** Ensure that all states and Union Territories (UTs) maintain dedicated and up-to-date CAMPA websites with comprehensive data, including Annual Plans of Operation (APOs), Monitoring and Evaluation (M&E) reports, annual progress reports, expenditure reports, and details of committee meetings.

- **Regular Data Updates:** Mandate regular updates to the e-Green Watch portal and state CAMPA websites to reflect the latest data on land diversion, compensatory afforestation, and plantation activities.

2. Addressing Land Unavailability, Fragmentation and Quality of Land

- **Consolidated Land Identification:** Encourage states to identify consolidated parcels of land for compensatory afforestation to avoid fragmentation, which can negatively impact ecosystem services.

- **Land Banks:** Maintenance of Land Banks through identification of degraded forest and potential non-forest land.

- **Land Quality:** Soil Quality should be considered while choosing land for compensatory afforestation.

- **Inter-State Coordination:** Promote inter-state coordination to address the challenges of land availability for compensatory afforestation, especially for states with high forest cover and limited non-forest land.

3. Enhancing Fund Utilization

- **Efficient Fund Allocation:** Implement stricter guidelines and regular audits to ensure that the funds collected under NPV, CA, CAT, SZ, etc., are efficiently utilized for their intended purposes.

- **Capacity Building:** Provide training and capacity-building programs for state forest departments to improve their ability to plan, execute, and monitor afforestation projects effectively. Special courses should be imparted on GIS and Database Management

4. Strengthening Monitoring and Evaluation

- **Third-Party Audits:** Regularly conduct third-party audits of compensatory afforestation projects to ensure transparency and accountability in fund utilization and project implementation.

- **Performance Metrics:** Develop clear performance metrics and targets for afforestation projects and establish a robust system for tracking and reporting progress.

- **Impact Evaluation:** There is no existing mechanism to quantify the impact of diversion and compensation done henceforth. It is utmost important to maintain a balance between the diversion and compensation and should be measured from time to time.

- **GIS-Based Monitoring** – Ensure GIS based monitoring is conducted regularly to check the integrity of plantations.

- Monitoring of State CAMPA is to be done by National CAMPA to ensure the principle of natural justice.

- Monitoring of plantation is to be done based on ecological parameters.

5. Enhancing Policy and Implementation Framework

- **Revising NPV Rates:** Periodically review and revise the Net Present Value (NPV) rates to reflect the true value of ecosystem services lost due to forest land diversion.

- **Ecological Considerations:** Ensure that compensatory afforestation efforts take into account the ecological and climatic conditions of the area to ensure that the plantation work provides comparable ecosystem services to the original forest.

6. Promoting Community Involvement

- **Community Engagement:** Involve local communities in the planning and implementation of compensatory afforestation projects to ensure their active participation and to leverage their traditional knowledge.

- **Benefit Sharing:** Develop mechanisms for sharing the benefits of afforestation projects with local communities to incentivize their participation and support.

7.   Research and Development

- **Innovative Techniques:** Promote research and development of innovative afforestation techniques and best practices that can be adopted by states to improve the success rates of plantation projects.
- **Data-Driven Decision Making:** Utilize advanced data analytics and Geographic Information Systems (GIS) for better planning and monitoring of afforestation activities.

7. Limitations of the Study

- The data used in the report is purely subject to the information made available on e-Green Watch.

- Data inconsistencies across different platforms, such as e-Green Watch and State CAMPA websites, as well as among various reports, including M&E reports and APOs, have resulted in varying outcomes and created challenges in developing a robust and accurate analysis.

- The scoring of the states is based on an analysis of the state CAMPA websites. While the absence of documents on these websites does not necessarily imply that the activities are not being carried out, it has impacted the scoring.

- Regarding the Key Personnel Interviews, it is important to note that participation was not mandatory, and individuals had the right to decline our request for information for a report of this nature.

- The accuracy of forest canopy density as well as land use land cover mapping have been affected due to the inherent limitations of remote sensing data. In this assessment, satellite sensor like sentinel-2 has been used, with spatial resolutions of 10 meters. Hence, heterogeneous information with a geometric dimension on the ground less than the respective resolutions mentioned is not discernible.

- Similarly, the presence of agricultural crops near forest regions and the heterogeneity of tree species often influence spectral signatures. As a result, it becomes difficult to precisely define forest cover and change detection.

- Since most CAMPA sites in Haryana involve avenue or roadside plantations with a typical width of 5 meters, the Sentinel imagery used for analysis, which has a 10-meter resolution, may not accurately capture these plantations, as their size is often smaller than the resolution of the imagery.

- In Odisha, the irregular polygons uploaded on the e-Green Watch portal result in an analysis that does not accurately reflect the status of the original CAMPA sites.

- Due to their limited growth, young plants and tree species characterized by a low leaf index and transmittance often remain indiscernible in satellite imagery. The occurrence of weeds like lantana in forest areas and agricultural crops like sugarcane, cotton, etc. specifically are adjacent to forest areas cause mixing of the spectral signatures and often make precise forest cover delineation comparatively difficult.

- Additionally, other limitations, including atmospheric conditions, terrain cast shadows, and the unavailability of seasonal data, lead to the minor misinterpretation of features in image classification methods.

8. Conclusion

This report presents an evaluation of the concept of Compensatory Afforestation and its implementation across various states in India, offering insights into the current status, achievements, and challenges associated with this crucial environmental initiative. The analysis begins with an exploration of the policy and legal frameworks that govern compensatory afforestation in India. Despite having comprehensive guidelines, significant gaps remain between policy directives and their actual implementation. This underscores the need for ongoing policy updates to effectively address emerging environmental challenges.

The review of the policy and legal framework governing compensatory afforestation (CA) in India reveals a well-intentioned but complex system, anchored in the Forest (Conservation) Act, 1980, and the Compensatory Afforestation Fund Management Act, 2016. These policies aim to mitigate forest losses by mandating afforestation on equivalent non-forest or degraded land and collecting financial levies to compensate for lost ecosystem services. However, the qualitative analysis highlights several gaps between policy design and execution. Additionally, procedural delays in fund disbursement, weak coordination between central and state CAMPA bodies, and overlapping governance roles hinder smooth implementation. The policy intends to support tribal livelihoods through the inclusion of indigenous fruit species in plantation plans, potentially enhancing local economic resilience. The ambitious goals of Policies are marred by numerous challenges and negative impacts. The displacement of local communities and the disruption of their traditional agricultural practices have been significant concerns. Despite the existence of comprehensive guidelines and acts, the actual on-ground implementation often deviates from these norms, pointing to a gap between policy and practice. For Instance, In Odisha, standardized afforestation schemes often fail to consider local dynamics, leading to ineffective outcomes. Despite claims of community involvement, actual participation is minimal, with the forest department misrepresenting public opinion (Ghosh, 2017; Valencia, 2019).

A detailed quantitative analysis of data from the e-Green Watch and Parivesh platforms reveals the extent of land diversion, compensatory afforestation, and plantation activities across different states. The national analysis revealed persistent challenges in aligning afforestation efforts with the extent and quality of forest land lost. One of the primary concerns is the disparity between diverted forest land and identified afforestation sites, leading to an ecological imbalance. While non-forest land is often scarce in states with significant forest cover, the strategy of inter-state compensation—where forest losses in one state are compensated through plantations in another—fails to fully replace

the ecological and social value of the lost forests. For instance, In Rajasthan, the amount of plantation work exceeds the extent of forest land diverted, even though the state has seen relatively less forest diversion. This shows since Rajasthan has the availability of non – forest land, the compensatory plantation activities for other states are being implemented here. While Rajasthan offers non-forest land for the plantation activities, its arid climate and unique ecology cannot replicate the ecosystems and biodiversity lost in states with higher-quality forests, such as Uttarakhand. Additionally, fund management emerged as a critical challenge, with many states utilizing only a fraction of the allocated resources. This underutilization of funds points to inefficiencies in project planning, capacity limitations within forest departments, and delays in fund disbursement, which collectively undermine the objectives of compensatory afforestation.

The analysis of individual states presents further insights into the complexities of implementing compensatory afforestation. Odisha has demonstrated relatively strong governance, with a well-structured CAMPA framework, consistent fund allocation, and significant plantation activities. However, despite meeting physical targets, the state struggles with the full utilization of allocated funds. The gap between planned activities and actual financial achievements indicates challenges in converting policy intent into effective action on the ground. Odisha's reliance on community engagement initiatives, such as the Ama Jangala Yojana, has improved plantation survival rates, yet sustaining local interest in long-term forest management remains a challenge. In Haryana, Since the state has limited forest cover, the focus has been on small-scale afforestation projects along agricultural boundaries, roads, and railways. Although Haryana's performance in fund utilization and monitoring has been commendable, but data inconsistencies across platforms and limited transparency has hindered effective evaluation. Uttarakhand, with more than 71% of its area under forest cover, faces difficulties in identifying suitable non-forest land for afforestation. Thus, the majority of compensatory activities has been done on degraded forest areas, which compromises the quality of ecological restoration. The state's afforestation efforts have not been sufficient to counteract the fragmentation caused by infrastructure projects, and the impact on wildlife habitats remains a concern.

The Remote Sensing and GIS analysis has attempted to monitor the maintenance of plantations done from 2016 to 2023 for the selected states. In west Hisar circle Haryana, most CAMPA sites are represented as linear polygons, reflecting that a significant portion of the plantations are along agricultural field boundaries and roadsides while an overall improvement in both forest quantity and quality was observed in the plantations done. In Rourkela Circle of Odisha, it was observed that despite afforestation efforts contributing 0.66 square kilometers and forest quality enhancement covering 6.23 square kilometers, the CAMPA sites have experienced an overall loss in vegetation. This is primarily due to 2.41 square kilometers of vegetation loss from deforestation and 9.12 square kilometers from degradation, resulting in a net decrease in overall vegetation cover. In CF Garhwal, Pauri Circle of Uttarakhand, it was observed that while new plantations are evident, there is a broader trend of forest degradation within the CAMPA sites.

Throughout the study, several issues have been identified that hinder the success of compensatory afforestation efforts. One of the key challenges is the fragmented nature of afforestation sites, which limits the ecological connectivity needed for sustaining biodiversity. The planting of non-native species in some areas, driven by the urgency to meet targets, further reduces the long-term resilience of afforested ecosystems. The underutilization of allocated funds is another significant challenge that limits the program's success. The underutilization often stems from administrative limitation or capacity limitations within forest departments. Additionally, inconsistent record-keeping and data discrepancies between government portals, such as e-Green Watch and Parivesh, undermine transparency and accountability. These issues are compounded by weak monitoring and evaluation mechanisms, with some states lacking third-party audits or comprehensive assessments of their CAMPA activities. Only a few states maintain comprehensive and accessible records, complicating the overall management of compensatory afforestation activities.

Despite the challenges, the compensatory afforestation program holds immense potential for contributing to India's climate goals, forest conservation efforts, and biodiversity preservation. To unlock this potential, it is essential to address the gaps between policy and practice. Strengthening inter-state coordination can help address the land scarcity problem, while the creation of land banks for degraded lands can provide additional space for afforestation activities. Revising Net Present Value (NPV) rates to accurately reflect ecosystem service losses will ensure that financial compensations align with environmental realities. Improving fund utilization through better planning, capacity-building initiatives, and timely fund disbursement will enhance the efficiency of forest departments. Integrating monitoring mechanisms with external third-party audits will also enhance transparency and enable better evaluation of project outcomes.

9. References

- Areendran, G., Rao, P., Raj, K., Mazumdar, S., & Puri, K. (2013). Land use/land cover change dynamics analysis in mining areas of Singrauli district in Madhya Pradesh, India. Tropical Ecology, 54(2), 239-250

- Badapalli, P. K., Kottala, R. B., Madiga, R., & Golla, V. (2023). An integrated approach for the assessment and monitoring of land degradation and desertification in semi-arid regions using physio-chemical and geospatial modeling techniques. Environmental Science and Pollution Research, 30(55), 116751-116764

- Balaji, P. (2014). Balancing Out Forests: Implications of the Forest Conservation Act, 1980 in Southern Odisha, India. Inequality, Democracy Development, 94.

- Bhan, M., Sharma, D., Ashwin, A. S., & Mehra, S. (2016). Critical observations on National CAMPA Bill, 2016. Current Science (00113891), 111(7).

- Bhattacharya, A., & Saha, S. (2019). Compensating for Forest Loss or Advancing Forest Destruction?

- CAG. (2013). Report of the Comptroller and Auditor General of India on Compensatory Afforestation in India. Union Government and Ministry of Environment and Forest.

- Chouhan, R., Rao, N. (2011). Vegetation detection in multispectral remote sensing images: protective role-analysis of coastal vegetation in 2004 Indian Ocean Tsunami. Geo-Information for disaster management, Turkey.

- e-Green Watch. Retrieved from e -Green Watch: https://egreenwatch.nic.in/

- FAO. Tropical Deforestation and Forest Degradation: A Case Study from India. Retrieved from Food and Agriculture Organisation: https://www.fao.org/4/XII/0250-A1.htm

- FSI (2020). FSI Technical Information Series. Volume 2, No:1. Forest Survey of India, Dehradun.

- FSI (2020b). Atlas Forest Types of India. Forest Survey of India, Dehradun

- Gao, Y.N., Gao, J.F., Wang, J., Wang, S.S., Li, Q., Zhai, S.H., Zhou, Y. (2017). Estimating the biomass of unevenly distributed aquatic vegetation in a lake using the normalized water-adjusted vegetation index and scale transformation method. Sci. Total Environ., 601, 998–1007.

- Ghosh, S. (2017). Compensatory Afforestation: 'Compensating 'Loss of Forests or Disguising Forest Offsets? Economic and Political Weekly, 67-75.

- Gitelson, A.A., Kaufman, Y.J., Stark, R., Rundquist, D. (2002). Novel algorithms for remote estimation of vegetation fraction. Remote Sens. Environ., 80, 76–87.

- Giri, K., Das, N., & Bora, N. (2020). Plantation under compensatory afforestation fund management and planning authority transforming jhum cultivation to a diverse agroforestry system: introspection from Phalong Village, Manipur.

- GOI. (1980). Forest (Conservation) Act, 1980. Ministry of Law, Justice and Company Affairs, Government of India.

- GOI. (1998). Forest (Conservation) Amendment Act. Ministry of Environment and Forests, Government of India.

- GOI. (2009). The Guidelines on State Compensatory Afforestation Fund Management and Planning Authority (State CAMPA). Ministry of Environment and Forests, Government of India.

- GOI. (2016). Compensatory Afforestation Fund Act. Ministry of Environment, Forests and Climate Change, Government of India.

- GOI. (2018). Compensatory Afforestation Fund Rules. Ministry of Environment, Forests and Climate Change, Government of India.

- GOI. (2023) Consolidated Guidelines and Clarifications issued under Van (Sanrakshan evam Samvardhan) Adhiniyam, 1980 and Van (Sanrakshan evam Samvardhan) Rules, 2023. Ministry of Environment, Forests and Climate Change, Government of India.

- GOI. (2023). Forest (Conservation) Amendment Act. Ministry of Environment, Forests and Climate Change, Government of India.

- GOI. (2023). Van Sanrakhshan evam Samvardhan Rules. Ministry of Environment, Forests and Climate Change, Government of India.

- Haryana CAMPA. Retrieved from https://campa.haryanaforest.gov.in/

- Indian Bar Association. Constitutional Provisions for the Protection of Environment with relevant case laws. Environmental Law Article.

- IPCC (2003). Good practice guidance for land use, land-use change and forestry. Good practice guidance for land use, land-use change and forestry.

- ISFR (2021) India State of Forest Report 2021. Forest Survey of India. Ministry of Environment, Forest and Climate Change, Government of India, Dehradun, India.

- Karaburun, A. (2010). Estimation of C factor for soil erosion modeling using NDVI in Buyukcekmece watershed. Ozean journal of applied sciences, 3, pp.77-85.

- Karra, K., Kontgis, C., Statman-Weil, Z., Mazzariello, J. C., Mathis, M., & Brumby, S. P. (2021). Global land use/land cover with Sentinel 2 and deep learning. In 2021 IEEE international geoscience and remote sensing symposium IGARSS (pp. 4704-4707). IEEE.

- Kohli, K., Menon, M., Samdariya, V., & Guptabhaya, S. (2011). pocketful forests of. Kalpavriksh.

- Lok Sabha unstarred question No. 1929, CAMPA funds, Ministry of Environment, Forest and Climate Change, Government of India.

- Lok Sabha unstarred question No. 5179, Allocation of funds under CAMPA, Ministry of Environment, Forest and Climate Change, Government of India.

- MoEFCC. Retrieved from Forest conservation, Ministry of Environment, Forest and Climate Change: https://moef.gov.in/forest-conservation-fc

- Narendran, T. (2015). Forest (Conservation) Act, 1980 3rd Edition - Rules, Guidelines and Clarifications. Sustainable Mining Initiative.

- National CAMPA Authority. Retrieved from https://nationalcampa.nic.in/

- National Informatics Centre. Operational Manual for e - green watch. Ministry of Environment, Forest and Climate Change.

- Odisha CAMPA. Retrieved from https://campa.odisha.gov.in/

- Parivesh. Retrieved from Ministry of Environment, Forest and Climate Change: https://parivesh.nic.in/

- Penman, J., Gytarsky, M., Hiraishi, T., Krug, T., Kruger, D., Pipatti, R., ... & Wagner, F. (2003). Good practice guidance for land use, land-use change and forestry.

- PWC. (2020). CAMPA: A tool for achieving climate resilient growth.

- Ramachandra, T.V., Kumar, U. (2004). Geographic resources decision support system for land use land cover dynamics analysis. In proceedings of the FOSS/GRASS users conference, Bangkok, Thailand, pp. 12–14.

- Saxena, K. B. (2019). Compensatory afforestation fund act and rules: Deforestation, tribal displacement and an alibi for legalised land grabbing. Social Change, 49(1), 23–40.

- Soubry I, Doan T, Chu T, Guo X. (2021). A Systematic Review on the Integration of Remote Sensing and GIS to Forest and Grassland Ecosystem Health Attributes, Indicators, and Measures. Remote Sensing. 13(16):3262.

- Tambe, S., Rawat, G. S., Krishen, P., Ranjitsinh, M. K., Ghosh, N., Rawat, A. S., & Takpa, J. (2022). Compensatory afforestation policy in India: an analysis using an ecorestoration lens. International Forestry Review, 24(4), 607–618.

- United Nations. Stockholm 1972, Conferences (Environment and Sustainable Development). Retrieved from United Nations: https://www.un.org/en/conferences/environment/stockholm1972

- Upadhyay, S., & Upadhyay, V. (2002). Handbook on Environmental Laws (Volume 1) - Forest Laws, Wildlife Laws and the Environment. New Delhi: LexisNexis.

- Uttarakhand CAMPA. Retrieved from https://www.ukcampa.org.in/

- Valencia, L. (2019). Compensatory afforestation in Odisha, India: A political ecology of forest restoration. University of Toronto (Canada).

- Verma, M., Negandhi, D., Wahal, A. K., Kumar, R., Kinhal, G. A., & Kumar, A. (2014). Revision of rates of NPV applicable for different class/category of forests. Indian Institute of Forest Management, Bhopal, 230.

- Wen, H., Linhoff, M.W., Hubbard, J.M., Nelson, N.R., Stensland, D., Dallman, J., Mandel, G., and Brehm, P. (2013) Zebrafish calls for reinterpretation for the roles of p/q calcium channels in neuromuscular transmission. The Journal of neuroscience: the official journal of the Society for Neuroscience. 33(17):7384–7392.

- Xie, Y., Zhao, X., Li, L., & Wang, H., (2010). Calculating NDVI for landsat7 etm data after atmospheric correction using 6s model: a case study in Zhangye City, China. In proceeding IEEE geoinformatics18th international conference on digital object identifier, pp.1–4.

10. Annexures

Annexure 1: Basics of e-Green Watch

1. The e-Green Watch portal is accessible through https://egreenwatch.nic.in/ On visiting the site, the following screen appears on the screen.

2. The major section in which the division and range wise data is uploaded by the forest department officials is highlighted in the figure above. It has six major sections, Forestry Works, Site/Assets, GIS, Maters, Funds and FCA (Diversion) Projects. The figure below explains the data uploaded under the "Forestry Works" section.

3. As explained in the report in Section 4.1.1, it is necessary to first identify the sites/ assets (Sites in case of plantation work and assets in case of non-plantation work) where the work will be eventually carried out. The "Site/Assets" maintains databases on the sites identified for execution of work under utilisation of CAMPA funds.
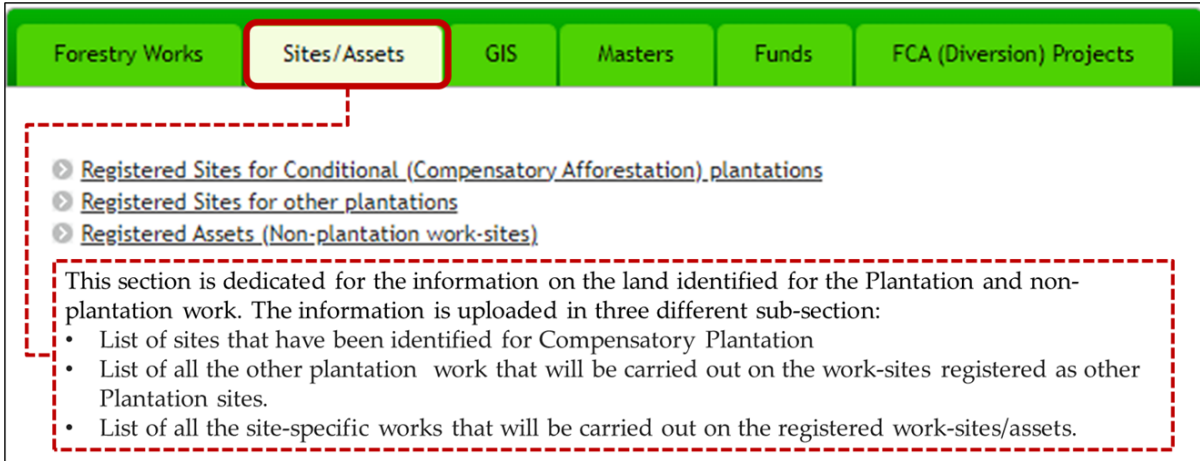
4. The "GIS" section maintain database on the kml files of land diverted, sites identified for compensatory afforestation, other plantation works, and non-plantation works and sites where plantation work has been executed. The polygons of plantation work from this section have been downloaded for the remote sensing-GIS analysis.
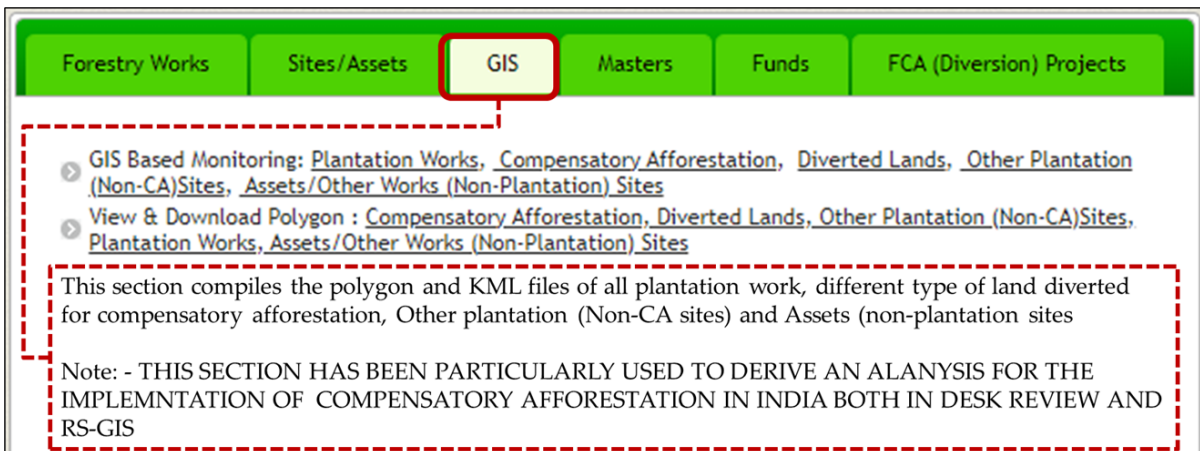
5. The "Masters" section contains the list of ranges, circles and divisions that would help in navigating through different databases. It also contains the list of species planted in each state along with different component of CAMPA activities.

6. The "Funds" section contains summary of the CAMPA funds allocated, received and spent by ranges, circles, division and state.

7. The last section "FCA (Diversion) Projects" contains details of the project that have been granted approval for diversion under Forest (Conservation) Act, 1980.

Annexure 2: Net Present Value and its calculation

The rationale for charging the compensatory payment of NPV when forests are diverted for non-forestry purposes, in addition to the payment for Compensatory Afforestation (CA), is multifaceted. Diversion of forest land results in the loss of various benefits—both tangible and intangible—that forests provide in terms of ecosystem goods and services, which CA alone does not fully address. Benefits from CA increase gradually, and NPV collection aims to compensate for the uncompensated benefits until the compensatory afforestation area matures and begins to deliver a portion of the benefits previously provided by the diverted forest area. But even after maturation, some benefits lost due to forest diversion may never be fully compensated by CA. The Central Empowered Committee (CEC) recognized in its 2002 report that plantations take significantly longer to mature and can never fully substitute natural forests. Thus, the NPV charge for forest diversion is a conservative measure.

Figure 47: Description of rationale of NPV collection for Forest Diversion
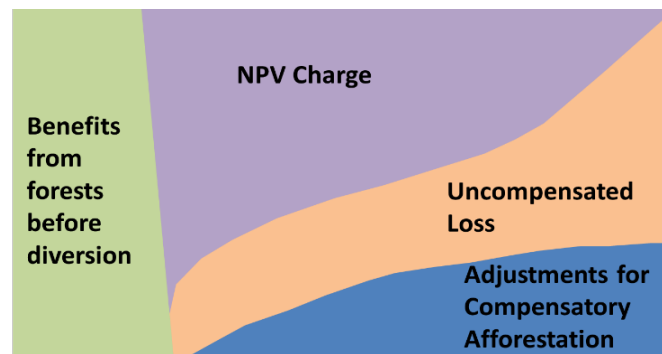
Following the CEC recommendations, the Supreme Court, in its order dated 28 March 2008, suggested that the rates of NPV for forest diversion be revised after three years. Accordingly, the Indian Institute of Forest Management was assigned a study under the guidance of Dr. Madhu Verma to calculate the revised rates of NPV for forest diversion.

NPV Expert Committee, 2005

In response to the Supreme Court's order on September 26, 2005, a three-member Expert Committee, chaired by Dr. Kanchan Chopra from the Institute of Economic Growth, developed a 12-step procedure for calculating Net Present Value (NPV) for forest land diverted for non-forest use. The 2006 report detailed site-specific calculations, using circle-wise rates for Himachal Pradesh, and emphasized that different forests provide varied services, necessitating distinct percentage values for each service. Following this, a supplementary report from the Central Expert Committee (CEC) on November 28, 2006, incorporated inputs from the Forest Survey of India and MoEF&CC officials, evaluating seven key forest services and estimating a minimum ground rent of ₹10,000 per hectare. The NPV, calculated over 20 years at a 5% social discount rate, was later revised by the CEC to ₹8 lakhs per hectare, incorporating additional services and reducing the discount rate to 4%. In 2008, the Supreme Court accepted the CEC's recommendations for NPV rates, ranging from ₹4.38 lakhs to ₹10.43 lakhs per hectare based on forest eco-value and canopy cover density.

The classification of forest used for NPV rates is based on two parameters:

• 14 Forest type groups (according to Champion & Seth Classification)

• 4 Canopy Cover Density Classes (which include VDF, MDF, OF & LTF).

Taking these two parameters – a 14 X 4 matrix has been prepared with each cell showing the NPV of forest diversion. The matrix was developed acknowledging the fact that few classification units may have dominant ecosystem services in terms of their economic value which may be very different from other classification units in which some other ecosystem services may dominate. Thus, matrix objectively estimate the economic value of ecosystem services originating from different classification units by appropriately considering the specific factors rather than using a blanket value across the country.

Figure 48: Formula for computing Net Present Value

$$NPV = \sum_{t=1}^{N} \frac{B_t - C_t}{(1+r)^t}$$

B_t = Annual Benefits from Forest

C_t = Annual cost from Forest

r = Social rate of discount

N = number of years for which annual benefit from the forest will accrue

Source: Verma et al., 2014

The Supreme Court suggested that the basis for NPV calculation should be the economic value spread over 50 years, representing the regenerative value for forest regeneration. Based on the recommendations of the CEC, a social discount rate of 4% was also accepted. Depending on the rotation period used for calculating NPV rates (specific to forest type groups or a blanket value across all forest type groups) and the total economic value used (complete or relevant summation), the NPV rates for four scenarios were presented. The rotation period used in Scenarios 1 and 2 is based on specific rotation periods estimated for each forest type group. For Scenarios 3 and 4, an average rotation period of 60 years, estimated from the average rotation period of all forest type groups, was used for estimating the NPV of forest diversion.

Table 27: Scenario 2 – NPV rates based on Forest Type Group specific rotation period, 4% rate of discount and Total Economic Value based on adjusting for double counting and simultaneous delivery of ecosystem services

NPV (in ₹ Lakhs/ha)	VDF	MDF	OF	LTF
Tropical Wet Evergreen Forests – North East	38.9	21.3	19.0	7.5
Tropical Wet Evergreen Forests – Western Ghats	43.3	31.3	14.2	9.0
Tropical Semi Evergreen Forests - North East	23.6	17.8	9.9	6.5
Tropical Semi Evergreen Forests - Eastern Deccan	55.6	45.7	27.0	24.9

NPV (in ₹ Lakhs/ha)	VDF	MDF	OF	LTF
Tropical Semi Evergreen Forests - Western Ghats	33.9	23.7	15.4	10.1
Tropical Moist Deciduous Forests	30.3	22.3	13.5	7.6
Littoral & Swamp Forests	49.0	35.1	22.6	17.5
Tropical Dry Deciduous Forests	25.1	18.6	11.2	7.7
Tropical Thorn Forests	14.4	13.4	10.6	7.8
Tropical & Subtropical Dry Evergreen Forests	28.4	21.4	13.2	7.5
Subtropical Pine/Broadleaved Hill Forest	22.7	18.0	11.6	6.6
Montane & Moist Temperate Fores	30.1	23.8	13.5	6.9
Sub Alpine & Dry Temperate Forest	25.3	20.1	11.3	5.6
Alpine Scrub	27.2	19.1	10.7	6.8
Average	**32.0**	**23.7**	**14.6**	**9.4**

Source: Verma et al., 2014

From the four scenarios discussed, the study team recommended using Scenario 2 as the applicable NPV for the diversion of forests to non-forestry uses in India. As this scenario internalizes the simultaneous delivery of ecosystem services from forests, thus avoiding double counting. It is based on the rotation period estimated for each forest type group, thereby considering the ecological diversity among forests in the country. Consequently, the NPV estimates are made scientific, objective, and region-specific, while remaining conservative to avoid overestimating the value of individual services or the total economic value.

Figure 49: An example to demonstrate the NPV calculation for forest land diverted

Hypothetical Case: A mining company (UA) is set to implement a mining project in state of Orissa and plans to divert 169. 178 ha of forest land. The land is diverted from two type of forest one classified as a tropical-moist-deciduous Moderately dense type and another as Tropical Dry Deciduous open forest type. The UA will e required to pay the following compensation :

Forest type	Density class	Area Diverted (in Ha)	Compensation (in INR)		
			CA	NPV	SZ
Tropical-moist-deciduous	Moderately dense	69.00	4,45,02,100	15,38,70,000	38,48,600
Tropical Dry Deciduous	open forest type	100.18			

NPV Charge = NPV rate for each forest type-class * forest area diverted

To conclude in a straightforward manner, any User Agency proposing to diverted an area of forest land, will be charged for the NPV funds for the loss of ecosystem services caused by land diversion. The estimation of the funds to paid will be calculated on the basis of the type and class of forest area being diverted, its area and the NPV rate defined for that particular type and class of forest.

Annexure 3: Highlights of CAG Audit Report, 2013

The audit report of the Comptroller and Auditor General of India was prepared for submission to the President under Article 151 of the Constitution for being laid before the Parliament. The audit was conducted during the period January – December 2012 through document analysis, collection of responses to audit queries and seeking information from the state/UTs in prescribed proformae.

The State Accountants General audited the State CAMPA and the divisions to which Compensatory Afforestation fund had been released, on a sample basis. The sample size was 50 per cent of the territorial divisions that had received fund disbursed by Ad-hoc CAMPA. Of the 35 States and Union Territories then present in India, all except Dadar & Nagar Haveli, Diu, Lakshadweep, Nagaland and Puducherry were covered in this audit exercise.

The objectives of the compliance audit on Compensatory Afforestation in India were to examine:

- whether the diversion of forest land for non-forest use was permitted as per extant laws and all conditions in this regard were complied with;

- whether measures taken for conservation, afforestation and preservation of forest lands consequent to diversion of portions of these lands for non-forest use were as per provisos of extant legislation, rules and Supreme Court judgments in this regard;

- whether the collection, utilisation, monitoring, accounting and the arrangement for safeguarding of compensatory afforestation funds was in compliance with applicable legislation, rules and Supreme Court judgements permitting diversion of forest land for non-forest purposes; and

- whether proper financial procedures had been followed in investing funds.

The highlights of the observations made by the audit was as follows:

- There were serious inadequacies in the regulation of land diversion under the Forest (Conservation) Act, 1980, falling short in the implementation of compensatory afforestation. Many cases were noticed that indicated illegal diversion of forest land in case of mining and violation of the environmental regime.

- The audit revealed that during the period of 2006 -12, only 27 % of receivable non – forest land was actually received and only 7% of the receivable non – forest land was actually afforested under the compulsory compensatory afforestation against the land diversion. Regarding the afforestation to be done on the degraded forest land, only 49 % was actually afforested. With respect to the transfer of ownership, the information made available revealed that only 48.58 % of received land was transferred/mutated in the name of State forest department, out of which only 29.03 % was declared as Reserve/Protected forest.

- Seven States namely, Gujarat, Haryana, Kerala, Maharashtra, Meghalaya, Punjab and Rajasthan carried out no compensatory afforestation either over non-forest land or over degraded forest land during 2006 -12. Interestingly, the States of Assam and Odisha showed a high level of achievement with regard to compensatory afforestation.

- The audit also observed discrepancies in the data maintained by the ministry and state government, with variation of almost 3.5 % and 17.3 % in the data of land diverted and non – forest land received.

- Compensatory afforestation was carried out on an area 759 sq. km without proper certificate from the chief secretary for non – availability of non- forest land in majority of the states.

- Numerous instances of auauthorised renewal of leases, illegal mining, continuance of mining leases without proper permission, arbitrariness in decisions of forestry clearances were observed.

- There were instances were clearance was done without prior permission from the Supreme Court such as the building of Nagarjunasagar Dam by Andhra Pradesh State Electricity Board. Similarly, unauthorised mining leases were renewed in states such as Rajasthan and Odisha.

- The information made available depicted encroachment of 1551.7 sq. km of forest land and the absence of any action of eviction despite orders from the Supreme Court.

- There was no dedicated database/MIS for monitoring which led to irregularities, poor quality and unchecked reconciliations in the data maintenance.

- In 2013 when this audit report was published, before the CAF Act, 2016 and CAF Rules, 2018 were put in place, all monies were accumulated with Ad – Hoc CAMPA. The audit observed that there was no assurance all the funds collected against the land diversion were deposited to the Ad-Hoc CAMPA by the states/UTs.

- The difference in the funds collected form the states and funds available with the Ad hoc CAMPA was about 6021.88 crores. The test check revealed that 23 state/UTs have the least not transferred 401.70 crore of CA fund to the Ad hoc CAMPA.

- Approximately, an amount of Rs. 5,311.16 crore was not recovered under NPV, CA, ACA, PCA, CAT, etc. as on 31 March, 2012. It also indicated the net present value of the forest land diverted was under assessed in few cases. This was very prevalent in few states such as Odisha (1,235.26 crore), Jammu & Kashmir (861.80 crore), Madhya Pradesh (512.84 crore), Tripura (333.19 crore), Assam (223.28 crore), Uttarakhand (207.51 crore), Gujarat (176.02 crore), Jharkhand (116.18 crore), Manipur (106.45 crore) and Chhattisgarh (111.29 crore).

- Only 60.7 % of the funds released by the Ad hoc CAMPA during 2009 -12 was utilized for compensatory afforestation activities which let a large amount of idle funds with state/UTs. Some of the states with very poor utilization were Meghalaya (100%), Arunachal Pradesh (91%), Bihar (77%), Tripura (68%), Chhattisgarh (67%), Andaman & Nicobar Islands (63%) and Delhi (63 %). This can be attributed to the delay in preparation of annual plan of operation further leading to delay in release of funds.

- An amount of Rs. 51.93 crore was utilised for unauthorised activities (activities other than mentioned in the CAF Act, 2016) in 17 state/UTs.

- The non – production of records for the appropriate examination of projects served as the major limitation to the scope of this audit, which is another setback on State/UTs authority. (CAG, 2013)

Annexure 4: Manner of Utilisation of Funds

1.   Manner of utilisation of Net Present Value (NPV)

The monies received towards Net Present Value deposited in the State Fund shall be used in the manner provided in the table below:

Not less than eighty per cent. of the monies shall be used for following activities for the forest and wildlife management in a State:	Not more than twenty per cent. of the monies shall be utilized for strengthening of the forest and wildlife related infrastructure, capacity building of the personnel involved in utilization of State Fund. The allowed activities are:
(a) assisted natural regeneration; (b) artificial regeneration; (c) silvicultural operations in forests; (d) protection of plantations and forests; (e) pest and disease control in forest; (f) forest fire prevention and control operations; (g) soil and moisture conservation work in the forest; (h) voluntary relocation of villages from protected areas; (i) improvement of wildlife habitat as provided in the approved wildlife management plan or working plan; (j) planting and rejuvenation of forest cover on non-forest land falling in wildlife corridors; (k) establishment, operation and maintenance of animal rescue centre and veterinary treatment facilities for wild animals; (l) supply of wood-saving cooking appliances and other forest produce saving devices in forest fringe villages as specified by the National authority from time to time; (m) management of biological diversity and biological resources. Explanation – In cases where funds towards wildlife management and conservation plans are specifically collected and deposited in State Fund, then the same shall be spent for wildlife management in specified wildlife area and not from the net present value.	(a) establishment, up-gradation and maintenance of modern nurseries and other planting stock production facilities for production of quality planting materials; (b) promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land and folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity. (c) purchase and maintenance of equipment or devices used for communication and information technology for the purpose of protection of forest and wildlife; (d) construction, up-gradation and maintenance of inspection paths, forest roads in forest area, fire lines, watch towers, check posts and timber depots; (e) construction of residential and official buildings in forests for front line staffs deployed for protection of forest and wildlife; (f) casual engagement of local people or labours to assist regular staff of State Forest Department for works for protection of forest and wildlife undertaken from State Fund; (g) survey and mapping of forest areas for forest fire control, compensatory afforestation works, soil and moisture conservation, catchment area treatment and wildlife management for preparing annual plans to be executed from the State Fund; (h) independent concurrent monitoring and evaluation and third party monitoring of various works undertaken from State Fund; (i) publicity-cum-awareness programme and exhibition on the various schemes being implemented by the State Authority from State Fund: (j) production and distribution of quality planting material through certified nurseries at subsidised price for promotion of trees outside forests on Government lands promoted by State Government; (k) forest certification and development of certification standards

2. **Utilization of Interest accrued on deposits in state fund**

The interest accrued on monies in the State Fund shall be used in the following manner,

Not less than sixty per cent. of the interest transferred to the State Fund and further accrued on the amount available in the State Fund shall be spent on activities for the purpose of conservation and development of forest and wildlife namely-	Not more than forty per cent. of the interest transferred to the State Fund and further accrued on the amount available in the State Fund shall be spent for the non-recurring and recurring expenditure of the State Authority, namely-
(a) to offset the incremental cost of compensatory afforestation and penal compensatory afforestation at the increased wage rates; (b) to offset the incremental cost of catchment area treatment plan at the increased wage rates; (c) to offset the incremental cost of wildlife management plan at the increased wage rates; (d) for disbursement of salary and allowances of members and staffs, both regular and contractual, of the State authority; (e) for disbursement of sitting fees and allowances to nominated members of the State Authority;	(a) management of office establishment; (b) office equipment including computers and peripherals and its maintenance for the State Authority; (c) hiring of staff cars for the use of the officers and officials of the State Authority; (d) hiring of buildings on lease for the office establishment and residences of the officers of State Authority; (e) other contingencies for management of the State Authority, with the approval of the steering committee of the State Authority; Explanation – Under no circumstances mixing of the interest accrued on the monies in the State Fund shall be allowed with any other State budget either for capital or spill over works and the works undertaken under this rule shall be on standalone basis and there shall not be any duplication of permitted works under different components.

Annexure 5: Selection of States

1. **Year of Establishment of CAMPA**

Category for Scoring

Category	Score
Notified in 2007	4
Notified in 2009	3
Notified in 2010	2
Notified in 2011	1
not notified/ Data not available	0

Score for each State/UT

State	Year of Establishment of Campa	Score
Andaman & Nicobar	2009	**3**
Andhra Pradesh	2009	**3**
Arunachal Pradesh	2009	**3**
Assam	2007	**4**
Bihar	2010	**2**
Chandigarh	2009	**3**
Chhattisgarh	2009	**3**
Daman and Diu and Dadra and Nagar Haveli	Not Notified	**0**
Delhi	2009	**3**
Goa	2010	**2**
Gujarat	2009	**3**
Haryana	2010	**2**
Himachal Pradesh	2009	**3**
Jammu and Kashmir	2011	**1**
Jharkhand	2009	**3**
Karnataka	2010	**2**
Kerala	2009	**3**
Ladakh	2011	**1**
Lakshadweep	Not notified	**0**
Madhya Pradesh	Data Not Available	**0**
Maharashtra	2009	**3**
Manipur	2009	**3**
Meghalaya	2009	**3**
Mizoram	2009	**3**

State	Year of Establishment of Campa	Score
Nagaland	Not Notified	0
Odisha	2009	3
Puducherry	Not Notified	0
Punjab	2009	3
Rajasthan	2009	3
Sikkim	2009	3
Tamil Nadu	2009	3
Telangana	2009	3
Tripura	2009	3
Uttar Pradesh	2010	2
Uttarakhand	2009	3
West Bengal	2009	3

Source: CAG Audit Report, 2013

2.   Public transparency of documents and information

Category for Scoring

Category	Score
Prescence of a dedicated website (1)	2
Details of CAMPA present under the forest department website (2)	1
Annual Plan of Operation (APOs) (3)	1
External Monitoring and Evaluation (4)	1
Internal Monitoring and Evaluation (5)	1
Annual Report/Progress Report/Audit Report (6)	1
Detail of Meeting of Committees (7)	1
Sanction Letters (8)	1

Score for each State/UT

State	1	2	3	4	5	6	7	8	Score
Andaman & Nicobar	X	X	X	X	X	X	X	✓	1
Andhra Pradesh	X	✓	X	✓	X	X	X	✓	3
Arunachal Pradesh	X	✓	✓	X	X	X	X	✓	3
Assam	X	✓	X	X	X	X	X	✓	2
Bihar	X	X	X	X	X	X	X	✓	1
Chandigarh	X	X	X	X	X	X	X	✓	1
Chhattisgarh	X	✓	X	X	✓	✓	✓	✓	5
Daman and Diu and Dadra and Nagar Haveli	X	X	X	X	X	X	X	X	0
Delhi	✓	X	X	✓	X	X	X	✓	4
Goa	X	✓	✓	✓	X	X	✓	✓	5
Gujarat	X	✓	✓	X	X	X	X	✓	2

State	1	2	3	4	5	6	7	8	Score
Haryana	✓	X	✓	✓	✓	✓	✓	✓	**8**
Himachal Pradesh	X	✓	✓	X	X	✓	✓	✓	**5**
Jammu and Kashmir	✓	X	✓	✓	✓	X	✓	✓	**7**
Jharkhand	X	✓	✓	X	X	✓	X	✓	**4**
Karnataka	X	✓	X	X	X	X	X	✓	**2**
Kerala	X	X	X	X	X	X	X	✓	**1**
Ladakh	X	X	X	X	X	X	X	✓	**1**
Lakshadweep	X	X	X	X	X	X	X	X	**0**
Madhya Pradesh	X	✓	X	X	X	X	X	✓	**2**
Maharashtra	X	✓	X	X	X	X	X	✓	**2**
Manipur	X	X	X	X	X	X	X	✓	**1**
Meghalaya	X	X	X	X	X	X	X	✓	**1**
Mizoram	X	✓	X	X	X	X	X	✓	**2**
Nagaland	X	X	X	X	X	X	X	X	**0**
Odissa	✓	X	✓	✓	X	X	✓	✓	**6**
Puducherry	X	X	X	X	X	X	X	X	**0**
Punjab	X	✓	X	X	X	X	X	✓	**2**
Rajasthan	X	✓	✓	X	X	✓	✓	✓	**5**
Sikkim	X	X	X	X	X	X	X	✓	**1**
Tamil Nadu	X	✓	✓	X	X	X	✓	✓	**4**
Telangana	✓	X	✓	✓	✓	X	✓	✓	**7**
Tripura	X	X	X	X	X	X	X	✓	**1**
Uttar Pradesh	✓	X	X	X	X	X	X	✓	**3**
Uttarakhand	✓	X	✓	X	✓	✓	✓	✓	**7**
West Bengal	X	✓	X	X	X	X	X	✓	**2**

Source: State CAMPA Websites

3. **Target Achieved from 2016 to 2023**

Category for Scoring

Category (%)	Score
0 to 10	1
10 to 20	2
20 to 30	3
30 to 40	4
40 to 50	5
50 to 60	6
60 to 70	7
70 to 80	8
80 to 90	9
90 to 100	10

Score for each State/UT

State	% Target Achieved from 2016 to 2023	Scoring
Andaman & Nicobar	0	0
Andhra Pradesh	15.13	2
Arunachal Pradesh	0	0
Assam	2.04	1
Bihar	0	0
Chandigarh	0	0
Chhattisgarh	8.03	1
Daman and Diu and Dadra and Nagar Haveli	0	0
Delhi	0	0
Goa	34.96	4
Gujarat	1.38	1
Haryana	1.71	1
Himachal Pradesh	2.88	1
Jammu and Kashmir	11.54	2
Jharkhand	5.75	1
Karnataka	0.83	1
Kerala	4.18	1
Ladakh	0	0
Lakshadweep	0	0
Madhya Pradesh	14.76	2
Maharashtra	1.92	1
Manipur	1.28	1
Meghalaya	28.46	3
Mizoram	0	0
Nagaland	0	0
Odisha	15.11	2
Puducherry	0	0
Punjab	0.45	1
Rajasthan	6.41	1
Sikkim	8.27	1
Tamil Nadu	42.33	5
Telangana	21.51	3
Tripura	29.32	3
Uttar Pradesh	0	0
Uttarakhand	28.08	3
West Bengal	24.9	3

Source: e-Green Watch

4. Percent forest area in a state

Category for Scoring

Category (%)	Score
0 to 20	1
20 to 40	2
40 to 60	3
60 to 80	4
80 to 100	5

Score for each State/UT

State / UT	Geographical Area (sq. km s)	Total Forest Area (sq. km s)	% of Forest area in State	Score
Andhra Pradesh	1,62,968	36,880	22.63	**2**
Arunachal Pradesh	83,743	66,690	79.64	**4**
Assam	78,438	18,530	23.62	**2**
Bihar	94,163	6,220	6.61	**1**
Chhattisgarh	1,35,192	63,140	46.70	**3**
Delhi	1,483	10	0.67	**1**
Goa	3,702	1,250	33.77	**2**
Gujarat	1,96,244	18,340	9.35	**1**
Haryana	44,212	1559	3.53	**1**
Himachal Pradesh	55,673	11,240	20.19	**2**
Jharkhand	79,716	22,390	28.09	**2**
Karnataka	1,91,791	30,730	16.02	**1**
Kerala	38,852	10,820	27.85	**2**
Madhya Pradesh	3,08,252	87,080	28.25	**2**
Maharashtra	3,07,713	52,200	16.96	**1**
Manipur	22,327	16,850	75.47	**4**
Meghalaya	22,429	9,290	41.42	**3**
Mizoram	21,081	15,850	75.19	**4**
Nagaland	16,579	8,630	52.05	**3**
Odisha	1,55,707	58,140	37.34	**2**
Punjab	50,362	2,530	5.02	**1**
Rajasthan	3,42,239	27,560	8.05	**1**
Sikkim	7,096	3,340	47.07	**3**
Tamil Nadu	1,30,060	21,570	16.58	**1**
Telangana	1,12,077	26,980	24.07	**2**
Tripura	10,486	6,290	59.98	**3**
Uttar Pradesh	2,40,928	16,710	6.94	**1**
Uttarakhand	53,483	38,120	71.27	**4**
West Bengal	88,752	11,750	13.24	**1**

Source: ISFR, 2019

5.   Land Diverted in a State

Category for Scoring

Category (sq. km)	Score
No data available	0
301–650	1
150–300	2
76–150	3
0--75	4

Score for each State/UT

Name	Area of Land Diverted (sq. km)	Score
Andaman & Nicobar	22.90	4
Andhra Pradesh	203.78	2
Arunachal Pradesh	148.25	3
Assam	29.38	4
Bihar	10.94	4
Chandigarh	0.53	4
Chhattisgarh	161.55	2
Daman and Diu and Dadra and Nagar Haveli	0.00	4
Delhi	0.43	4
Goa	0.61	4
Gujarat	231.39	2
Haryana	43.69	4
Himachal Pradesh	89.94	3
Jammu and Kashmir	2.20	4
Jharkhand	71.62	4
Karnataka	314.23	1
Kerala	2.55	4
Ladakh	Data Not Available	0
Lakshadweep	Data Not Available	0
Madhya Pradesh	643.52	1
Maharashtra	154.56	2
Manipur	17.10	4
Meghalaya	3.88	4
Mizoram	56.92	4
Nagaland	0.00	4
Odisha	545.97	1
Puducherry	Data Not Available	0
Punjab	105.19	3
Rajasthan	141.93	3
Sikkim	5.53	4

Name	Area of Land Diverted (sq. km)	Score
Tamil Nadu	52.45	4
Telangana	371.72	1
Tripura	40.71	4
Uttar Pradesh	69.63	4
Uttarakhand	425.93	1
West Bengal	22.25	4

Source: e-Green Watch

6. CA Land Identified in a state

Category for Scoring

Category (sq. km)	Score
0/No data available	0
1-100	1
101-200	2
201-400	3
401-1100	4

Score for each State/UT

Name	Area of CA Land (sq. km)	Score
Andaman & Nicobar	5.17	1
Andhra Pradesh	388.64	3
Arunachal Pradesh	381.20	3
Assam	50.90	1
Bihar	28.67	1
Chandigarh	0.81	0
Chhattisgarh	393.00	3
Daman and Diu and Dadra and Nagar Haveli	0.00	0
Delhi	3.77	1
Goa	7.20	1
Gujarat	409.73	4
Haryana	228.57	3
Himachal Pradesh	191.71	2
Jammu and Kashmir	8.64	1
Jharkhand	634.74	4
Karnataka	231.38	3
Kerala	5.06	1
Ladakh		0
Lakshadweep		0

Name	Area of CA Land (sq. km)	Score
Madhya Pradesh	598.92	4
Maharashtra	319.02	3
Manipur	53.40	1
Meghalaya	7.62	1
Mizoram	102.75	2
Nagaland	0.00	0
Odisha	1,043.52	4
Puducherry		0
Punjab	164.58	2
Rajasthan	178.15	2
Sikkim	31.36	1
Tamil Nadu	29.15	1
Telangana	318.84	3
Tripura	95.63	1
Uttar Pradesh	229.41	3
Uttarakhand	223.01	3
West Bengal	26.41	1

Source: E-Green Watch

7.   Plantation work done in a state

Category for Scoring

Category (sq. km)	Score
0/No data available	0
1-250	1
251-1500	2
1500-3000	3
3001-5500	4

Score for each State/UT

Name	Area of Plantation Work (sq. km)	Score
Andaman & Nicobar	0.20	0
Andhra Pradesh	1,460.16	3
Arunachal Pradesh	617.44	3
Assam	57.68	1
Bihar	56.30	1
Chandigarh	0.08	0
Chhattisgarh	1,963.87	4
Daman and Diu and Dadra and Nagar Haveli	0.00	0

Name	Area of Plantation Work (sq. km)	Score
Delhi	0.00	0
Goa	14.84	1
Gujarat	151.52	1
Haryana	584.30	3
Himachal Pradesh	112.06	1
Jammu and Kashmir	473.21	2
Jharkhand	1,351.30	3
Karnataka	1,655.61	4
Kerala	6.95	1
Ladakh	Data Not Available	0
Lakshadweep	Data Not Available	0
Madhya Pradesh	2,540.05	4
Maharashtra	1,418.18	3
Manipur	247.71	1
Meghalaya	18.65	1
Mizoram	12.59	1
Nagaland	0.00	0
Odisha	2,823.18	4
Puducherry	Data Not Available	0
Punjab	377.10	2
Rajasthan	3,869.58	4
Sikkim	90.69	1
Tamil Nadu	13.44	1
Telangana	5,424.80	4
Tripura	85.49	1
Uttar Pradesh	1,142.70	3
Uttarakhand	209.15	1
West Bengal	10.46	1

Source: E-Green Watch

Annexure 6: Data Procurement for RS-GIS Assessment

Table 28: Data Source for LULC Mapping

Study Area	Acquisition Date	Data Source	Type	Resolution	Sensors	Coordinate System	Remarks
Haryana	10 August 2016 to 10 January 2017	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_43N	Cloud Free Image taken from Google Earth Engine
	20 October 2023 to 31 December 2023	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_43N	
Odisha	10 October 2016 to 10 March 2017	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_45N	Cloud Free Image taken from Google Earth Engine
	20 October 2023 to 31 December 2023	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_45N	
	20 October 2023 to 30 December 2023	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_44N	
Uttarakhand	10 Oct 2016 to 9 March 2017	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_44N	Cloud Free Image taken from Google Earth Engine
	15 August 2023 to 31 December 2023	Sentinel 2 L2A	Multispectral	10m	MSI	WGS_1984_ UTM_ Zone_44N	

Table 29: Data Source for FVC Mapping

Study Area	Acquisition Date	Data Source	Type	Resolution	Sensors	Coordinate System	Remarks
Haryana	13 June 2016 to 20 December 2016	Landsat 8	Multispectral	30 m, Resampled at 10m	MSI	WGS_1984_ UTM_ Zone_43N	Cloud Free Image taken from Google Earth Engine
	5 September 2023 to 8 December 2023	Landsat 8	Multispectral	30 m, Resampled at 10m	MSI	WGS_1984_ UTM_ Zone_43N	

Odisha	21 June 2016 to 28 December 2016	Landsat 8	Multispectral	30 m, Resampled at 10m	MSI	WGS_1984_ UTM_ Zone_45N	Cloud Free Image taken from Google Earth Engine
	15 October 2023 to 16 December 2023	Landsat 8	Multispectral	30 m, Resampled at 10m	MSI	WGS_1984_ UTM_ Zone_45N	
Uttarakhand	3 Sept 2016 to 15 December 2016	Landsat 8	Multispectral	30 m, Resampled at 10m	MSI	WGS_1984_ UTM_ Zone_44N	Cloud Free Image taken from Google Earth Engine
	06 August 2023 to 19 December 2023	Landsat 8	Multispectral	30 m, Resampled at 10m	MSI	WGS_1984_ UTM_ Zone_44N	