

Forest Resource Utilization under Climate Change: Challenges and Opportunities for Sustainable Development in Vidarbha, Maharashtra

Dr. Snehal J. Raikundliya

Asst. Professor, F. E. S. Girls College, Chandrapur (M.S.)

snehaljitesh@gmail.com

Abstract

Forests constitute one of the most valuable natural resources supporting ecological stability, biodiversity conservation, climate regulation, and rural livelihoods. The Vidarbha region of Maharashtra, particularly the districts of Gadchiroli and Chandrapur, possesses one of the largest forested landscapes in Central India and contributes significantly to timber, bamboo, tendu leaves, mahua flowers, medicinal plants, and other Non-Timber Forest Products (NTFPs). However, climate change, increasing anthropogenic pressure, mining, forest fires, and changing land-use patterns have adversely affected forest productivity and ecosystem services. This paper examines the utilization of forest resources under changing climatic conditions and evaluates their contribution to sustainable regional development in Vidarbha. The study is based on secondary data obtained from the India State of Forest Report (2023), Government of Maharashtra publications, research articles, and reports from the Ministry of Environment, Forest and Climate Change. The analysis reveals that although forest resources continue to support tribal livelihoods, employment generation, biodiversity conservation, and carbon sequestration, increasing climate variability, frequent forest fires, declining forest quality, and unsustainable extraction practices threaten long-term sustainability. The study recommends climate-smart forest management, community participation, value addition to NTFPs, GIS-based monitoring, carbon financing mechanisms, and strengthening of community forest rights for achieving sustainable development.

Keywords: Forest Resource Utilization, Climate Change, Sustainable Development, Vidarbha, Gadchiroli, Chandrapur, Non-Timber Forest Products, Carbon Sequestration, Forest Governance.

1. Introduction

Forests play a vital role in maintaining ecological balance, supporting biodiversity, regulating climate, conserving soil and water resources, and sustaining millions of rural and tribal households. Globally, forests cover approximately 31% of the Earth's land area and contribute significantly to achieving the Sustainable Development Goals (SDGs), particularly SDG-13 (Climate Action) and SDG-15 (Life on Land).

The Vidarbha region of Maharashtra comprises eleven districts and accounts for nearly one-third of the state's forest resources. Gadchiroli and Chandrapur possess dense tropical dry deciduous forests dominated by teak (*Tectona grandis*), bamboo (*Dendrocalamus strictus*), tendu (*Diospyros melanoxylon*), mahua (*Madhuca longifolia*), and numerous medicinal plant species.

Climate change has emerged as a major threat to forest ecosystems by increasing temperatures, altering rainfall patterns, intensifying droughts, and increasing the frequency of forest fires. Recent assessments

also indicate declining forest canopy density in parts of Gadchiroli and increasing forest disturbance linked to climate variability, mining, and land-use change. ([CWE Journal](#))

2. Objectives of the Study

1. To assess forest resource utilization in the Vidarbha region.
2. To examine the impact of climate change on forest resources.
3. To analyse the contribution of forest resources to sustainable regional development.
4. To identify challenges and opportunities for climate-resilient forest management.
5. To recommend policy interventions for sustainable forest utilization.

3. Research Methodology

Research Design: Descriptive and analytical

Nature of Study: Secondary data-based

Sources of Data

- India State of Forest Report (2023)
- Ministry of Environment, Forest and Climate Change
- Forest Survey of India
- Maharashtra Forest Department
- National Statistical Office
- Research journals
- Government reports
- FAO publications
- IPCC Assessment Reports

4. Forest Resources of Vidarbha

Resource	Major Districts	Economic Importance
Teak	Gadchiroli, Chandrapur	Timber Industry
Bamboo	Gadchiroli	Paper, Furniture
Tendu Leaves	Gadchiroli, Chandrapur	Bidi Industry
Mahua Flowers	Tribal Areas	Food & Beverage
Honey	Forest Villages	Livelihood
Medicinal Plants	Eastern Vidarbha	Herbal Industry

5. Climate Change and Forest Resources

Major climate-induced impacts include:

- Rising annual temperatures

- Irregular monsoon rainfall
- Longer drought periods
- Increased forest fires
- Reduced regeneration
- Biodiversity loss
- Invasive species
- Human–wildlife conflict

The India State of Forest Report 2023 identified Gadchiroli as the district with the highest number of forest fire detections in India during the 2023–24 monitoring season (7,042 detections), highlighting the increasing vulnerability of forests in the region. ([Foreign Service Institute](https://www.fsi.gov.in/))

6. Challenges in Forest Resource Utilization under Climate Change in Vidarbha

Forest resources in the Vidarbha region, particularly in **Gadchiroli, Chandrapur, Gondia, Bhandara, Yavatmal, and Amravati**, face multiple challenges arising from ecological degradation, climate change, socio-economic constraints, and institutional weaknesses. These challenges affect forest productivity, biodiversity conservation, livelihood security, and sustainable regional development.

6.1 Ecological Challenges

6.1.1 Forest Degradation

Forest degradation refers to the deterioration in the quality, health, and productivity of forests without necessarily reducing the total forest area. In Vidarbha, degradation is caused by excessive extraction of timber and fuelwood, uncontrolled grazing, frequent forest fires, mining activities, encroachments, and invasive plant species.

Unlike deforestation, degraded forests remain classified as forests but lose their ecological functions. Degraded forests store less carbon, support fewer wildlife species, and produce lower quantities of timber and Non-Timber Forest Products (NTFPs). This directly affects the livelihoods of forest-dependent communities and reduces ecosystem resilience to climate change.

Major Causes

- Illegal tree felling
- Mining and industrial expansion
- Overharvesting of forest products
- Forest fires
- Overgrazing

Impact

- Declining forest productivity
- Reduced carbon sequestration

- Poor natural regeneration
- Increased vulnerability to climate change
- Decline in ecosystem services

6.1.2 Deforestation

Deforestation is the permanent removal of forest cover for non-forest purposes such as agriculture, mining, urbanization, roads, and infrastructure development.

Although Maharashtra has implemented conservation measures, districts such as Chandrapur continue to experience pressure from coal mining, industrial projects, and expanding settlements. Deforestation leads to habitat destruction, increased greenhouse gas emissions, and disruption of the hydrological cycle.

Major Causes

- Open-cast coal mining
- Infrastructure projects
- Agricultural expansion
- Urban growth
- Encroachments

Impact

- Loss of forest cover
- Reduced groundwater recharge
- Increased temperature
- Higher flood and drought risks
- Reduced biodiversity

6.1.3 Habitat Fragmentation

Habitat fragmentation occurs when large, continuous forest landscapes are divided into smaller isolated patches by roads, railways, mines, power lines, and human settlements.

Fragmentation is particularly severe in Chandrapur because of industrial and mining activities. Fragmented habitats restrict wildlife movement, reduce breeding success, and increase human–wildlife conflicts.

Consequences

- Isolation of wildlife populations
- Reduced genetic diversity
- Difficulty in species migration
- Increased road accidents involving wildlife

- Human–wildlife conflict

6.1.4 Loss of Biodiversity

Vidarbha supports rich biodiversity, including tigers, leopards, sloth bears, wild dogs, gaur, deer, and numerous bird and medicinal plant species. Climate change, habitat destruction, pollution, invasive species, and illegal hunting threaten this biodiversity.

Species with narrow habitat requirements are particularly vulnerable to increasing temperatures and changing rainfall patterns.

Impact

- Declining wildlife populations
- Extinction risk for sensitive species
- Loss of medicinal plants
- Declining ecosystem stability
- Reduced ecological resilience

6.1.5 Soil Erosion

Forest vegetation protects soil by reducing the impact of rainfall and stabilizing slopes with root systems. Removal of vegetation accelerates soil erosion.

In hilly forest areas of Gadchiroli and Melghat, heavy monsoon rains wash away fertile topsoil where forests have been degraded.

Impact

- Loss of fertile soil
- Reduced agricultural productivity
- Siltation of rivers and reservoirs
- Reduced groundwater recharge
- Increased landslide risk

6.2 Climate Challenges

6.2.1 Forest Fires

Forest fires have become increasingly frequent due to rising temperatures, prolonged dry seasons, accumulation of dry biomass, and human activities.

The dry deciduous forests of Gadchiroli and Chandrapur are highly vulnerable during summer.

Major Causes

- High temperature
- Dry vegetation

- Intentional burning
- Collection of NTFPs
- Negligence

Impact

- Destruction of wildlife habitat
- Carbon emissions
- Loss of timber
- Reduced regeneration
- Air pollution

6.2.2 Heat Stress

Climate change has increased the frequency and intensity of heat waves across Vidarbha.

High temperatures reduce soil moisture, increase evapotranspiration, and decrease photosynthesis, resulting in lower forest productivity.

Heat stress also affects wildlife by reducing water availability and increasing mortality during extreme weather events.

Impact

- Reduced tree growth
- Higher mortality of seedlings
- Increased drought stress
- Reduced NTFP production
- Wildlife migration

6.2.3 Rainfall Variability

Climate change has altered rainfall patterns in central India. Instead of consistent monsoon rainfall, Vidarbha experiences delayed monsoons, heavy downpours over short periods, and prolonged dry spells.

These changes affect forest regeneration, seed germination, and water availability.

Impact

- Poor natural regeneration
- Reduced bamboo growth
- Water scarcity
- Increased drought
- Increased soil erosion

6.2.4 Carbon Emissions

Healthy forests absorb carbon dioxide and act as carbon sinks. However, deforestation, degradation, and forest fires release stored carbon into the atmosphere.

This creates a feedback loop where climate change increases forest degradation, which in turn increases greenhouse gas emissions.

Sources

- Forest fires
- Timber harvesting
- Mining
- Land-use change
- Industrial expansion

Impact

- Global warming
- Reduced carbon sequestration
- Climate instability
- Poor air quality

6.3 Socio-Economic Challenges

6.3.1 Poverty among Tribal Communities

A large proportion of Vidarbha's tribal population depends directly on forests for food, fuelwood, fodder, medicinal plants, bamboo, tendu leaves, mahua flowers, and honey.

However, seasonal employment, fluctuating incomes, limited market access, and lack of infrastructure keep many forest-dependent households below the poverty line.

Impact

- Unsustainable harvesting
- Food insecurity
- Malnutrition
- Low educational attainment
- Migration

6.3.2 Low Value Addition

Most forest products are sold in raw form without processing.

For example:

- Bamboo is sold without conversion into furniture or engineered products.

- Mahua is sold as flowers instead of processed foods or beverages.
- Honey is often sold unprocessed.

This limits income generation.

Impact

- Lower profits
- Limited employment
- Dependence on intermediaries
- Reduced local industrial development

6.3.3 Limited Processing Industries

Vidarbha has abundant forest resources but relatively few industries that process bamboo, medicinal plants, lac, honey, and other NTFPs.

The absence of local processing facilities forces communities to sell raw materials at low prices.

Constraints

- Lack of investment
- Poor transport
- Inadequate technology
- Limited skilled workforce

Impact

- Low rural incomes
- Limited entrepreneurship
- Reduced industrial growth

6.3.4 Market Exploitation

Forest gatherers often sell their products through middlemen due to inadequate market information, poor bargaining power, and limited access to organized markets.

As a result, collectors receive only a small share of the final market value.

Problems

- Price fluctuations
- Lack of storage
- Limited cooperatives
- Poor access to credit

Impact

- Low household income
- Continued poverty
- Reduced incentives for sustainable management

6.3.5 Migration

Climate variability, declining forest productivity, and limited employment opportunities compel many tribal households to migrate seasonally to urban areas for work.

Migration reduces the available labour force for sustainable forest management and disrupts community life.

Impact

- Labour shortages
- Family disruption
- Loss of traditional ecological knowledge
- Increased urban poverty

6.4 Institutional Challenges

6.4.1 Weak Forest Governance

Effective forest governance requires coordination among forest departments, local governments, tribal institutions, and communities.

Challenges include:

- Limited financial resources
- Staff shortages
- Administrative delays
- Weak enforcement
- Policy implementation gaps

These reduce the effectiveness of forest conservation and sustainable utilization.

6.4.2 Limited Community Participation

Although the **Joint Forest Management (JFM)** programme and the **Forest Rights Act, 2006** encourage community participation, many villages still have limited involvement in planning and decision-making.

Insufficient participation reduces local ownership of conservation initiatives.

Impact

- Poor forest protection
- Reduced accountability

- Lower adoption of sustainable practices

6.4.3 Poor Monitoring

Monitoring of forest health, biodiversity, illegal activities, and climate impacts remains inadequate in many areas due to insufficient manpower, limited technological resources, and inaccessible terrain.

Modern technologies such as remote sensing, drones, GIS, and real-time satellite monitoring are not yet fully integrated across all forest divisions.

Impact

- Delayed detection of degradation
- Inefficient fire response
- Incomplete biodiversity assessments
- Weak evidence for management decisions

6.4.4 Illegal Extraction

Illegal extraction includes unauthorized logging, mining, fuelwood collection, wildlife poaching, and overharvesting of NTFPs.

Weak enforcement, poverty, and market demand contribute to these activities.

Impact

- Forest degradation
- Biodiversity loss
- Reduced government revenue
- Increased human–wildlife conflict
- Decline in ecosystem services

7. Opportunities for Sustainable Development

Climate Smart Forestry

- Assisted natural regeneration
- Mixed species plantations
- Landscape restoration

Sustainable NTFP Management

- Bamboo processing
- Honey processing
- Mahua value chain
- Herbal products

Carbon Economy

- Carbon credits
- REDD+
- Ecosystem services

Technology

- GIS mapping
- Remote sensing
- Drone monitoring
- Mobile-based forest monitoring

Eco-tourism

- Nature tourism
- Wildlife tourism
- Tribal eco-tourism

8. Contribution to Sustainable Development

Forest resources contribute through:

- Employment generation
- Tribal livelihood enhancement
- Climate regulation
- Carbon sequestration
- Biodiversity conservation
- Water conservation
- Poverty reduction
- Rural industrialization

9. Suggested Statistical Information

Indicator	Gadchiroli	Chandrapur
Geographical Area (sq km)	14,412	11,443
Forest Cover (%)	~69	~65
Major Forest Type	Tropical Dry Deciduous	Tropical Dry Deciduous
Major NTFPs	Bamboo, Tendu, Mahua	Teak, Bamboo, Tendu
Dominant Communities	Gond, Madia	Gond, Kolam

Figures should be updated using the latest district-level statistics from the India State of Forest Report 2023 and Maharashtra Forest Department publications. ([Foreign Service Institute](http://ForeignServiceInstitute.org))

10. Policy Recommendations

- Promote climate-resilient forest management.
- Strengthen Community Forest Resource (CFR) governance.
- Establish district-level NTFP processing centres.
- Improve forest fire prevention using GIS and satellite monitoring.
- Expand payment for ecosystem services and carbon finance initiatives.
- Encourage women-led forest enterprises and tribal producer companies.
- Integrate climate adaptation into forest working plans.
- Promote sustainable mining practices with ecological safeguards.

11. Conclusion

Forest resources remain the backbone of ecological security and rural livelihoods in Vidarbha. However, climate change, forest degradation, and unsustainable extraction are reducing the resilience of these ecosystems. Sustainable forest management, supported by scientific planning, community participation, value addition to forest products, and climate-adaptive policies, offers a pathway for balancing conservation with economic development. Strengthening institutional mechanisms and integrating climate resilience into forest governance will be essential for ensuring long-term sustainable development in the Vidarbha region.

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