SWITCH ON FOUNDATION

LAND DEGRADATION, DESERTIFICATION, AND DROUGHT

IN JHARKHAND

JUNE 05, 2024

WORLD ENVIRONMENT DAY

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Executive Summary

'Restoring Land, Fighting Desertification, and building drought resilience are important for keeping our environment healthy and sustainable'.

Desertification, land degradation, and drought (DLDD) represent a silent and invisible crisis that significantly impacts people by obstructing land productivity, causing biodiversity loss, and leading to water scarcity. These severe hydrological imbalances greatly affect land resource production and ecological processes, directly impacting humans, wildlife, and plant communities. Desertification's intensity has surged 30-35 times historical rates in recent decades. Droughts, major threats to sustainable development, are escalating globally. By 2050, they may affect over three-quarters of the world's population. Since 2000, drought frequency and duration have increased by 29%, exacerbating water stress for 2.3 billion people.

Land degradation in **India** leads to soil erosion, nutrient depletion, and reduced fertility. 30% of soil is degraded, and droughts exacerbate this (Pandey, 2023). Land degradation, causing crop failures and food security issues, is expected to decrease by 20% by 2050 due to climate change (PIB, 2023) Over-extraction of groundwater leads to decreased water tables and aquifer recharge, impacting 60% of agriculture. Groundwater levels are declining rapidly, affecting crop yields and productivity. Climate change impacts crop selection and pest management, increasing malnutrition and micronutrient deficiencies, affecting 18.7% of India's population (NFHS, 2019-2021). Water scarcity and poor water quality also cause health issues and economic losses because 70 per cent of rural households still depend primarily on agriculture for their livelihood (FAO, 2024).

Jharkhand, a state in eastern India, grapples with multifaceted environmental challenges stemming from changing land use patterns, groundwater depletion, drought vulnerability, wetland degradation, urban forestry issues, and the imperative for regenerative agricultural practices. 5.5 million hectares of land in Jharkhand is affected by desertification (MoEFCC 2023). Rapid urbanisation, notably in Ranchi, has precipitated significant forest loss and dwindling agricultural expanses. Groundwater over-extraction in zones like Jamshedpur-Sadar intensifies water scarcity. Escalating drought frequency, exacerbated by poor soil moisture retention and deforestation from mining activities, severely disrupts agricultural productivity and local economies. Wetland ecosystems face encroachment, pollution, and invasive species infestation. Urban forestry initiatives confront declining tree cover, socio-economic obstacles, and insufficient community involvement.

Jharkhand is among the top five states in India which has witnessed rapid desertification. According to the 'Desertification and Land Degradation Atlas of India-2016' (Space Application Centre, Ahmedabad), Jharkhand has the highest area under desertification in the country with respect to total geographical area, i.e., 68.98% (around 54987.26 sq km), followed by Rajasthan (62.90%) and Gujarat (52%).

As per a report 'Economics of Desertification, Land Degradation and Drought (EDLDD)' the land degradation costs India nearly 2.54% of its GDP (Rs. 3,177.39 billion). Similarly, in terms of total economic loss incurred (to land use and cover change in 2009 compared with 2001), the annual cost of land degradation in Jharkhand is estimated at around 218.7 million dollar and annual per capita cost of land degradation is around 6.6 dollar.

The most significant process of desertification/land degradation in the state is Water Erosion (50.64%) followed by Vegetation Degradation (17.30%) however man-made reasons like urbanisation and settlements have led to an increase in land degradation.

Regenerative agriculture emerges as a promising solution, fostering soil health, water conservation, and biodiversity enhancement, though widespread implementation remains pivotal to counteract pervasive environmental degradation in the state.

Forest cover in the state has decreased by 6.7%, reflecting the ongoing challenges of forest loss, while the built-up area has surged by 57% between 2017 and 2023, highlighting the alarming pace of urban expansion and its associated impacts on natural ecosystems. Land restoration and sustainable agriculture practices can increase crop yields and improve food availability, reducing the risk of malnutrition and related health issues. This is particularly important in Jharkhand, where over 50% of the land area is prone to desertification and drought. Effective management practices and sustainable land use policies are crucial to restoring ecological balance and ensuring long-term environmental health in the region.

Climate change and erratic monsoons intensify drought conditions, lowering soil moisture, biodiversity, and agricultural productivity. Declining groundwater levels and poor soil moisture retention compound these challenges. Despite efforts in wetland restoration, regenerative farming, and urban forestry, resource allocation, policy enforcement, and community engagement remain persistent obstacles. Effective management practices and **sustainable land use policies** are imperative for restoring ecological balance and ensuring long-term environmental health in the region.

Given the severity and frequency of increasingly severe dry spells, it is imperative that we increase our capacity to withstand drought. Droughts worsen poverty and increase already-existing disparities while also endangering agriculture and water supplies. However, by implementing integrated water resource management, better farming methods, and community empowerment, we may increase our resistance to drought and guarantee the sustainable growth of global communities. We create the conditions for a future in which ecosystems flourish, communities prosper, and our planet's landscapes are preserved for future generations by investing in drought-resistant technologies, encouraging soil conservation, and improving water efficiency.

The world is celebrating World Environment Day 2024 on June 05, and bringing attention to how people can contribute to halting environmental deterioration and revitalising neglected regions. A few suggestive ways to get involved in ecosystem restoration on World Environment Day, are to *make agriculture sustainable and use smart farming practices*, *preserve the soil, protect the pollinators, revitalization of the Freshwater Ecosystem*, *renew the coastal belts*, *reintroduce nature to the urban space*.

Jharkhand government has developed a comprehensive Land Restoration Plan aimed at rehabilitating degraded land through afforestation, soil conservation, and sustainable land use practices. The Jharkhand Forest Department has launched an Afforestation Program to increase forest cover and combat desertification by planting trees and restoring forests.

To address desertification specifically, Jharkhand has implemented the Desertification Mitigation Program, which focuses on soil conservation, water harvesting, and sustainable agricultural practices. The state also runs the Integrated Watershed Management Program, targeting the reduction of soil erosion, improvement of water quality, and promotion of sustainable land use practices. Additionally, the community-based land restoration initiatives engage local communities in land restoration efforts. This program emphasizes capacity building, training, and community-led initiatives to ensure sustainable and effective land restoration.

1.Introduction-

Land Use Land Cover (LULC) studies are vital for environmental management, urban planning, and agricultural development. They aid in biodiversity conservation, climate change mitigation, and sustainable infrastructure growth. LULC data supports disaster management, watershed management, and waterbody conservation, informing land use policies that promote balanced regional development and sustainable practices. Additionally, LULC studies provide valuable insights for scientific research, enhancing our understanding of ecological and climate systems.

World Environment Day 2024 focuses on land restoration, desertification, and drought resilience (World Environment Day 2024, n.d.), under the theme "Our Land, Our Future" with the tagline "We are #GenerationRestoration" (UN Environment Programme, n.d.). This theme aligns closely with Sustainable Development Goal (SDG) 15, "Life on Land," which aims to protect and conserve all forms of life on land (Martin, 2024). SDG 15 efforts include protecting and restoring ecosystems and biodiversity, sustainably managing forests, halting deforestation, combating desertification, reversing land degradation, restoring degraded land and soil, and protecting threatened species to halt biodiversity loss. In recognition of this occasion, SwitchON Foundation has highlighted several land restoration issues in the state of West Bengal through this comprehensive report.

2.An assessment of land use and land cover

Recent studies have provided a detailed understanding of land use and land cover in Jharkhand, with specific insights into the Jabalpur Block and Ranchi district. The analysis, based on IRS P6 LISS-III data from 2006 and subsequent field visits, reveals the following distribution of land use in the Jabalpur Block: agricultural land dominates with 6798.93 hectares (77%), built-up land accounts for 520.70 hectares (5.9%), forest cover stands at 148.41 hectares (1.70%), wasteland comprises 118.30 hectares (1.35%), and water bodies cover 1160.76 hectares (13.27%) (Sharma et al., 2012).

In the Ranchi district, significant changes have been observed over the years, primarily due to rapid urbanization and population growth. A study by Kashyap et al. (2020) documented a notable expansion of built-up areas, which increased from 9.69% in 1992 to 21% in 2017. This growth highlights the substantial urban development occurring in the district.

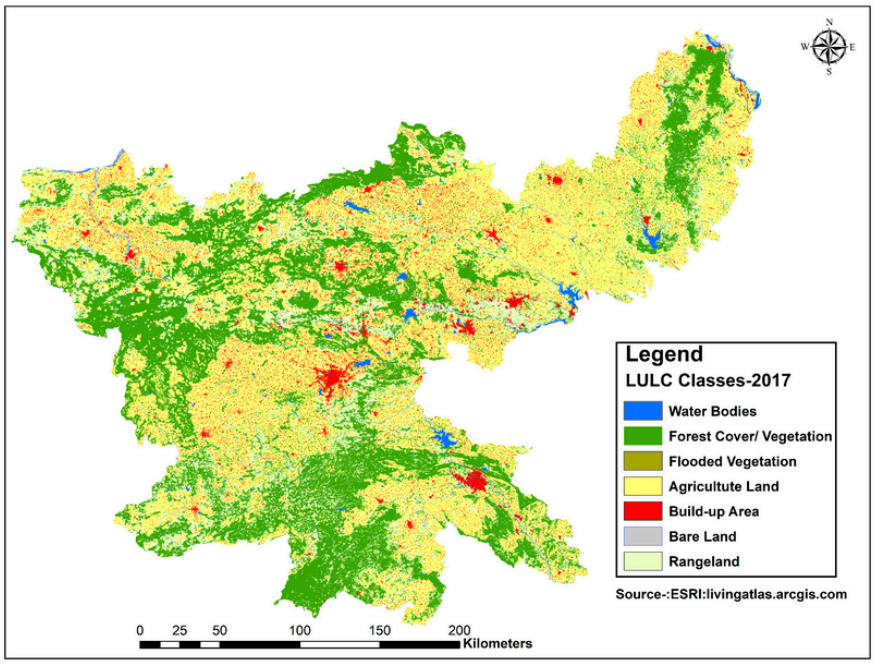
Further analysis by Kumar et al. (2018) using Landsat Thematic Mapper Satellite Imagery supports these findings, showing that built-up areas have expanded while forest areas have decreased. The study indicates that barren land and vegetation areas have remained relatively stable over this period. Additionally, the spatial trend of built-up areas points to a more significant increase in the central part of Ranchi district compared to other regions, with forest areas decreasing by approximately 10% from 1992 to 2017.

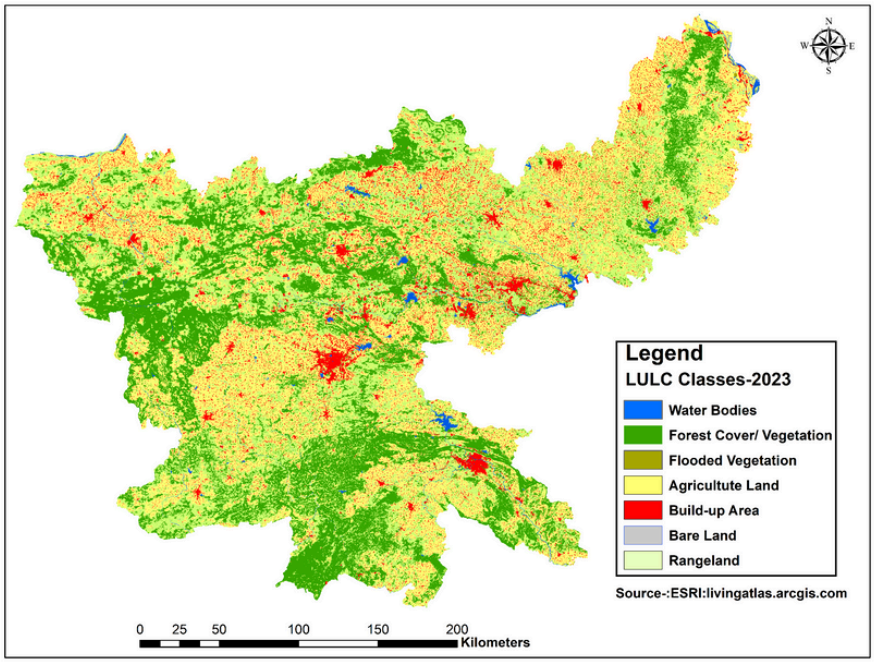
The studies have identified several land use classes in the Ranchi district, including agriculture, barren land, forest area, settlement area, vegetation, and water bodies. These classifications provide a comprehensive understanding of the region's land use dynamics.

Overall, the findings underscore the significant impact of urbanization on land use in Jharkhand. The substantial increase in built-up areas, particularly at the expense of forest cover, reflects the ongoing changes in the state's landscape due to urban growth and development pressures.

3.Maps on Land Use, Cover, and Pattern: Highlighting the Shifts over time

Land Use and Land Cover (LULC) maps of the state for the years 2017 and 2023 were obtained from ESRI's Living Atlas of the World (livingatlas.arcgis.com) in GeoTIFF format. These GeoTIFF files were subsequently opened in a GIS platform. Initially, the datasets contained 256 classes, including 0 values, which were later consolidated into 7 classes: water bodies, forest, natural vegetation/forest, built-up areas, barren land, and rangeland (uncultivated grasslands, shrublands, woodlands, wetlands, etc.). The symbology tool in QGIS was employed to classify these areas. The areas of the 7 classes for both years were analysed and calculated to assess the changes between 2017 and 2023.



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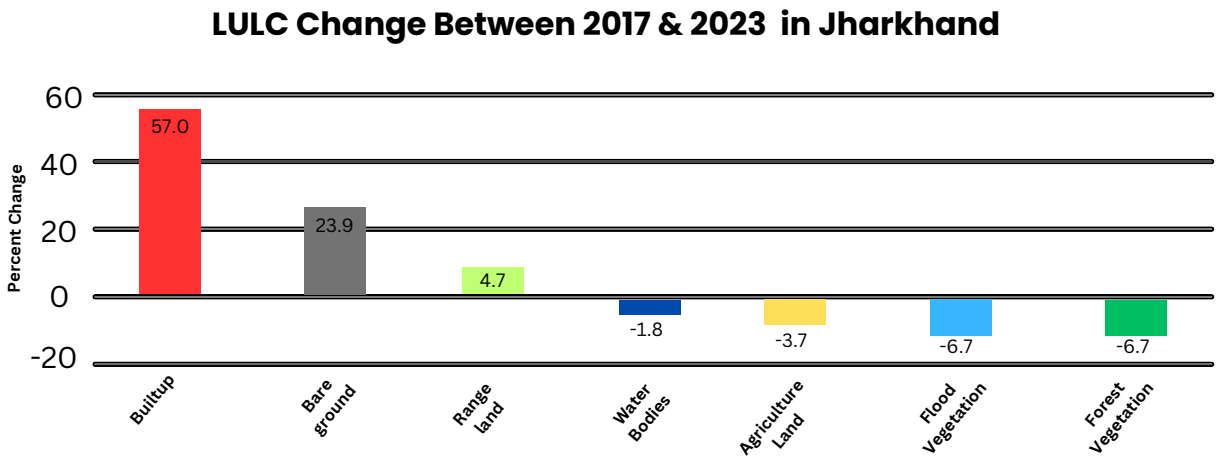

3.1 Increasing Trends

Between 2017 and 2023, there have been notable positive changes in land use and land cover in Maharashtra. Rangeland expanded by 612.10 sq km, a 4.72% increase, possibly due to improved land management practices or efforts in land reclamation to enhance pasture areas. Bare ground saw a significant rise of 222.11 sq km, marking a 23.92% increase. This increase could be indicative of land clearing for development or the result of deforestation. The most substantial positive change was observed in built-up areas, which expanded by 2125.61 sq km, a 56.96% increase, reflecting rapid urbanisation driven by population growth, economic development, and urban sprawl.

3.2 Decreasing Trends

Conversely, several negative land use and cover changes were observed between 2017 and 2023. Forest and vegetation areas decreased significantly by 1561.65 sq km, a 6.75% reduction, likely due to deforestation and the conversion of forest land for agricultural or urban purposes. Flood vegetation experienced a decrease of 54.81 sq km, a 6.72% decline, potentially resulting from changes in water management or climatic factors affecting flood regimes. Agricultural land saw a reduction of 1354.44 sq km, a 3.74% decrease, which may be attributed to urban encroachment, land degradation, or shifts to other land uses. Additionally, water bodies decreased slightly by 34.60 sq km, a 1.80% reduction, possibly due to water extraction, climate change impacts, or land reclamation reducing wetland areas.

4.Groundwater Resources: Current Scenario and how it has changed over time-

As the primary source of drinking and irrigation water, groundwater in Jharkhand is facing a challenging situation due to the increasing population. Jharkhand receives 1100 mm to 1442 mm of rainfall, which contributes to over 70% of the state's groundwater supply. More than 50% of this groundwater is utilized for irrigation, 35% for domestic purposes, and the remaining 15% for industrial purposes (STATIC, 2022).

As per Central Ground Water Board (CGWB) 2022 data, Jharkhand state's total groundwater is 6.20 BCM. and the annual extractable Groundwater amount of the state is 5 69 BCM. The annual groundwater draft in the state is 1 78 BCM with an irrigation draft of 0.93 BCM' a Domestic draft of 0.65 BCM and an industrial draft of 0.21 BCM. The state's Ground water Extraction stage is 31.35 % (CGWB, 2022).

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Based on groundwater extraction data, Jharkhand is divided into three categories. Since 2009, Jamshedpur-Sadar has been classified as an over-exploited zone for groundwater extraction, a status that remains unchanged. Recently, five additional regions have been added to the over-exploited category: Bermo, Baliapur, Thitrapur, Golmuri, and Lugsalai. From 2009 to the present, the urban areas of Dhanbad have been designated as critical, along with the Topchanchi, Ramgarh, Silli, and Jainagar blocks, which are also considered critical zones for groundwater extraction (WRDJHARKHAND, 2009, CGWB, 2022). District-wise, the highest stage of groundwater development has been observed in Dhanbad district at 75.08%, while the lowest is in West Singhbhum district at 9.93% (CGWB, 2022).

Table 1. Change in groundwater Scenario over 10 years

Years	Annual groundwater recharge (BCM)	Net annual groundwater availability (BCM)	Stage of groundwater extractions (%)
2011	6.31	5.76	32.3 %
2017	6.21	5.69	27.73 %
2022	6.20	5.69	31.35%

(Source, Central Ground Water Board, 2022)

Table 1 highlights the changes in Jharkhand's groundwater scenario over a decade. In 2011, the annual groundwater recharge was 6.31 BCM, with a net annual availability of 5.76 BCM and a groundwater extraction stage of 32.3%. By 2017, the recharge slightly decreased to 6.21 BCM, and the availability dropped to 5.69 BCM, resulting in a lower extraction stage of 27.73%. In 2022, the recharge further declined to 6.20 BCM, maintaining the same availability of 5.69 BCM, but the extraction stage increased to 31.35%. This data indicates fluctuating groundwater recharge and extraction rates over the period.

5.Perceived Impact of Drought in Ecology-

Jharkhand is one of the most vulnerable states to changing climate conditions. Rising temperatures and shorter monsoon periods have impacted the state severely in recent times. Since its inception, the state has recorded ten droughts. In recent times the frequency of droughts has increased with 2022 and 2023 experiencing severe back-to-back droughts. This has severely impacted the state's large farming population. In 2022, 226 of 260 blocks across 22 districts were drought-affected, impacting approximately 33.62 lakh farmers. In 2023, the Jharkhand government declared 158 blocks in 17 districts as drought-affected, impacting around 15 lakh farmers (DownToEarth, 2024). This also had severe economic repercussions for the state. In 2022 the government announced an amount of 500 crores in aid to farmers in drought-hit regions. However, this amount only aided 10 lakh farmers, with 23 lakh farmers still awaiting some form of aid (Pulitzer Center 2023).

What is interesting to note is that Jharkhand's neighbouring states of Bihar and Uttar Pradesh received comparatively less rainfall, but fared better than Jharkhand in terms of drought resilience. Researchers attribute this to the fact that the two neighbouring states have soil that has higher moisture retention capacity (Gangetic alluvial soil). Jharkhand in comparison has soil with lower moisture retention abilities (Outlook 2024). Furthermore, the desertification of soil in the state has been accelerated due to large-scale deforestation from mining activities. This has further exasperated drought-like conditions in the state and severely affected the local ecology.

Prolonged periods of insufficient rainfall have reduced the availability of water in forested areas, causing a decline in tree health and forest density. This has led to increased tree mortality and a reduction in biodiversity, as many plant and animal species struggle to survive in the drier conditions. The degradation of forests also exacerbates soil erosion, further depleting the already fragile soil quality. The state is home to a large population of tribal communities who rely on agriculture and selling forest products (Mahua flowers, Tendu leaves, tamarind) to survive. These communities have been severely impacted due to the drought conditions. Droughts have reduced the abundance of these forest products and also lowered the quality, impacting the income of tribal communities (Pulitzer Center 2023). The combination of deforestation and drought has created a vicious cycle, where reduced forest cover leads to decreased rainfall retention, worsening drought conditions, and further ecological destruction.

6.Conservation, Restoration and the Management Plan of the Wetlands-

6.1 Overview

- There are over 2,437 wetlands in Jharkhand, which span 1,568.30 km².
- In Jharkhand, wetlands are essential to water storage, water level maintenance, and ecological sustainability.
- Major wetlands in the state include the Udhwa Lake Bird Sanctuary, Kansjor Dam, Konar Dam, Tilaiya Dam, Getalsud Dam, Maithon Dam, Massanjore Dam, and Tenughat Dam (Narayan, 2020).

6.2 Threats to wetlands in Jharkhand

- According to a recent study of Ranchi, a total of 21 lakes and ponds dried up in 2018, losing 1.2 ha of area in 10 wards, while 21 lakes and ponds disappeared altogether, losing 5.1 ha of area to built-up areas in 18 wards (Narayan, 2019).
- Wetland regions are becoming more and more encroached upon by mining activity in places like Dhanbad and Bokaro.
- Wetlands like the Udhwa Lake Bird Sanctuary are contaminated by agricultural runoff that contains excessive amounts of pesticides and fertilizers (Narayan, 2019) .
- Wetlands such as Getalsud dam have reported cases of heavy metal contamination due to mining operations (Sharma et al., 2012).
- The proliferation of invasive plants, including as salvinia and water hyacinth, has clogged major wetlands in Jharkhand, including the Tilaiya and Kansjor dams (Prakash & Raziuddin, 2023).

6.3 Restoration Activities

- Restoration activities such as desilting, de-weeding, and biodiversity conservation are being undertaken in select wetlands in Jharkhand, with the Udhwa Lake Bird Sanctuary targeted for restoration under the National Plan for Conservation of Aquatic Ecosystems (NPCA) (Narayan, 2019).
- Through increasing social ownership and engagement in the management of these wetlands, Mission Sahbhagita encourages community participation in Jharkhand's wetland conservation efforts.
- Under the Wetlands (Conservation and Management) Rules, 2017, the state has notified a number of wetlands. These rules provide a framework for the conservation of wetlands.

7. Urban Forestry: The Contemporary Scenario

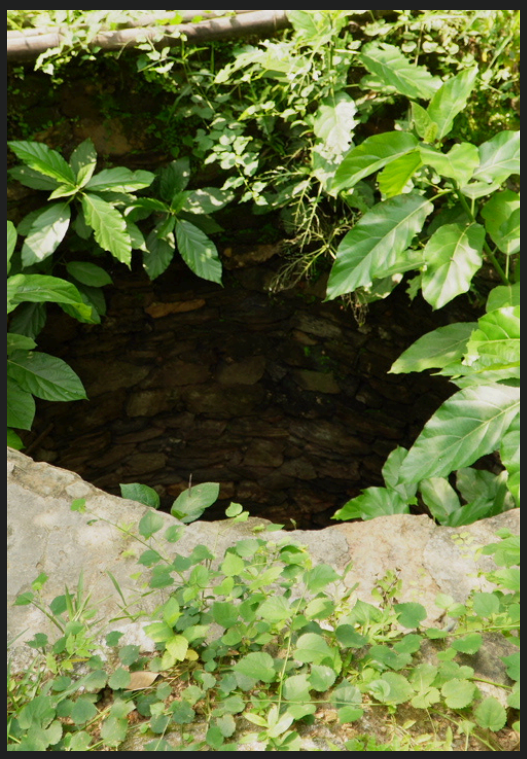
- The urban forests in Jharkhand, are expected to contribute to climate resilience in several ways. Urban forests act as green infrastructure, mitigating the urban heat island effect by providing shade, cooling the environment through evapotranspiration, and reducing the need for air conditioning. By absorbing pollutants and dust, urban forests can help improve air quality in the cities, which are among the most polluted in Jharkhand. Urban forests will include water harvesting systems, which can help manage stormwater runoff and reduce the burden on urban drainage systems, thereby enhancing the resilience of cities to extreme rainfall events. Also, By reducing the urban heat island effect and improving air quality, urban forests can help mitigate the impacts of climate change on urban populations. It will also provide additional ecosystem services such as soil conservation, improved water quality, and enhanced aesthetic appeal, all of which contribute to climate resilience. Some recent observations regarding the urban forestry in Jharkhand are hereby assembled:

- Jharkhand has a significant forest cover, with the total forest area being 23,605 km², which is 29.61% of the state's geographical area. The total forest cover in Jharkhand increased by 58.41 sq km between 2017 and 2019, from 23,553 sq km to 23,611.41 sq km.

- Very Dense Forest (VDF) increased from 1,405 sq km to 1,415 sq km, while Moderately Dense Forest (MDF) rose from 5,177 sq km to 5,185 sq km. However, the tree cover in Jharkhand decreased by 265 sq km during the same period (FSI, 2019).

- The forest cover in the state decreased slightly from 21,692 sq km in 1997 to 22,637 sq km in 2001. A study found a net forest cover decline of 40.5% of the total forest and a mean annual rate of deforestation of 0.69% per year during 1935-2011.

- From 2001 to 2023, Jharkhand lost 5.98 kha of tree cover, equivalent to a 1.1% decrease since 2000 (TOI, 31 October 2019), mostly in the urban areas in cities of Ranchi, Dhanbad, Jamshedpur etc.



Forest cover in Jharkhand (2019)

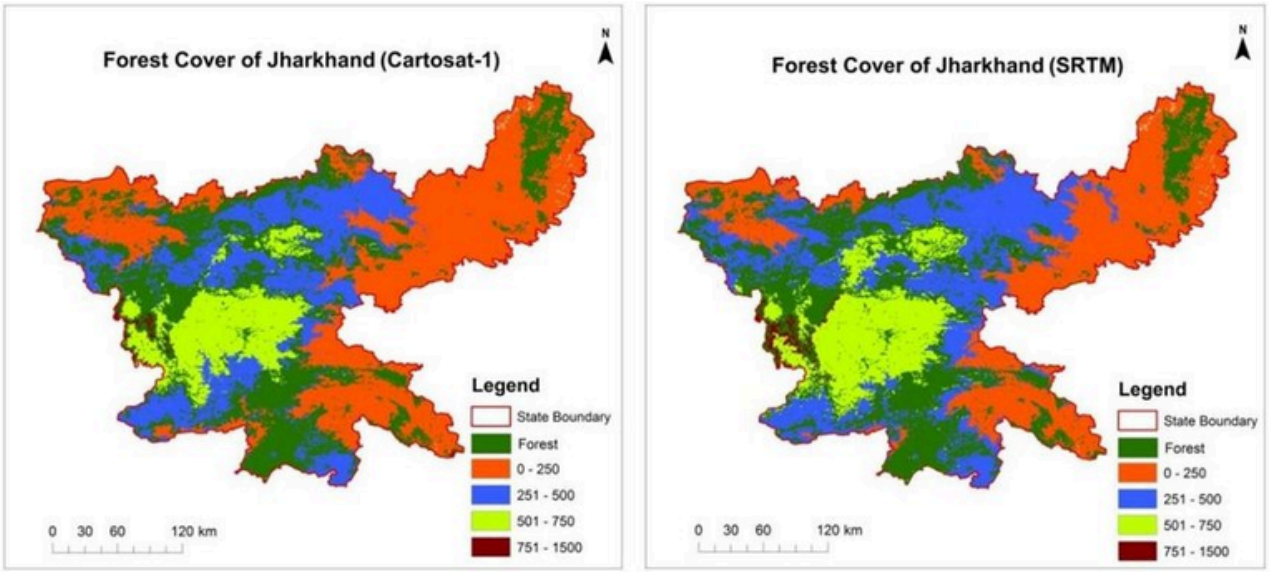


Fig. Source- Mishra et, al. (2019)

As per data, the forest cover has declined by 0.5% to 0.79% in Jharkhand's five districts — Ranchi, Dumka, Giridih, Pakur and West Singhbhum — between 2013 and 2015 and it has increased by only 5 square kilometer in the state during the period, according to the Jharkhand Economic Survey (2015-16).

7.1 Constraints and some remedies in urban forestation-

Urban development and land use changes can lead to the destruction of natural habitats and the loss of tree cover, making it essential to balance development with conservation efforts. They often face challenges related to social and economic factors, such as unequal distribution of resources, lack of community engagement, and limited funding. The state government has undertaken various measures since 2017 to boost forest cover, including conservation, protection, afforestation, silvicultural and soil conservation programs, and regular plantation drives (TOI, 31 October 2019). These include:

- The state has been selected for the Centre's "Nagar Van" or urban forest scheme, which aims to develop urban forests in six cities, including Ranchi, Bokaro, Dhanbad, Hazaribag, Jamshedpur, and Giridih (The Print, 3 July 2022).
- The scheme involves community participation and collaboration between the Forest Department, Municipal bodies, NGOs, Corporates, and local citizens to ensure the long-term success of the project.
- The central government will provide financial assistance of Rs 4 lakh per hectare for the development of these urban forests, which can be used for fencing, maintenance, and administrative costs. The state government also plans to collaborate with private players and corporates to develop additional facilities like benches, toilets, lighting, and drinking water in these urban forests.
- While the overall forest cover in Jharkhand has increased from 22,977 square kilometres in 2011 to 23,721 square kilometres in 2021, the tree cover has declined. The Nagar Van scheme aims to address this imbalance by focusing on urban areas and creating more green spaces for the benefit of the local population and the environment (FSI, 2019).
- Additionally, Jharkhand gets its first urban Miyawaki forest in May 2024 in Jamshedpur. It is spread over 5.10 acres of land and has more than 37,000 tree plantations of over 33 species of plants (The Telegraph, 31 May, 2024).

8.Regenerative Agriculture: Its effectiveness in preventing land degradation-

Regenerative agriculture holds promise in preventing land degradation in regions like Jharkhand. This approach focuses on restoring soil health, increasing biodiversity, and enhancing ecosystem services, which are crucial for sustaining agricultural productivity in the long term. In Jharkhand, where land degradation due to deforestation, mining, and unsustainable agricultural practices is a significant issue (Saikia et al., 2021).

- Regenerative practices such as cover cropping, minimal tillage, and composting help rebuild soil organic matter, improve soil structure, and enhance nutrient cycling. This can mitigate soil erosion and nutrient depletion, common problems in Jharkhand due to intensive farming and mining activities (Samra, 2020).
- Implementing regenerative techniques like agroforestry, contour plowing, and rainwater harvesting can improve water retention in soils and reduce the risk of waterlogging and runoff. This is crucial in Jharkhand, where erratic rainfall patterns and poor water management exacerbate land degradation (Saikia et al., 2021).
- By promoting diversified cropping systems, intercropping, and habitat restoration, regenerative agriculture fosters biodiversity both above and below ground. This can enhance pest control, pollination, and overall ecosystem resilience, mitigating the impact of land degradation on local ecosystems (Samra, 2020).

9.State government initiatives for the promotion of sustainable agricultural practices-

- The State is committed to focus on proper soil management for improving crop productivity and for sustainability. GoJ is promoting soil health card scheme, which is a sub scheme of National Mission on Sustainable Agriculture aiming at Integrated Nutrient Management (INM) through judicious use of chemical fertilizers, including secondary and micro nutrients in conjunction with organic manures and bio fertilizers. As of January 2017, 44,454 Soil Health Cards (SHC) have been printed and distributed in the State covering around 3,37,636 farmers.

- State is determined to promote judicious use of fertilizer and thus plans to increase fertilizer consumption to 115 kg/ha by 2020 -21.

- The State has established the Organic Farming Authority of Jharkhand in 2012. Till April 2016, 30363.73 ha of land had been certified by approved certifying agencies. State will also focus on creating appropriate market linkage mechanisms for the organic produce for differential price realization.

- Mahila Kisan Sashaktikaran Pariyojana (MKSP) : The primary objective of the MKSP is to empower women in agriculture by making systematic investments to enhance their participation and productivity, as well as create and sustain agriculture based livelihoods of rural women. As of December 2017, more than 46000 women farmers have been covered under MKSP. (Source: NABARD)

10.Suggestive ways to restore land, halt desertification, and combat drought-

The world is celebrating World Environment Day 2024 on June 05, and bringing attention to how people can contribute to halting environmental deterioration and revitalizing neglected regions. Here are a few ways to get involved in ecosystem restoration on World Environment Day-

Make agriculture sustainable and use smart farming practices

In Jharkhand, a significant majority of the people are dependent on agriculture for their livelihood. However, our current farming practices are unsustainable and a prime driver of land degradation. There is a lot that can be done to fix this. Governments and the finance sector can promote regenerative agriculture to increase food production while preserving ecosystems.

The use of artificial intelligence in smart farming techniques offers a practical answer to the problems facing agricultural sustainability in the contemporary period. Time series analysis, deep learning, and machine learning are crucial to smart farming. Agriculture involves a wide range of operations, including crop selection, crop yield prediction, categorization of soil compatibility, and water management. Time series analysis is used for agricultural demand forecasting, commodity price prediction, and crop yield production forecasting. Machine learning algorithms are to be utilized for crop selection and management. Deep learning techniques are to be used for crop selection and crop production forecasting. Machine learning and deep learning algorithms are to be used to select crops based on a variety of parameters, including soil composition and compatibility classification.

Preserve the Soil

One of the most biodiverse environments is soil. 95% of the food we eat comes from the earth, where nearly 60% of all organisms reside. To mitigate climate change, healthy soil serves as a carbon sink, trapping greenhouse gasses that might otherwise escape into space. Governments and the financial industry may encourage organic and soil-friendly farming to maintain healthy and productive soil. Zero-tillage is a practice that agricultural businesses can use to maintain organic soil cover by farming crops without disturbing the soil through tillage. The fertility of the soil could be increased by adding compost and other organic materials. Mulching and drip irrigation are two examples of irrigation strategies that can be utilized to assist in maintaining soil moisture levels and minimize drought stress. Individuals can also make compost from leftover scraps of fruits and vegetables and use them in their kitchen gardens and balcony plant pots.

Protecting the Pollinators

75% of the crops are dependent on pollinators (United Nations Environment Program, 2024). The most abundant pollinators are bees, bats, insects, butterflies, birds, and beetles all contribute significantly but bees are the most prolific ones. Some fruits, such as mangoes, avocados, and bananas would disappear if bats disappeared. All pollinators, bees, in particular, are seriously declining despite their importance.

In order to save them, humans need to reduce air pollution, lessen the harmful effects of fertilizers and pesticides, and preserve the wetlands, woodlands, and meadows that are home to pollinators. To help restore nature, governments and citizens need to grow urban green areas and add additional ponds that are beneficial to pollinators. Birds, butterflies, and bees will be drawn to urban and residential gardens when a wide variety of native flowers are planted.

Revitalization of the Freshwater Ecosystem

Freshwater ecosystems sustain the water cycles that keep land fertile. They supply food and water to people, protect us from droughts and floods, and provide a habitat for countless plants and animals. Yet they are disappearing at an alarming rate due to pollution, climate change, overfishing and over-extraction. People can stop this by improving water quality, identifying sources of pollution and monitoring the health of freshwater ecosystems. Jharkhand can join the Freshwater Challenge to accelerate the restoration of degraded rivers and wetlands by 2030 (Freshwater Challenge, 2023). Invasive species could be removed from degraded freshwater habitats and native vegetation replanted. Cities could champion wastewater innovation that addresses sewage management, stormwater runoff and urban flooding.

Reintroducing Nature to the Urban Space

24.5% of the people of Jharkhand live in cities (Census of India, 2011). By 2050, it is projected that two in three people will live in an urban centre. Cities consume 75 per cent of the planet's resources, produce more than half its global waste and generate at least 60 per cent of greenhouse gas emissions (United Nations Environment Program, n.d). As cities grow, they transform the natural world around them, potentially leading to droughts and land degradation (United Nations Environment Programme, 2024). Urban forests can improve air quality, provide more shade and reduce the need for mechanical cooling. Preserving cities' canals, ponds and other water bodies can alleviate heatwaves and increase biodiversity. Installing more roof and vertical gardens in city buildings can provide habitats for birds, insects, and plants.

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