Agroforestry: A Sustainable Landuse Management for Better Quality of Life and Climate Crisis Solution in Madhya Pradesh

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Abstract:

Agroforestry is an essential instrument for sustainable, long-term agricultural production. Based on the physiographic and climatic conditions, farmers and/or landowners use various woody perennials into their cropping system in addition to the animal unit. The potential of MP's population can be used to promote tree farming as a significant economic activity in order to meet the Sustainable Development Goals. Similarly, the state's sizable cattle population can be effectively managed by implementing various horticultural and silvipastoral techniques. The importance of agroforestry in bridging the growing gap between the production and demand of forest products from territorial forests in India appears to be significant. In both low-income and developed countries, agroforestry presents a special set of possibilities for reducing poverty, stopping land degradation, and delivering ecosystem services. One of the viable options for improving food and nutritional security without creating the environmental risks associated with input-intensive land-use systems is the improvement and exploitation of the numerous fruit trees and medicinal plants. In the current environmental and socioeconomic context, agroforestry may be the most effective management strategy to generate income, limit the deforestation of forests, and serve as an example for sustainable land management in a state with a large number of residents.

Keywords: *Agroforestry, landuse, horticulture, cropping system, sustainable development*

Introduction:

The term "agroforestry" refers to a group of land use systems and practices wherein woody perennials are intentionally combined with crops and animals on the same land management unit, either in a specific combination or in a sequential order. It is the combination of farming and forestry as one land use option rather than handling them as two distinct possibilities. The phrase is new, but

the behaviour is quite old. In addition to providing a fresh approach to land use management, agroforestry is essential in easing human strain on protected forest areas. Agroforestry's introduction and growth may lessen the strain on forested regions while simultaneously raising people's standards of life. It is a more effective way to raise landuse management techniques to the point where they can mitigate climate change and improve the quality of life in adverse locations. India is mostly an agricultural nation with a land area of 32,87,263 km^, of which only 8, 02,088 km² are covered in forests (21.54 %) and tree cover (2.85%). The portion of the total forest cover that is covered by moderately dense forests (3, 08,318 km2) is greater than the areas covered by open forests (3, 01,797 km2) and extremely dense forests (98,158 km2). It is projected that the entire growing stock of India's forests and tree outside of them is 5,822.377 million cubic metres, of which 4,218.380 million are inside forests and 1,603.997 million are outside (ISFR, 2017). Adopting an agroforestry policy is a first for India amongst nations globally i.e., 2014 National Agroforestry Policy.

Study Area:

In the "heart of India," or between 21° 6' and 26° 30' North latitude and 74° 59' to 82° 66' East longitude, is the state of Madhya Pradesh. It belongs to the Indian peninsula structurally. Madhya Pradesh is divided physically into two main areas, the Central Highlands and the Peninsular Plateau Division, based on the geomorphic regions of India identified by P. Chatterjee and displayed in the National Map of India. These departments split apart at the Narmada Son basin. Beyond this basin sits more than half of the state. There are eight divisions within these divisions. It occupies 308,000 km² and is located between 305 and 610 m above mean sea level. In addition to Rajasthan to the northwest, the state borders Uttar Pradesh to the northeast, Chhattisgarh to the southeast, Maharashtra to the south, and Gujarat to the southwest. Bhopal, which is located in the west central region of the state, serves as the capital. The state of Madhya Pradesh has 7.27 crore people living in it, according to the 2011 census. After the states were reorganised, it was established on November 1, 1956. For administrative purposes, the state of Madhya Pradesh is split up into 55 districts. There are 428 Tehsils that are further subdivided into the Districts.

Figure 1. Study Area Map
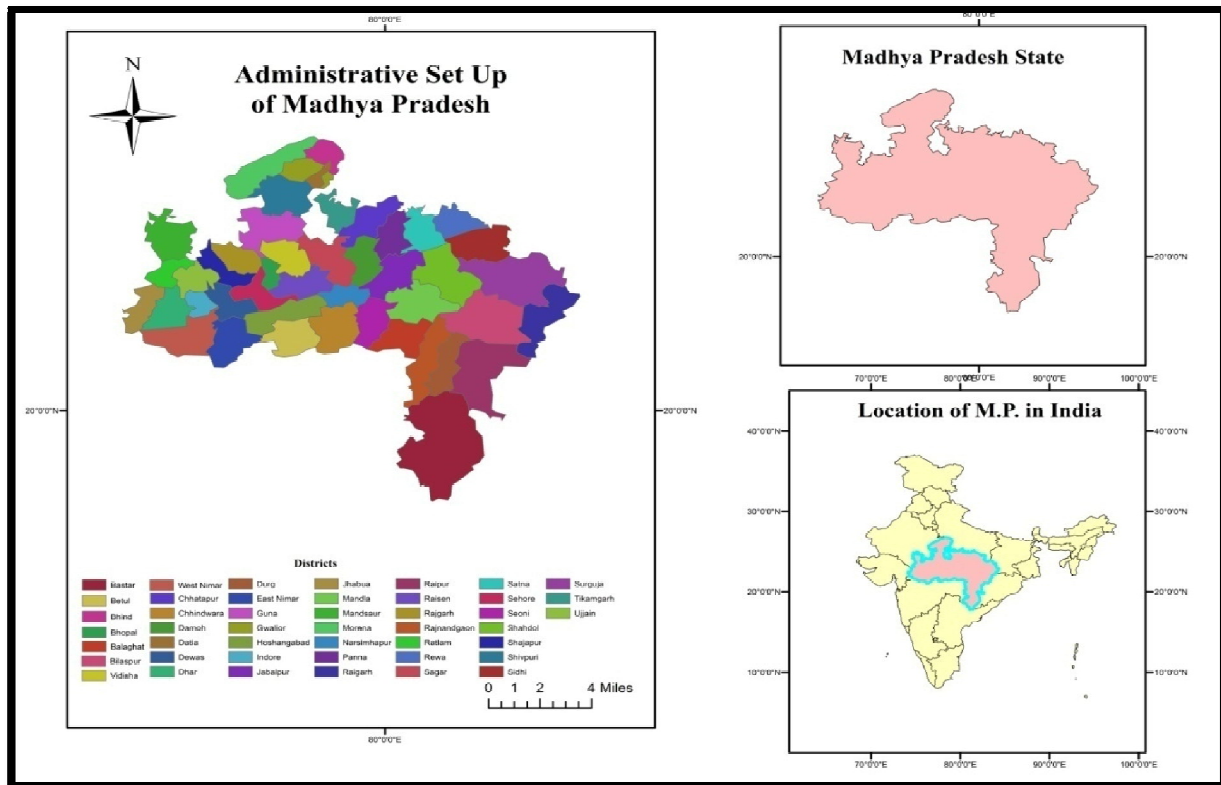
Objectives:

The goal of this research article is to investigate agroforestry as a sustainable land use management strategy to improve living standards and address the climate issue.

Database and Methodology:

The current research investigation was carried out using secondary data sources. The data was acquired from a variety of published research articles, periodicals, and journals, as well as the Green India Mission Perspective Plan (2016–17) to (2020–21), the Census of India, and the Greening and Restoration of Wastelands with Agroforestry Report of Madhya Pradesh 2024. Effective data visualisation was achieved through the use of graphs. The study is based on a geographic database, and the maps were created with ArcGIS version 10.3.

Agroforestry for Better Quality of Life:

In order to meet the demands of an ever-increasing human and animal population, agroforestry systems are essential for increasing land productivity. It offers chances for creating jobs in rural regions and has the ability to be both protective and productive. In agroforestry systems, trees are a significant source of income and help provide food security during lean times. Geographic information about agroforestry in India has been made public by the Indian Space Research Organisation. Approximately 6.18% of India's land is very suitable for agroforestry. One of the best large states for agroforestry turned out to be Madhya Pradesh. Micro-watersheds are to be used as working units for the Green India Mission in Madhya Pradesh. To effectively plan the treatment of these working units, it is critical to understand which areas is forest and which are not. For the

purpose of raising biomass and establishing a carbon sink, Agroforestry and Social Forestry were included in one of the five submissions that Green India Mission considered for the plan's execution, which covers a total of 142835 acres. An area of 59827 hectares has been set aside for the treatment of agroforestry and social forestry on farmer property, including present fallows; 13142 hectares have been set aside for these practices in Shelterbelt plantations, highways, rural roads, canals, and tank bunds. In figure 2, the area suitability index for agroforestry in Madhya Pradesh is shown. The index is divided into 5 classes such as, highly suitable, moderately suitable, others/not applicable, settlement and water body. The area shown with green colour is highly suitable for agroforestry in the state, yellow colour shows moderately suitable land area for agroforestry, red colour depicts settlement area, blue colour is the representation of water body and white colour is not applicable land area. The figure 3, represents the suitable area of extent for greening in Madhya Pradesh. The area highly suitable for greening in the region is 29644 km^2 and 11830.2 km^2 is moderately suitable area.

Figure 2. Area Suitable for Agroforestry in Madhya Pradesh
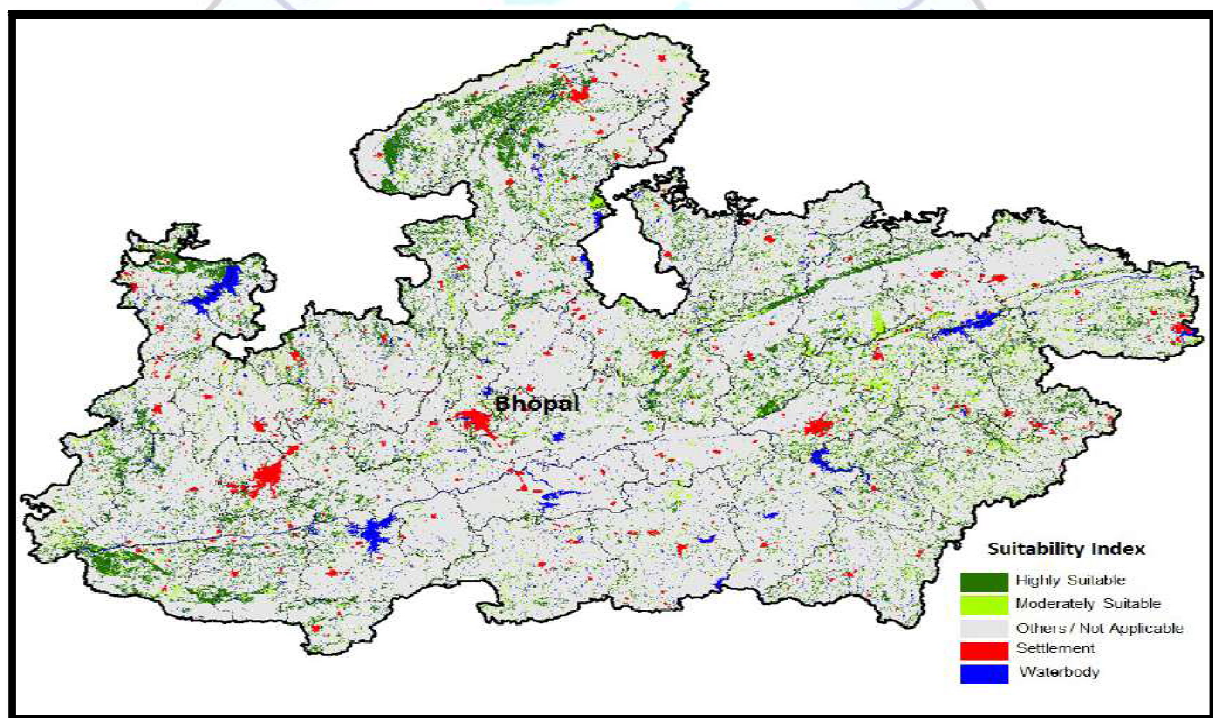
Source: NITI Aayog (2024). Greening and Restoration of Wastelands with Agroforestry Report (G.R.O.W).

Figure 3
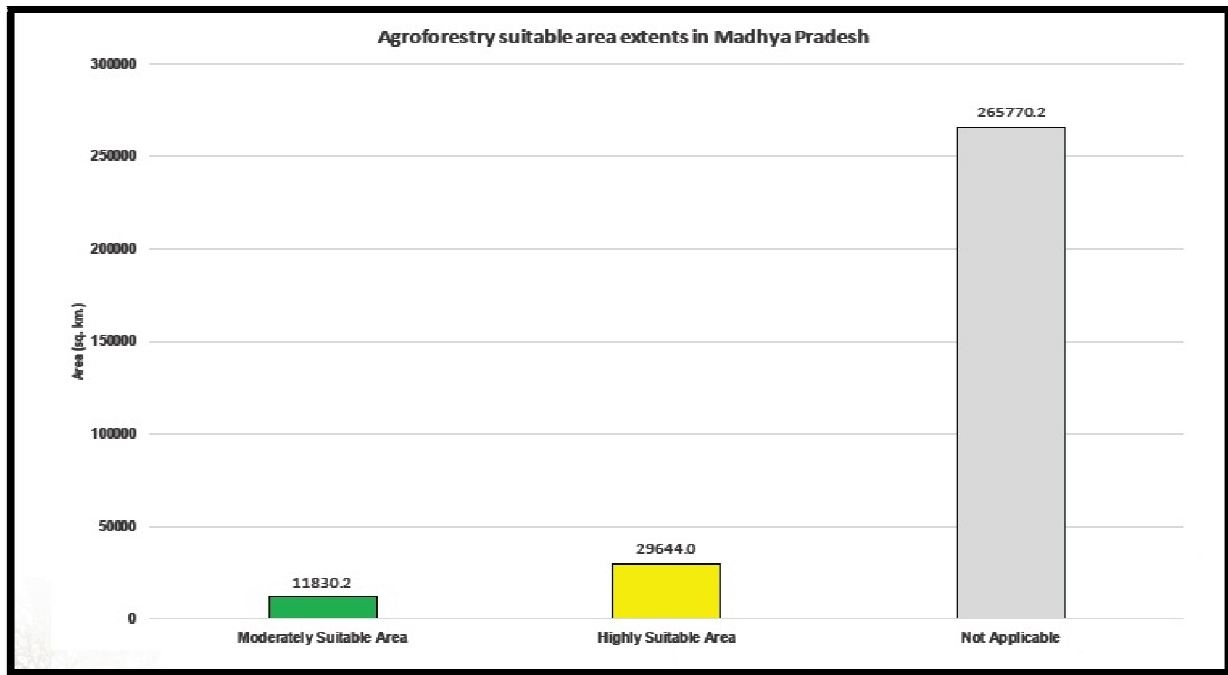
Source: NITI Aayog (2024). Greening and Restoration of Wastelands with Agroforestry Report (G.R.O.W).

Dhyani. et al. (2003, 2005) have emphasised the importance of agroforestry in helping low-income families satisfy their subsistence needs and in giving the community a foundation for a more substantial and long-lasting way of life. The creation of jobs and income are two areas where agroforestry has significantly benefited the economy. Combining food crops—such as fruits, vegetables, legumes, pulses, citrus fruits, and edible medicines—with timber crops and other profitable crops that yield a variety of goods and advantages makes this feasible. Assistance for improving livelihoods through dairy and poultry farming, as well as NTFP-based livelihood activities, would be given on a district-wise basis. There will be a variety of trainings offered, including instruction on how to collect small forest products without causing damage. In agroforestry systems, trees are a significant source of income and help provide food security during hard times. Traditional agroforestry systems' multipurpose trees are crucial for generating money and providing food security in rural areas, as well as, to some extent, maintaining social and cultural stability (Boffa, 1999). The MP government launched the Lok Vaniki programme in April 1999 in an effort to effectively manage state-owned trees. This programme was ultimately passed into law as the "MP Lok Vaniki Adhiniyam 2001." In many districts of Madhya Pradesh, green initiatives such as farm forestry have proven to be successful. They offer high-quality, site-specific pulpwood planting stock that grows quickly, and they help small and marginal farmers by helping them obtain bank loans for plantations. When it comes time for harvest, the paper business buys pulpwood at the market price or a predetermined support price, whichever is higher. It also expedites market linkage with farmers. A variety of agroforestry systems, including boundary plantings (BP), hortisilviculture (HS), silvi-

pasture (SP), agri-silviculture (AS), horti-horticulture (AH), and others are frequently used in MP to meet the multipurpose demands of the local populace. Farmers base their choice of trees on things like household necessities, expanding markets, and financial gains. Farmers in the state conduct traditional agroforestry, but the financial rewards are little for their way of life.

Madhya Pradesh has 72.7 million people living there as of the 2011 census, and the state is expected to have 86.9 million people living there by 2023—6% of all people living in India. Seventy percent of the people in Madhya Pradesh worked in agriculture or related fields. In 2019–20, agriculture's share of the GSDP as a whole was 23.46%. Each farm household's average monthly income is less than the national average for India. The creation of jobs and income are two areas where agroforestry has significantly benefited the economy. Combining food crops, timber crops, and other profitable crops with a range of benefits and goods makes it feasible. In agroforestry systems, trees are a significant source of income and help provide food security during hard times.

In addition to providing raw materials for building, crafting, and manufacturing value-added items, an agroforestry system has the potential to provide a lot of jobs in planting and to boost revenue in Madhya Pradesh's rural areas across all districts. Madhya Pradesh's poor and tribal populations can generate revenue through the production of crops and plants, ensuring food security. It's possible that this activity may meet local demand and help the impoverished and tribal people make more money.

Climate Crisis Solution:

Agroforestry systems have enormous potential to reduce soil erosion, increase agricultural yield, provide economic advantages, and slow down global warming by sequestering carbon. The Indian State of Forest Report 2021 states that this state has 94,689 square kilometres of recorded forest land. Madhya Pradesh is the state with the most forest area, making up 30.71% of the state's total land and 12.4% of the nation's total forest area. In contrast to the 2019 forest report, the state's forest cover is 77,482.49 sq km, or 25.14 percent, of the total land area. Because forests are able to absorb and store CO2, they help to keep the climate stable by storing carbon in biomass from various plant sections. Madhya Pradesh's population is growing, and because of man's insatiable thirst for invention and technology, the amount of carbon in the atmosphere is rising daily. As of the 2011 census, the population was 72,626,809, having been 12,679,214 in 1901. This rapid population growth poses a serious threat to the region's climate. A strategy we can use to limit it is agroforestry. As per the IPCC report from 2000, agroforestry holds significant promise in reducing the build-up of greenhouse gases in the atmosphere. In figure 4, the district wise area suitable for agroforestry in Madhya Pradesh is shown. Out of total 51 districts, Shivpuri has the largest highly suitable area for agroforestry in square kilometres, followed by Sheopur, Sagar, Barwani and Khargone. These districts have more than 1200 km^2 area highly suitable for agroforestry. Districts such as, Bhind,

Harda, Hoshangabad, Datia have less area highly suitable for agroforestry.

Figure 4. District Wise Area Suitable for Agroforestry in Madhya Pradesh
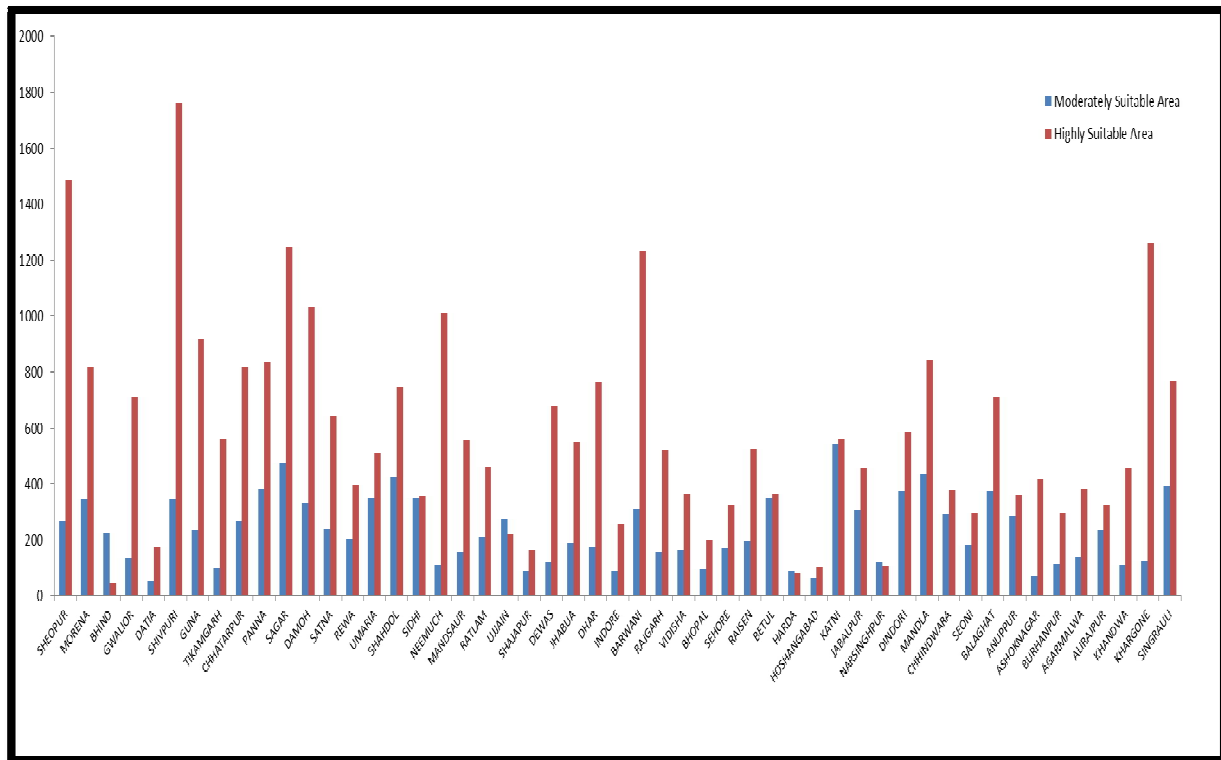
Source: NITI Aayog (2024). Greening and Restoration of Wastelands with Agroforestry Report (G.R.O.W).

Conclusion:

The interplay of trees, crops, and cattle reduces the risk to the environment, aids in establishing a permanent soil cover to prevent erosion, lessens the impact of flooding, improves water storage, and boosts productivity. More benefits per hectare of land are received by farmers through agroforestry, and the rural and urban development strand provides funding for the establishment or upkeep of landuse management. Madhya Pradesh has the large area suitable for agroforestry to avoid climate change and for better livelihood for the people. It is one among the states ranked top large sized state suitable for agroforestry in India. Agroforestry techniques support farmers in maintaining their livelihoods, boost species diversity, and yield financial dividends.

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