कृषि एवं किसान
कल्याण मंत्रालय
MINISTRY OF
AGRICULTURE AND
FARMERS WELFARE

सत्यमेव जयते

भाकृअनुप
ICAR

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CAFRI

Promising Agroforestry Models for Madhya Pradesh

ICAR-Central Agroforestry Research Institute

Jhansi-284003, Uttar Pradesh, India

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Contribution

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Disclaimer

The document has been prepared fully in academic spirit for educational and ready reckoning purposes. The information in the document is based on primary observations and secondary information from published sources. The information provided in this document is to best of our knowledge, accurate although we do not guarantee the information not are we liable for any damages arising from use of information.

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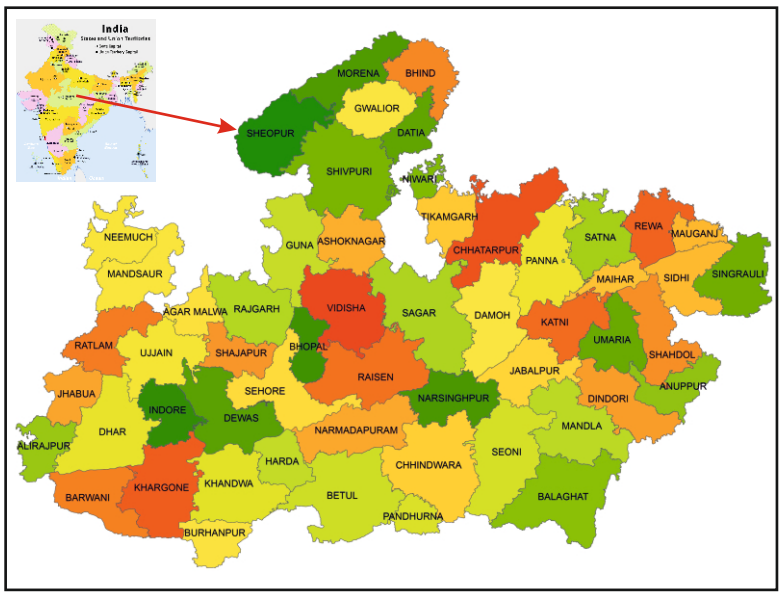
Promising Agroforestry Models for Madhya Pradesh



Madhya Pradesh is cherished as "Heartland of India", with its geographical location at 21.17° N to 26.52 N° latitude and 74.08°E to 82.49°E (ISFR, 2023) . The state was established on 1st November 1956 , and named by Pt. Jawahar Lal Nehru. The city of Bhopal is the capital of the state Madhya Pradesh. The central location hold symbolic significance, yet it's true identity lies in it,s rich culture, diverse landscapes and historical depth. With ancient monuments and vibrant wildlife, it reflects India's essence, where history and modernity harmoniously blend. This state covers an area of 3,08,245 sq.km. (ISFR, 2023), making up 9.38% of India's geographical area, and it is the second largest state in India. It share it's border with o Uttar Pradesh in the north east, Rajasthan in the north west, Gujarat in the west, Chhattisgarh in the south east and Maharashtra in the south. Madhya Pradesh consists of a total of 52 districts , divide into into 10 administrative divisions.

Physiography

Madhya Pradesh is divided into several distinct physiographic regions. These divisions are based on variations in elevation, containing a number of plateaus, hills and valleys.

Malwa Plateau: The Malwa Plateau, situated in the western part of Madhya Pradesh, rises to an average height of 350-450 meters and is composed of Deccan trap rocks. It covers several districts, such as Guna, Rajgarh, Mandsaur, Jhabua, Dhar, Ratlam, Dewas, Ujjain, Sehore, Vidisha, Shajapur, Raisen, and Sagar. The plateau is mainly drained by the Chambal, Mahi, Kshipra, Betwa, and Parvati rivers.

1. **Plateau of Central India**: The plateau covers the lower part of the northern basin of the lower Chambal River. While its highest point reaches 500 meters, the plains to the north and northeast are situated at elevations between 150 and 300 meters. Formed by the Vindhyan rock groups, it is bordered by Deccan trap rocks to the south and Bundelkhand gneiss rocks to the east. The region, with a combination of lowland and upland topography, spans the districts of Morena, Bhind, Gwalior, Shivpuri, Sheopur, Guna, and Mandsaur, and is characterized by deep ravines carved by the Chambal, Kalisindh, and Parvati rivers.
2. **Bundelkhand Plateau:** It is a flat plateau, with gentle slopes, lies to the east of the Central India Plateau and is bounded by the Rewa-Panna Plateau to the northeast. The region's elevation ranges from 150 to 450 meters and includes the districts of Tikamgarh, Chhattarpur, Datia, Gwalior, and Shivpuri. It is primarily composed of granite rocks from the Arabian era.
3. **Rewa and Panna Plateau:** It is also known as Vindhyan Plateau**.** It covers most of the geographical area in the districts of Damoh, Panna, Satna, and Rewa. It is located to the northeast of the Bundelkhand Plateau, it reaches a maximum height of 750 meters and is drained by the Ken, Sonar, Betwa, and Tons rivers.
4. **Narmada-Sone Valley:** It is bordered by the Vindhyan, Bhander and Kymore hills in the north, Satpura and Maikal hills in the south; and the Baghelkhand highlands in the east, the Narmada-

Sone Valley includes districts like Mandla, Jabalpur, Hoshangabad, Raisen, East Nimar, West Nimar, Barwani, Harda, Dhar and Dewas of Madhya Pradesh. Part of Rewa, Shahdol, Umaria and Sidhi districts form the part of Sone valley.

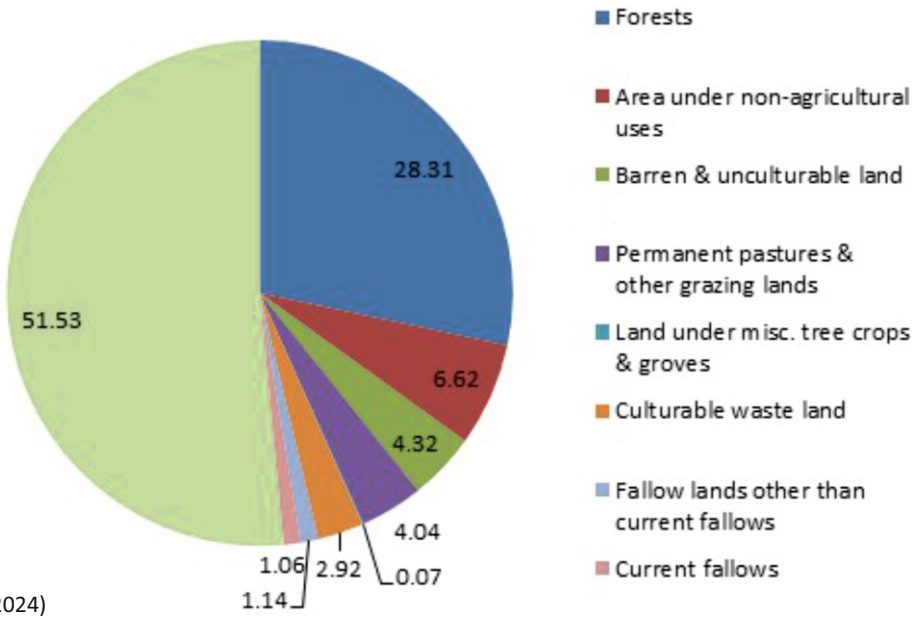
5. **Satpura and Maikal Plateau:** The Satpura and Maikal region includes Chhindwara, Betul, Seoni, Balaghat, Mandla, and parts of Khandwa and Khargone districts. With an average elevation of 300 meters, the Satpura slopes sharply to the south and gently to the north. Dhupgarh, the highest point in the state, is located in this region. The area is drained by the Tawa, Johila, Denwa, Wainganga, and Vardhan rivers.
6. **Eastern Plateau:** It is also referred to as the Baghelkhand Plateau; it stretches across the eastern districts of the state, with elevations ranging from 400 to 1000 meters.

Climate

The state experiences a sub-tropical climate, with hot and dry summers from April to June, followed by monsoon rains from July to September, and cooler, drier winters. The average annual temperature ranges from 22.5°C to 25°C, and the average rainfall varies between 800 mm and 1800 mm. While the western and northwestern districts receive 1000 mm or less of rainfall, the southeastern districts experience the highest rainfall, with some areas receiving up to 2150 mm.

Land use pattern

Land use statistics provide valuable insights into how land is allocated and used for various purposes, including agriculture, forestry, and infrastructure. This data helps in analyzing land use patterns, such as cultivated versus non-cultivated areas, irrigated versus non-irrigated land, and forest or barren land. It plays a key role in studying changes in land use, assessing the impact of development programs, and promoting sustainable resource management.



Source: GOI (2024)

Forests and its resources

Madhya Pradesh records the highest forest cover in India. It covers an area of 3,08,252 km^2 covers 30.72% of geographical area. Forest cover of Maharashtra is 67,770.50 km^2. The state projected maximum decrease in forest and tree cover in the state of Madhya Pradesh (612.41 km^2), the states also projected decrease in the forest cover outside RFA (344.77 km^2). The state has a gives growing stock of 130.46 million m^3. Top five species of the state are *Tectona grandis, Shorea robusta, Diospyros melanoxylon, Lagerstroemia parviflora, Anogeissus latifolia/Terminalia anogeissiana*. Major NTFP's produced by state are *Diospyros melanoxylon, Shorea robusta, Buchanania Lanzan, Aegle marmelos, Madhuca longifolia/M. latifolia/M. indica, Helicteres isora, Tylophora indica/Vincetoxicum indicum, Celastrus paniculatus, Chlorophytum borivilianum, Andrographis paniculata.*

Forest types: According to Champion Seth's classification, forest of Madhya Pradesh can be broadly classified into broad-leaved subtropical hill forest, dry tropical forest, moist tropical forest and thorny tropical forest.

Forest types

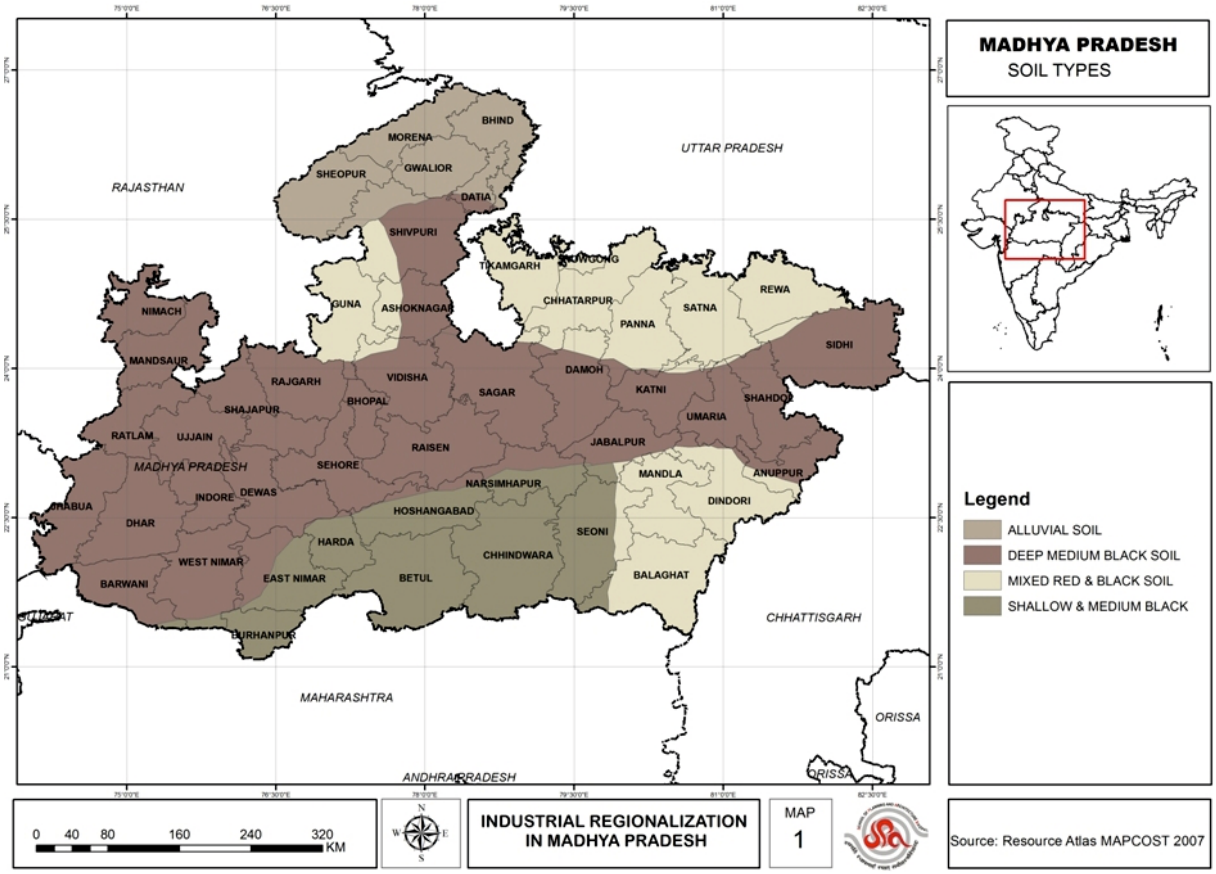
S.No.	Type of Forest	Area (in sq km)	% of the total mapped area
1.	3B/C1c Slightly moist teak forest	1,889.83	2.36
2.	3B/C2 Southern moist mixed deciduous forest	1,933.43	2.41
3.	3C/C2e (i) Moist peninsular high level sal	2,747.26	3.42
4.	4E/RS1 Riparian fringing forest	15.07	0.02
5.	5A/C1a Very dry teak forest	678.30	0.85
6.	5A/C1b Dry teak forest	21,715.29	27.06
7.	5A/C3 Southern dry mixed deciduous forest	19,580.68	24.40
8.	5B/C1c Dry peninsular sal forest	4,205.91	5.24
9.	5B/C2 Northern dry mixed deciduous forest	15,094.58	18.81
10.	5/DS1 Dry deciduous scrub	4,474.46	5.58
11.	5/DS2 Dry savannah forest	1.19	0.00
12.	5/E1 Anogeissus pendula forest	2,708.81	3.38
13.	5/E1/DS1 Anogeissus pendula scrub	348.66	0.43
14.	5/E2 Boswellia forest	387.23	0.48
15.	5/E5 Butea forest	188.23	0.23
16.	5/E9 Dry bamboo brakes	745.10	0.93
17.	5/1S2 Khair-sissu forest	1,315.30	1.64
18.	6B/C2 Ravine thorn forest	740.69	0.92
19.	8A/C3 Central Indian subtropical hill forest	1.37	0.00
20.	TOF/Plantation	1,426.25	1.78
21.	3C/C2/ DS1 Moist sal savannah	40.72	0.05
22.	5/DS4 Dry grassland	6.98	0.01

***Source*:** ISFR (2023)

Soil

The following types of soils are reported in the state

Soil Group	District covered
Alluvial soil	Morena, Bhind, Gwalior, Shivpuri, Guna Sheopur, Ashoknagar
Deep medium black soil	Sagar, Damoh, Bhopal, Sehore, Raisen, Vidisha, Narsinghpur, Narmadapuram, Khargone, Khandwa, Barwani, Burhanpur, Harda, Betul, Pandhurna, Chhindwara
Mixed red and black soil	Jabalpur, Satna, Mauganj, Maihar, Panna, Seoni, Rewa, Sidhi, Katni, Anuppur, Singrauli, Balaghat, Umaria, Mandla, Dindori, Shahdol, Datia, Niwari, Tikamgarh, Chhatarpur
Shallow and medium black soil	Ujjain, Indore, Mandsaur, Ratlam, Shajapur, Rajgarh, Dewas, Neemuch, Agar Malwa, Betul, Jhabua, Alirajpur, Dhar



***Source*:** Kumari etal (2019)

Water Resources of Madhya Pradesh

Madhya Pradesh state is rich in water resources. Rivers are major source of surface water in the state. Rivers of this state constitute part of the Ganga, Narmada, Tapi, Mahi and Godavari basins. The Ganga basin, comprising the sub-basins of Chambal and its tributaries, Betwa, Ken (all part of Yamuna basin), Tons and Son, drains the largest area of the state. The northern part of the state is drained by the rivers Chambal, Betwa, Ken and their tributaries, which flow northerly through Bundelkhand region and ultimately join River Yamuna. The Son River flows east–northeast and joins Ganga near Patna. The Narmada, flowing in a westerly direction, is a major river between Satpura and Vindhayan ranges draining to Arabian Sea. Tapi is also westerly flowing river debouching its water in Arabian Sea. Wainganga and Pench are tributaries of Godavari River draining in southeastern part of the state. Mahi covers small area of Dhar and Jhabua districts in the west. The water resource department of the state has estimated the annual flow of rivers of the state at 81.7 billion cubic meters at 75% reliability. Out of this, 57.1 billion cubic meters can be utilized in this state and rest 24.6 billion cubic meters are allocated to the bordering states. Basin-wise distribution of this potential is very uneven. Largest availability, more than two fifths (41.4%) of the state is in the Yamuna sub-basin followed by the Narmada basin (39.5%). Godavari basin is at third place (36.4%). Remaining Ganga basin possesses only 15.3% of potential surface water of the state. The combined potential of the Ganga-Yamuna basin (57.6%) is largest in the state.

Madhya Pradesh: basin- wise availability of surface water (Crore cubic meters)

Basin/ Sub-basin	Catchment area in MP (km^2)	Av. Flow at 75% dependability	Allocated to other states	Share of M.P.
Ganga Basin				
a. Tons/Tamsa	11,974	224.4	-	224.4
b. Son	28,880	787	-	397
c. Yamuna Basin	142,250	2762.7	-	2364.2
Ken	24,785	570.3	104.8	465.5
Kuwari Sindh	26,999	507.9	-	507.9
Chambal	59,940	1059.2	197.9	861.3
Jamani	1235	22	(-) 1.3	23.3
Paisuni-Badhain	1920	8.9	4.8	4.1
Dhasan	8291	172.3	-	172.3
Betwa	19,365	385.7	92.3	293.4
Bagain	1500	36.4	-	36.4
Godavari	23,388	7630	ND	ND
Narmada Basin	85,149	3454.2	1203.1	2251.1
Tapti Basin	9800	240.1	75.5	164.6
Mahanadi Basin	154	ND	ND	ND
Mahi Basin	6700	195.2	161.4	33.8
Total	308,245	8171.9	-	5705.1

Source: Water Resources Department, M.P. and updated using WRIS river wise data

Agriculture

Madhya Pradesh has remarkable agricultural diversity due to its wide range of climate and soil types, with each of its 9 agro-climatic zones having unique cropping patterns and inherent challenges. The rice-wheat cropping system is followed in Kymore Plateau & Satpura Hills zone. The Central Narmada Valley & Vindhya Plateau mainly grow wheat, while the Gird Region, Bundelkhand and Satpura Plateau zones follow a wheat-jowar cropping pattern. However, Malwa Plateau, Nimar Plains and Jhabua Hills follows a cotton-jowar cropping pattern. The crop area has increased by 5.46 percent in the year 2022-23. When compared to 2021–2022, the area under cereals increased by 1.11 percent in the year 2022-23. Production of cereals and oilseeds rose by 2.58 percent and 16.38 percent, respectively while production of pulse increased by 17.04 percent, respectively. Comparing 2022–2023 to the previous year, the production of total crops increased by 4.16 percent. Area covered by paddy in the year 2021-22 increased by 12.00 percent when compared to year 2020-21. Paddy production rose from 12502 thousand metric tons in 45 the year 2020–2021 to 13193 thousand metric tons in the year 2021–2022 which shows an increase of 5.53 percent. The average production of paddy in the last ten years is 80.87 lakh metric tons. Madhya Pradesh produced an average of 36.93 lakh metric tons of maize and 245.89 crore metric tons of wheat over the previous ten years. The production of maize increased from 4430.00 thousand metric tons in the year 2020–21 to 4607 thousand metric tons in the following year, showing a 4.0 percent rise.

Production of major crops/fruits/spices in Madhya Pradesh (lakh metric tonnes) in 2022-23

Crops	Production
Maize	47.86
Paddy	131.87
Wheat	352.73
Lentil	7.74
Urd	8.67
Gram	35.69
Cotton	8.48
Mustard seeds	19.36
Soyabean	64.01
Tomato	31.65
Potato	39.25
Onion	51.61
Mango	8.42
Banana	22.19
Orange	22.29
Chilly dry red	2.93
Coriander seeds	3.99
Garlic	20.16

Source: Agriculture and Rural Development, SLBC, MP, 2022

Schemes of Madhya Pradesh

Madhya Pradesh launched several initiatives on its own, also in collaboration with the Government of India aimed at improving livelihood, agriculture productivity and sustainability. Key initiatives include National Mission on Agriculture Extension and Technology, Weather-based Crop Insurance Scheme and Social security in Tendu patta. The livestock population of the state is 50.6 million, making it third largest state in India in terms of Livestock after Rajasthan and West Bengal.

S.No.	Scheme	Objective
1.	MGNREGA	The scheme aims to support water conservation, drought proofing, irrigation, land development, flood control, rural connectivity, and other government-notified works. It also promotes horticulture, inland fisheries, and pond development on both private and public land.
2.	MP State Bamboo Mission (MPSBM)	It aims to promote bamboo cultivation, enhance farmers' income, support bamboo-based industries, and ensure sustainable resource management. It also encourages agroforestry, provides subsidies, and strengthens the bamboo value chain for economic and ecological benefits.
3.	National Mission on Agricultural Extension and Technology	The scheme aims to enhance agricultural extension by delivering modern technology and improved practices to farmers. It focuses on outreach, ICT-based information sharing, capacity building, mechanization, quality seeds, and plant protection. It also supports forming FIGs and FPOs. The mission (NMAET) includes four sub-missions:

		Sub-Mission on Agricultural Extension (SMAE) Sub-Mission on Seed and Planting Material (SMSP) Sub-Mission on Agricultural Mechanisation (SMAM) Sub-Mission on Plant Protection and Plant Quarantine (SMPP).
4.	Weather-based Crop Insurance Scheme	The scheme supports weather-based crop insurance while promoting diversified agricultural and allied livelihoods, including livestock and horticulture, to enhance farmers' resilience and income.
5.	*Pradhan Mantri Krishi Sinchai Yojana* (PMKSY)	The scheme provides end-to-end irrigation solutions, covering water sources, distribution, and farm-level application. It includes three components: PMKSY (Per Drop More Crop), watershed management, and AIBFMP under the Ministry of Water Resources.
6.	Integrated Scheme on Agricultural Marketing	Provides assistance towards marketing of various agricultural products.
7.	*Rashtriya Krishi Vikas Yojana*	The scheme ensures comprehensive irrigation solutions, from water sources to farm-level application. It comprises three components: Per Drop More Crop (PMKSY), watershed management, and AIBFMP under the Ministry of Water Resources.
8.	Mission for Integrated Development of Horticulture	The scheme integrates various horticulture programs, including NHM, HMNEH, NBM, National Horticulture Board, Coconut Development Board, and the Central Institute for Horticulture, Nagaland, under the National Mission on Horticulture (MIDH). NHM and HMNEH are implemented through State Horticulture Missions, while NBM is managed by State Bamboo Development Agencies and Forest Development Agencies. Farmers can contact district officers for benefits and assistance.
9.	National Mission on Sustainable Agriculture	*Paramparagat Krishi Vikas Yojana* promotes organic farming to improve soil health and reduce reliance on fertilizers and chemicals. It encourages eco-friendly cultivation using natural inputs like farm manure, compost, and biogas slurry.
10.	*Paramparagat Krishi Vikas Yojana*	The scheme addresses climate change, water conservation, management, efficiency, soil fertility, and sustainable resource use, including rainfed agriculture, through initiatives like drip and sprinkler irrigation under the Micro Irrigation Scheme.
11.	Organic Farming in North East Region	Supports Organic Farming in NE States.
12.	*CM Kisaan Videsh Adhyayaan*	The scheme provides financial support for progressive farmers under 65 to visit international agricultural institutes and learn advanced farming techniques. The team includes SC/ST farmers, women farmers, and other progressive farmers.

13.	National Mission on Agriculture Extension and Technology	The program strengthens local democracy by empowering accountable Gram Panchayats and active Gram Sabhas while supporting ATMA Governing Boards, Management Committees, and Farmer Advisory Committees.
14.	Social Security for Tendu-Patta Collector	The scheme provides financial support to individuals in case of accidents occurring while collecting Tendu leaves.
15.	Eklavya Education Development Schemes	Children of Tendu Patta collectors and committee members are eligible for financial support for education, including fees, books, transportation, and hostel expenses.

***Source*:** NIRDPR, (2014)

NIRDPR (National Institute of Rural Development and Panchayati Raj), (2014). Department of Rural Development Ministry of Rural Development Government of India. https://nirdpr.org.in/nird_docs/sagy/MadhyaPradesh.pdf. Accessed on 26 March 2025.

Biodiversity

Madhya Pradesh is a genetic highway connecting the two hot spots Western Ghats and North East. It hosts a diversity of ecosystem including plateau, ravines, ridges, valleys, riparian area and flat plains. It is one of the richest repositories of biological diversity with four major types of forest, 12 National Parks, 22 wildlife Sanctuaries. The state is a habitat to about 500 plant species, 500 birds species and 180 fish species. The state nurtures indigenous health systems, harbouring over 1000 medicinal contributing significantly to health security in rural areas.

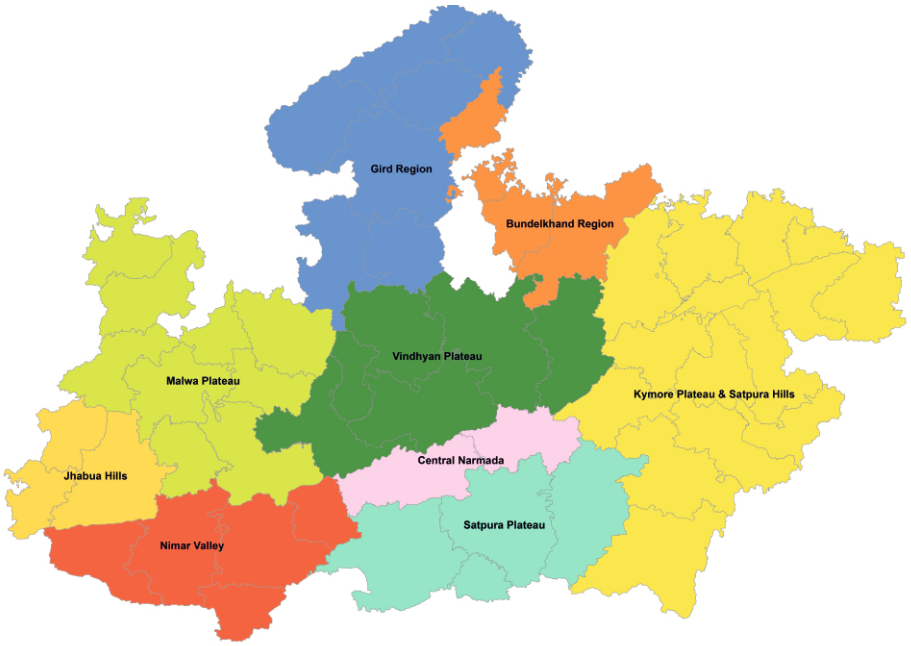
Groups	Number of species in Madhya Pradesh
Butterflies	250
Fish	216
Amphibian	31
Moth	313
Snake	23
Plant	500
Bird	500
Grass	150
Bamboo	12

***Source*:** MPSSB Reports

Agro-climatic Zones

The state is bestowed with nine agro-climatic zones. Rice, wheat-rice, wheat, wheat-jowar and cotton- jowar are the five crop- zones in Madhya Pradesh. The State has a sub-tropical climate. It has a hot dry summer from April to June, which is followed by monsoon rains from July to September and a cooler and drier winter. The annual average temperature ranges from 22.50 C to 250 C. The average rainfall varies from 800-1800 mm. While the western and north western districts receive 1000mm or less rainfall, the south eastern districts have the highest rainfall some of them receiving as much as 2150mm.

S.No.	Agro-Climatic Zones	Districts	Mean annual rainfall (mm)	Crop zones	Soil types Mixed red
1	Kymore plateau & Satpura Hills	Jabalpur, Satna, Mauganj, Maihar, Panna, Seoni, Rewa, Sidhi, Katni, Anuppur, Singrauli, Balaghat, Umaria, Mandla, Dindori, Shahdol	1000 to 1400	Wheat Rice Zone	and black soils (Medium)
2	Vindhyan Plateau	Sagar, Damoh, Bhopal, Sehore, Raisen, Vidisha	1200 to 1400	Wheat Zone	Medium black & deep black (Medium/ Heavy)
3	Central Narmada	Narsinghpur, Narmadapuram	1200 to 1600	Wheat Zone	Deep black (Deep)
4	Gird Region	Morena, Bhind, Gwalior, Shivpuri, Guna, Sheopur, Ashoknagar	800 to 1000	Wheat-Jowar	Alluvial (Light)
5	Jhabua Hills	Jhabua, Alirajpur, Dhar	800 to 1000	Cotton-Jowar	Medium black skeletal (Light/ Medium)
6	Bundelkhand	Datia, Niwari, Tikamgarh, Chhatarpur	800 to 1400	Wheat-Jowar	Mixed red and black (Medium)
7	Satpura Plateau	Betul, Pandhurna, Chhindwara	1000 to 1200	Wheat-Jowar	Shallow black (Medium)
8	Malwa Plateau	Ujjain, Indore, Mandsaur, Ratlam, Shajapur, Rajgarh, Dewas, Neemuch, Agar Malwa	800 to 1000	Cotton-Jowar	Medium black (Medium)
9	Nimar Valley	Khargone, Khandwa, Barwani, Burhanpur, Harda	800 to 1000	Cotton Jowar	Medium black (Medium)



Agro-climatic Zones of Madhya Pradesh

(***Source:*** *ICAR-CAFRI*)

Demography

Total population of Madhya Pradesh as per 2011 census is 7.27 crore, of which male and female are 3.76 crore and 3.51 crore respectively, resulting in a sex ratio of 931 females per 1,000 males. The scheduled castes and the scheduled tribes constitute a significant portion of the population of the State and constituting 15.54% (1.13 crore) and 21.04% (1.53 crore) of the total population respectively. According to the census of 2011, 90.9% of the state residents followed Hinduism, while others are Muslim (6.6%), Jain (0.8%), Buddhists (0.3%), Christians (0.3%), and Sikhs (0.2%). The population density is 236 individuals per square kilometer, covering a total geographical area of 3,08,245 km². The overall literacy rate is recorded at 69.30% (Madhya Pradesh at a glance, 2025).

Administrative profile

Madhya Pradesh, the second-largest state in India by area, is administratively structured into 55 districts spread across 10 divisions—Bhopal, Indore, Gwalior, Chambal, Jabalpur, Rewa, Sagar, Shahdol, Narmadapuram, and Ujjain. The state has a vast rural expanse with 54,903 villages, which are governed by 23,043 Gram Panchayats, playing a crucial role in local self-governance. For decentralized administration and development, the state is further divided into 313 Block/Janpad Panchayats and 369 Tehsils, ensuring effective implementation of government schemes and policies at the grassroots level. (Madhya Pradesh at a glance, 2025).

State symbols

Madhya Pradesh's state insignia features a circular seal depicting the Lion Capital of Ashoka, with a Banyan tree in the background. Surrounding this emblem is a circle of rice and wheat stalks, and the entire logo is encircled by 24 stupas arranged in a circular pattern. The Asian Paradise Flycatcher (*Terpsiphone paradise*), known as "Dudhraj," is the state bird of Madhya Pradesh. This elegant bird measures between 18 to 22 cm in length. The state animal is the Barasingha (Swamp Deer), while the Madonna Lily (*Lilium candidum*), with its white petals tinged with yellow at the base and a strong fragrance, is the state flower. The Banyan tree serves as the official state tree, and the Mahseer is recognized as the state fish. Hindi is the official language of Madhya Pradesh. In addition to Hindi, the state is home to a rich linguistic diversity, with languages such as Bundeli, Bagheli, Nimari, Marathi, Sindhi, Urdu, and Malwi being widely spoken. Various tribal dialects, including Gondi and Bhili, also contribute to the region's cultural and linguistic heritage.

Agroforestry in Madhya Pradesh

In Madhya Pradesh, India, agroforestry is being practised in nearly every region of the state in the form of traditional agroforestry since time-immemorial. However, the extension of agroforestry practices is slow in most of the regions. Traditionally, trees like babul, neem, shisham, teak, bamboo, palash, mahuwa, jamun, aonla, mango, guava, etc. are deliberately retained by farmers on their farm; however, some new entrants such as subabool (*Leucaena leucocephala*), Eucalyptus and khamair (*Gmelina arborea*) have also been adopted under agroforestry.

Agro-climatic zones	Major forest tree in agroforestry	Major Fruit tree in agroforestry	Major agricultural crops in agroforestry	Common agroforestry combinations
Kymore Plateau and Satpura Hills	Babul, Khamer Karanj, Teak, Arjun, Mahua, Palash, Shisham, Sirish, Subabul, Eucalyptus, Bamboo	Mango, Jamun, Aonla, Guava, Jackfruit, Lemon, Ber	Wheat, paddy, gram, maize, arhar, moong, urad, masoor	Paddy/wheat + babul, teak + wheat/paddy, wheat + guava, wheat + khamer, wheat + mango, gram/wheat + custard apple, paddy + shisham, eucalyptus + wheat, subabul + wheat

Central Narmada Valley	Shisham, Khamer, Palash, Bamboo, Mahua, Babul, Subabul, Bamboo	Mango, Jamun, Ber, Guava, Pomegranate, Aonla, Ber, Lemon, Mandarin, Papaya	Wheat, paddy, gram, soybean, sugarcane, pea, moong, urad, arha	Subabul + wheat, sugarcane + Babul, wheat + Khamer, Soybean + bamboo
Vindhya Plateau	Babul, Shisham, Neem, Khamer, Mahua, Siris, Subabul, Bamboo	Guava, Ber, Lemon, Aonla, Mosambi, Mango, Chiku, Papaya	Paddy, wheat, sugarcane, maize, arhar, gram, jowar	Paddy + babul, Shisham + maize, Guava + wheat, Guava + paddy, Babul + soybean
Gird Region	Babul, Siris, Shisham, Paalas, Neem, Khejri, Anjan, Tendu	Ber, Karonda, Custard Apple, Pomegranate, Bael, Aonla, Guava	Jwar, bajra, mung, urad, sessome, sarson, arhar, cotton	Babul + jwar, Mango + sarson, Shisham + gram
Bundelkhand Region	Neem, Palash, Shisham, Khair, Karanj, Mahua, Subabu	Pomegranate, Custard apple, Aonla, Ber, Guava, Orange, Chiku, Mango, Mosambi, Lime, Kraounda	Jwar, maize, mung, gram, til, sarson, wheat, arhar, masoor	Neem + wheat, Shisam + wheat, Palash + sarson, Custard apple + wheat
Satpura Plateau	Teak, Shisham, Sal, Neem, Mahua, Babul	Pomegranate, Orange, Papaya, Mosambi, Guava, Ber, Jamun, Custard Apple, Lemon, Mango, Karonda	Wheat, paddy, jowar, bajara, potato, urad, gram, aarhar, moong, soyabean	Teak + wheat, Shisham + wheat, Orange + agriculture crops
Malwa Plateau	Suababul, Babul, Neem, Khamer, Shisham, Siris	Lemon, Orange, Aonla, Papaya, Pomegranate, Guava, Banana, Mosambi, Chiku, Grape, Ber	Wheat, cotton, arhar, moong, urad, jwar, bajra	Wheat + khamer, Wheat + babul, Neem + Cotton
Nimar Plains	Shisham, Siris, Babul, Subabul, Mahua, Palash, Khamer	Guava, Aonla, Lime, Banana, Papaya, Pomegranate, Mango, Grape, Chiku	Wheat, arhar, gram, cotton, soybean, moong, urad	Wheat + mahua, Shisham + wheat
Jhabua Hills	Mahua, Tadi, Palash, Siris, Babul, Subabul, Neem, Khejri, Shisham	Aonla, Guava, Ber, Pomegranate, Mango, Karaunda	Wheat, maize, urad, gram, sarson, ground-nut, moong, Mustard	Wheat + babul, Wheat + tadi, Neem + wheat

Source: Bijalwan *et al.* (2019)

The agroforestry models developed by ICAR-CAFRI and its AICRP on Agroforestry Centre for Madhya Pradesh

S. No.	Agroforestry models	Tree component	Crop component	Economic returns/Benefits Cost Ratio (BCR)
1.	Agrihorticulture system	Guava	Mustard varieties viz. Pusa Tarak, Pusa Agati, Jaikishan and Menthol	The highest yield of guava of 361.56 kg ha^{-1} was obtained with 1.0m pruning, followed by 1.5m and 2.0m pruning. The Pusa Tarak wheat variety achieved the highest yield of 393.22 kg ha^{-1}, followed by Pusa Agati and Jaikishan.
2.	Agrisilviculture system	*Dalbergia sisso*	Paddy varieties of IR 36, MR 219, WGL 32100	Paddy varieties of IR 36, MR 219, WGL 32100 The highest yield of 32.5 q ha^{-1} was obtained with 75% pruning of Dalbergia sissoo, followed by 50% pruning and then 25% pruning. The highest yield of 29.37 q ha^{-1} was obtained from the MR 219 variety of paddy, followed by IR 36 and WGL32100.
3.	Agrisilviculture system	*Dalbergia sisso*	Wheat varieties of MP-3020, GW-273, GW-266	Highest yield of 1700 kg ha^{-1} obtained from 75%, followed by 50% pruning, followed by 25% pruning. Highest yield of 1778 kg ha^{-1} from GW-273 followed by MP-3020 followed by GW-266.
4.	Agrisilviculture system	*Dalbergia sisso*	Wheat varieties of MP-3173, MP-3288, Sujata	The highest yield of 1751 kg ha^{-1} was achieved with 75% pruning of Dalbergia sissoo, followed by 50% pruning and then 25% pruning. The highest crop yield of 1720 kg ha^{-1} was obtained from the MP-3173 wheat variety, followed by MP-3288 and Sujata.
5.	Agrihorticulture system	Aonla, Bael	Turmeric	The highest monetary return of Rs. 95,250 ha^{-1} was recorded for bael and turmeric system, followed by aonla and turmeric system.
6.	Hortipastoral system	Guava	Oat varieties viz.JO-2, JO-9, JO-93	The highest net profit of Rs. 43,161 was recorded with pruning at 1.5m of guava, followed by pruning at 2.0m and then 1.0m. The highest monetary value of Rs. 42,889 ha^{-1} was recorded for the JO-93 oat variety, followed by JO-93 and JO-2.
7.	Agrisilviculture System	*Dalbergia sissoo*	Turmeric	Highest B:C ratio of 1.93 recorded at 25% pruning of *Dalbergia sissoo* and superior to all pruning treatments.
8.	Agrisilviculture System	*Madhuca longifolia*	Wheat	Agroforestry system not profitable during 1st year compared to arable cropping

9.	Agroforestry system	*Dalbergia sisso*	Paddy, wheat	The highest monetary return of Rs. 85,312/ha was recorded with *Dalbergia sissoo* pruning in a wheat and paddy model, compared to the crop-alone system. This was followed by the paddy-wheat system and then the unmanaged agroforestry system.
10.	Agrihorticulture system	Mango	Mustard varieties Arpan, JM-3	Arpan variety recorded higher grain yield (888 kg ha^{-1}), followed by variety JM-3 mustard
11.	Agrisilviculture System	*Dalbergia sisoo*	Mustard	25% Pruning recorded higher monetary return (Rs. 80225 ha^{-1}), followed by no pruning and 50% pruning.
12.	Agrihorticultural system	Mango+ minor millets	Oilseed crops	Mango + Mustard variety Urvashi recorded higher monetary return (Rs. 16320 ha^{-1}), followed by mango+ mustard variety NRCDR-2 and mango + linseed variety JLS-27
13.	Agrisilviculture System	*Gmelina arborea*	Greengram-toria	Recorded the net return (Rs. 38465 ha^{-1}) and B:C ratio (2.26) as compared to sole arhar yield of 772.2 kg ha^{-1}
14.	Agrisilvipastoral system	*Dalbergia sisoo*	Fodder crops-maize, jowar Mustard varieties	Higher green fodder yield in fodder maize (289.6 q ha^{-1}) with fodder jowar (261.4 q ha^{-1}). Maximum grain yield of of mustard was recorded in 75% pruning (498 kg ha^{-1}), followed by 50% and 25%.
15.	Agrisilviculture System	*Dalbergia sisoo*	Paddy	Highest yield of paddy 1674 kg ha^{-1} obtained from 75%, followed by 50% pruning, followed by 25% pruning.

Bamboo species of Madhya Pradesh

Madhya Pradesh has maximum bamboo bearing area of 20,421 km^2 , followed by Arunachal Pradesh (18,424 km^2), Maharashtra (13,572 km^2), and Odisha (12,328 km^2).

S.No.	Species Name	Common Name	Forest divisions
1.	*Dendrocalamus strictus*	Desi bans	North Balaghat, South Balaghat, North Betul, South Betul, West Betul, Bhopal, Raisin, Obedullahganj, Sehore, Vidisha, Rajghar, Chhatarpur, Tikamgarh, North Panna, South Panna, East Chhindwara, West Chhindwara, South Chhindwara, Gwalior, Morena, Datia, Sheopur, Bhind, Hoshangabad, Harda, Indore, Dhar, Jhabua, Alirajpur, Jabalpur, Katni, West Mandla, Dindori, Khandwa, Burhanpur, Khargon, Barwaha, Sendhwa, Barwani, Rewa, Satna, Sidhi, Singrauli, North Sagar, South Sagar, Damoh, North Seoni, South Seoni, Narsinghpur, Umaria, Anuppur, North Shahdol, South Shahdol, Shivpuri, Guna, Ashoknagar, Ujjain, Shajapur, Mandsaur, Neemuch, Dewas, Ratlam
2.	*Bambusa bambos*	Katang bans	North Balaghat, South Balaghat, Bhopal, Obedullahganj, Sehore, East Chhindwara, West Chhindwara, South Chhindwara, Jhabua, Jabalpur, Katni, East Mandla, West Mandla, Dindori, North Seoni, South Seoni, Narsinghpur
3.	*Bambusa vulgaris* var. *striata*	-	Jabalpur, Katni
4.	*Cephalostachyum pergracile*	-	South Balaghat
5.	*Bambusa tulda*	-	Rewa, Sagar
6.	*Bambusa polymorpha*	Narangi bans	Hoshangabad (Bori Sanctuary)
7.	*Bambusa nutans*	Mala bans	Private plantation (Ranga), Jabalpur
8.	*Dendrocalamus asper*	-	Private plantation, Jabalpur
9.	*Bambusa balcooa*	Bema bans	Hoshangabad

Source: Madhya Pradesh State Bamboo Mission

Agroforestry Systems for Madhya Pradesh

Bamboo-*based* Agroforestry Model

Scientific Name: *Bambusa balcoa, B. bambos, B.tulda, B.nutans*

Suitable spacing: 10mX8m or 12mX10m in agroforestry and 3-4m between clumps on boundary.

Rotation: Yield starts after 4th year upto 30-35 years.

Suitable intercrops: Wheat, soybean, mustard, pulses etc. during establishment phase with normal yields and shade-loving crops *i.e.* ginger and turmeric.

Tree Productivity: 500-750 culms ha^{-1}yr^{-1}

Economic Returns: Net income of Rs. 95,000 to 2,00,000 ha^{-1}yr^{-1} after 4 years under irrigated conditions.

Shisham-*based* Agroforestry Model

Scientific name: *Dalbergia sissoo*

Suitable spacing: 6mX4m, 8mX4m for agroforestry and 4-5m between trees for boundary

Rotation: 20-25 years

Suitable intercrops

***Kharif*-**Paddy, soybean and pulses

***Rabi*-**Wheat, mustard and barley

Perennial-Napier hybrid grass

Tree productivity: Timber yield of 100$m^3 ha^{-1}$ and biomass of 210 t ha^{-1}

Economic returns: Net income of paddy-wheat & napier hybrid under Shisham increases from Rs. 7500 to Rs. 11,000 yr^{-1} and Rs. 35,000 to Rs. 50,000 yr^{-1} after 11 years under irrigated conditions.

Gamhar-*based* Agroforestry Model

Scientific Name: *Gmelina arborea*

Suitable spacing: 8mX2.5m, 6mX3m, 4mX3m for timber; 1.2mX1.2m, 1.8mX1.8m for pulp and small poles.

Rotation: 4-5 years for small size timber and 12-15 years for sawn timber.

Suitable intercrop: Legumes, maize, rice, vegetable crops and mustard

Tree Productivity: 20-22$m^3 ha^{-1}$ of timber and 200 t ha^{-1} of total biomass after 12-15 years

Economic Returns: Net income of Rs. 30,000 to 50,000 $ha^{-1}yr^{-1}$ with crops after 12-15 years of rotation

Teak-*based* Agroforestry Model

Scientific Name: *Tectona grandis*

Spacing: 8mX2m, 12mX2m for agroforestry, 2mX2m for block and 2-5m for boundary plantation

Rotation: 20-25 years; intermediate yield from thinning at 7^{th} and 12^{th} year

Suitable Intercrops:

***Kharif*:** Black gram, soybean, cotton, red gram and sesame

***Rabi*:** Sorghum, cowpea and linseed

Tree Productivity: First thinning (50%) at 7^{th} year (300 poles ha^{-1}), second thinning (25%) at 12^{th} year (small timber 7.65 m^3 ha^{-1}) and final harvesting (timber 77$m^3$$ha^{-1}$) at 20-25 years

Economic Returns: Rs. 60,000 ha^{-1} at first thinning upto 7 years; Rs. 2.28.900 ha^{-1}at second (25%) thinning upon 12 years and Rs. 19,44,000ha^{-1} at final harvesting upon 20-25 years.

Eucalyptus-*based* Agroforestry Model

Scientific Name: *Eucalyptus tereticornis*

Suitable Spacing: 3mX3m or 4mX2m for block and 2-5m for boundary

Rotation: 3-4 years for poles, pulpwood and 6-8 years for plywood

Suitable intercrop:

***Kharif*:** Pearl millet, cowpea, sorghum, soybean, cotton

***Rabi*:** Wheat, potato, barley, oats, berseem

Annuals: Turmeric, ginger

Fruits: Kinnow, mango, citrus alternate to tree

Tree productivity: 260t ha^{-1} under agroforestry and 50-80 t ha^{-1} in boundary

Economic return: Net income Rs. 95, 000 to Rs. 1,26,072 $ha^{-1}yr^{-1}$ under irrigated condition

References

NIRDPR (National Institute of Rural Development and Panchayati Raj), (2014). Department of Rural Development Ministry of Rural Development Government of India. https://nirdpr.org.in/nird_docs/sagy/MadhyaPradesh.pdf. Accessed on 26 March 2025.

Madhya Pradesh State Bamboo Mission. Government of Madhya Pradesh. https://mpforest.gov.in/bamboomission/vision_document.pdf. Accessed o 27 march 2025.

Madhya Pradesh state portal, 2025. Government of Madhya Pradesh. https://asha.mp.gov.in/AboutMp.aspx. Accessed on 27 march 2025.

Madya Pradesh State Biodiversity Board, Dept. of Forest, Government of Madhya Pradesh

Madhya Pradesh State Biodiversity Board (MPSBB). Accessed on 28 March 2025.

Government of India ministry of agriculture & farmers welfare department of agriculture & farmers welfare economics, statistics and evaluation division, New Delhi, September 2024.

Land Use Statistics – At a Glance | Official website of Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. Accessed on 27 March 2025.

Kumari, R., Kumari, P., Kumari, R., & Chandola, V.K. (2019). Growth and yield responses of soybean under rainfed condition in selected districts of Madhya Pradesh, India. *Int. J. Curr. Microbiol. App. Sci*, *8*(8), 713-721.

Bijalwan, A., Verma, P., Dobriyal, M.J., Patil, A.K., Thakur, T.K., & Sharma, C.M. (2019). Trends and insights of agroforestry practices in Madhya Pradesh, India. Current Science, 117(4), 597-605.

Agroforestry Business Incubation Centre

ABiC

Institute Technology Management Unit (ITMU) of CAFRI facilitates incubation of new startup/entrepreneurs and enterprises for innovation technologies by providing need based physical, technical, business and networking support, facilities and services to test and validate business ventures of the incubates in agroforestry-based enterprises. Also, the IP/deemed IP are commercialized for creating an ecosystem for entrepreneurship. ABiC activities includes thematic areas like are plant nursery; semi-processed items like juice, jam, pulp, gum & resin, etc.; tree seed marketing; timber and wood-based products; fibre and flosses; biofuels and briquettes; essential oils; mini-clonal technology and agroforestry models.

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