PARIVARTAN: Every Taluka, Climate Ready.

Maharashtra's Climate Data Guide for Local Interventions



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PARIVARTAN

Every Taluka, Climate Ready

Jointly prepared by:

Maharashtra Institution for Transformation (MITRA), Planning Department,
Government of Maharashtra, and Council on Energy, Environment and Water (CEEW)

February 2026

MESSAGE



SHRI PRAVEEN PARDESHI

CEO, MITRA, and Chief Economic Advisor to the Chief Minister of Maharashtra

Maharashtra is blessed with a rich and diverse landscape that defines its identity, sustains its people and drives its development. From long coastlines and river basins, tropical rainfall areas, forests, arid interiors and the fast-expanding cities all across, Maharashtra's landscapes face rising climate threats but also present significant opportunities for climate-resilient development. Strengthening resilience at the local level is essential, with talukas emerging as the frontline of climate action and development planning. This requires a granular level understanding of climate data and consolidating it for strategic guidance at taluka-level.

Aligned with the Viksit Maharashtra 2047 and Maharashtra State Action Plan on Climate Change (MH SAPCC), the state is launching the Maharashtra Sustainable and Climate-Resilient Pact, aimed at integrating sustainable economic growth with climate at the heart of it. As part of it, we launch: "PARIVARTAN: Every Taluka, Climate Ready. Maharashtra's climate data guide for local interventions." It maps climate information like heat and rainfall and its impact on important economic sectors in each district and taluka. It presents taluka-level climate profiles through rigorous scientific projections and granular data-driven insights, into an accessible and actionable toolkit. In order to realise the 1 trillion-dollar economy by 2030, talukas, as the foundational units of governance and economic activity, must be prepared for climate adversities.

At MITRA, we view climate action as an opportunity to leverage sustainable economic growth to strengthen policy making and implementation. PARIVARTAN is an effort to recognise that climate action, alongside top-down governance, must capture local realities and sensitivities at the grassroot level. It complements our ongoing projects at MITRA along with the Government of Maharashtra and World Bank, such as the Maharashtra Resilience Development Program (MRDP), where climate-induced flooding and heat waves are addressed through advanced hydrological modelling, AI-enabled forecasting systems and early warning mechanisms. Vulnerable communities are further supported through adaptive planning measures, including livelihood-focused insurance coverage and climate-resilient risk financing solutions.

I congratulate the Maharashtra State Climate Action Cell (MahaSCAC), Department of Environment and Climate Change, and the technical partner, the Council on Energy, Environment and Water, on bringing this significant dynamic work to life. May PARIVARTAN empower districts and talukas to advance their role in sub-national climate action and resilient development.

5th Floor, Nirmal Building, Nariman Point, Mumbai - 400021, Maharashtra

MESSAGE



SMT JAYASHREE BHOJ

Secretary

Department of Environment and Climate Change,
Government of Maharashtra

Climate change today stands as one of the most defining challenges of our time, with its impacts increasingly visible across ecosystems, economies, and communities. Maharashtra, with its diverse geography, is witnessing an increase in the frequency and intensity of extreme weather events due to climate change. Addressing these challenges requires informed planning, grounded in science, local realities, and inclusive governance.

This report presents a compelling and insightful narrative of climate change impacts across Maharashtra at the district and taluka levels, while aligning these vulnerabilities with the strategic priorities outlined in the Maharashtra State Action Plan on Climate Change (MH SAPCC). By translating complex climate data into accessible visuals, taluka-specific insights, and the district's sectoral priorities, this publication bridges the gap between policy, planning, and public awareness.

The strength of this work lies in its emphasis on localised climate vulnerabilities, recognising that resilience must be built where impacts are felt most acutely. To address the same, this initiative informs district officials and state-level policymakers with actionable recommendations for enhancing Maharashtra's resilience against climate change. Whether it is water stress, extreme weather events, agricultural risks, or coastal erosion, among others. This book underscores the importance of targeted local-level actions as a cornerstone of the State's climate response.

I commend the efforts of the technical partner, the Council on Energy, Environment and Water (CEEW), the support extended by Maharashtra Institution for Transformation (MITRA), and the Maharashtra State Climate Action Cell (MahaSCAC) in developing this publication. It is our hope that this book will serve not only as a knowledge resource but also as an inspiration for policymakers, practitioners, and citizens to collectively advance Maharashtra's journey towards climate-resilient and sustainable development.

217, Annex Building, Mantralaya, Fort, Mumbai 400001, Maharashtra

ACKNOWLEDGMENT

The Council on Energy, Environment and Water (CEEW) is thankful to the **Maharashtra Institution for Transformation (MITRA)** led by Mr Praveen Pardeshi, CEO, MITRA and Mr Aman Mittal, Jt.CEO, MITRA, the Maharashtra State Climate Action Cell (MahaSCAC) led by Mr Abhijit Ghorpade, Director, MahaSCAC, and the Department of Environment and Climate Change, Government of Maharashtra, led by Smt Jayashree Bhoj, Secretary DoECC, for their strategic leadership and guidance for the development of this guide book.

We sincerely acknowledge the technical guidance and mentorship provided by Dr Arunabha Ghosh, Chief Executive Officer, CEEW and Dr Vishwas Chitale, Fellow, CEEW. We deeply appreciate the efforts of the CEEW Team including Mr Soham Shah, Ms Anushka Maheshwari and Dr Pushp Bajaj in the conceptualisation, data collection and analysis, stakeholder coordination and drafting of this guide book. We appreciate the efforts of Mr Gaurav Sahni, Mr Ritwick Dutta, Ms Nupur Joshi, and Ms Risaal Amina Esa in data collection and analysis, visualisations and review of the document. We would also like to thank Ms Poojil Tiwari, Mr Dhruv Korula Joseph, Ms Shivani Singh Ghoshi, Ms Alina Sen, and Ms Purnima Vijaya for their support in the data visualisations, design and editing of this document.

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We would like to express our sincere gratitude to the French Development Agency (Agence Française de Développement, AFD) for their support in the production of this book.

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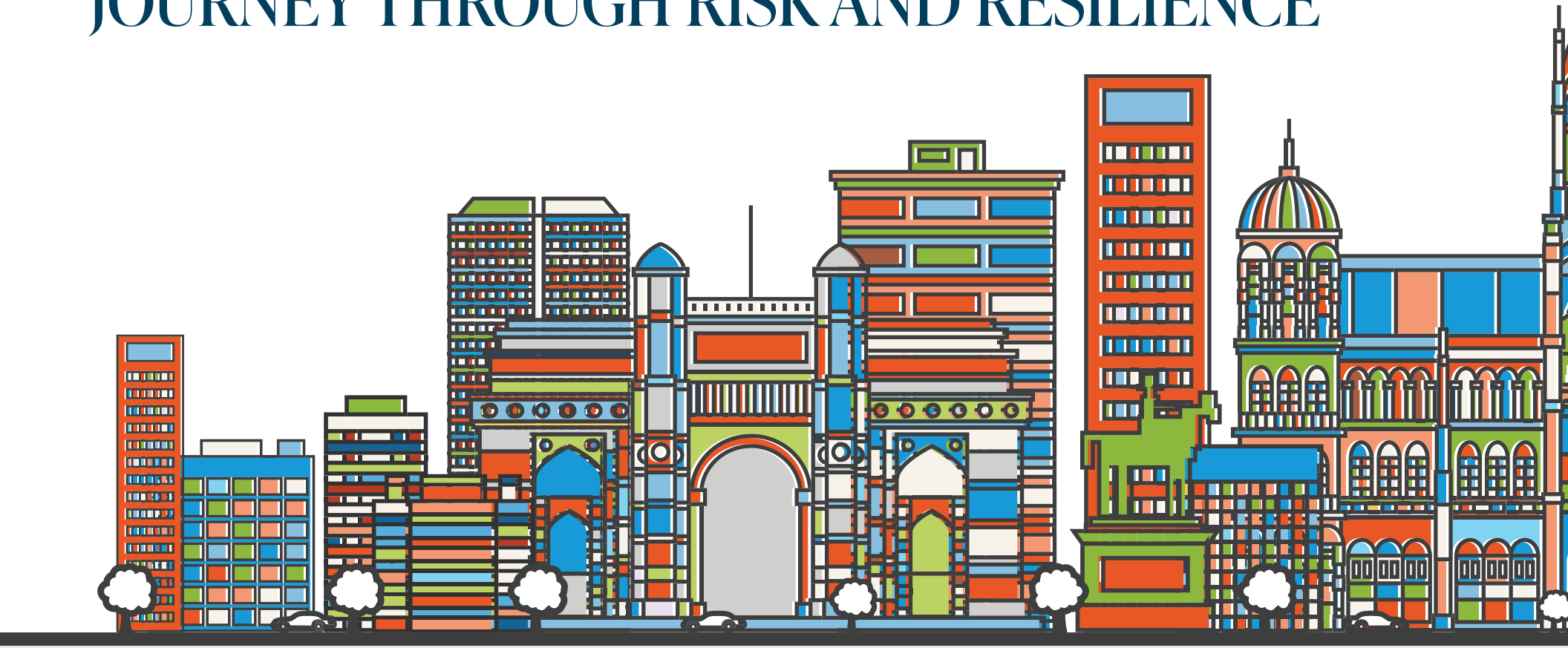
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LANDSCAPES OF STRENGTH: MAHARASHTRA'S JOURNEY THROUGH RISK AND RESILIENCE



Maharashtra, known for its vast history, tourist attractions and development sectors has played an important role in the growth and development of the country. Every district and taluka in Maharashtra has a feature that makes it unique.

This coffee table book presents key features and attributes of all the districts and talukas of the state, including statistics, sectoral information, vulnerabilities to extreme weather and examples of successful resilience building initiatives.

The book is designed to convey the taluka-level assessment and readiness against the impacts of the extreme weather events. Each district shows the trends of such events across the talukas and identifies key sectors that are impacted. To enhance their resilience, the book outlines various strategies along with success stories implemented by different districts, offering valuable lessons for other districts and talukas.



Colours of the book

EXTREME HEAT

EXTREME RAINFALL

IMPACT ON THE KEY SECTORS

RECOMMENDATIONS

NAME OF THE DISTRICT

Area | Population Density | Households | Literacy rate | Demographics

CENSUS INFORMATION
Source: District Census Handbook

DISTRICT LAND USE LAND COVER MAP WITH TEHSIL BOUNDARIES
Source: ESRI - Sentinel 2 Land Use Land Cover; ArcGIS Pro

Water (%) | Built-up (%) | Crops (%) | Trees (%) | Range Land (%)

Fact Heading
Source: District Socio-Economic Review, Planning Department, Govt of Maharashtra

Fact Heading
Source: District Socio-Economic Review, Planning Department, Govt of Maharashtra

Fact Heading
Source: District Socio-Economic Review, Planning Department, Govt of Maharashtra

GDP GRAPH

GDDP GRAPH
Source: District Strategic Plan, Government of Maharashtra

INSIGHTS ON THE TREND AND SECTORAL CONTRIBUTION TO GDDP
Source: Author's analysis and District Strategic Plan, Government of Maharashtra

EXTREME SUMMER HEAT

TEHSIL LEVEL HEAT EXPOSURE MAP
Source: India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satellite data for land surface temperature at 30m resolution derived from Google Earth Engine

Very Low | Low | Medium | High | Very High

ANALYSIS OF THE MAP
Source: Author's analysis

EXTREME RAINFALL

TEHSIL LEVEL RAINFALL EXPOSURE MAP
Source: India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satellite data for flood susceptibility at 30m resolution derived from Google Earth Engine

Very Low | Low | Medium | High | Very High

ANALYSIS OF THE MAP
Source: Author's analysis

LAND SURFACE TEMPERATURE

TEHSIL LEVEL LAND SURFACE TEMPERATURE MAP
Source: Landsat 8 satellite data at 30m resolution derived from Google Earth Engine

Temp (°C) 66.22 32.91

ANALYSIS OF THE MAP
Source: Author's analysis

FLOOD SUSCEPTIBILITY

TEHSIL LEVEL FLOOD SUSCEPTIBILITY MAP
Source: Landsat 8 satellite data at 30m resolution derived from Google Earth Engine

Susceptibility Very High Very Low

ANALYSIS OF THE MAP
Source: Author's analysis

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS

A **Heavy Rain Day** is defined as a day on which the daily rainfall amount exceeds the 90th percentile threshold of daily rainfall, calculated using a baseline reference period. This percentile threshold represents the value above which only the top 10% of wettest days occur in the baseline period.

OBSERVED TREND OF HEAVY RAINFALL DAYS (1981-2010)

Source: India Meteorological Department at 25km resolution;

PROJECTED TREND OF HEAVY RAINFALL DAYS (2030-2050)

Source: CORDEX CMIP5 at 25km resolution;

ANALYSIS OF THE GRAPHS

Source: Author's analysis

OBSERVED AND PROJECTED TRENDS OF HOT DAYS

A **Hot Day** is defined as a day when the daily maximum temperature (Tmax) exceeds the 90th percentile threshold of maximum temperature, calculated from the baseline reference period (1981-2010).

OBSERVED TREND OF HOT DAYS (1981-2010)

Source: India Meteorological Department at 25km resolution;

PROJECTED TREND OF HOT DAYS (2030-2050)

Source: CORDEX CMIP5 at 25km resolution;

ANALYSIS OF THE GRAPHS

Source: Author's analysis

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS

A **Warm Night** is defined as a night when the daily minimum temperature (Tmin) exceeds the 90th percentile threshold of minimum temperature, calculated from the baseline reference period.

OBSERVED TREND OF WARM NIGHTS (1981-2010)

Source: India Meteorological Department at 25km resolution;

PROJECTED TREND OF WARM NIGHTS (2030-2050)

Source: CORDEX CMIP5 at 25km resolution;

ANALYSIS OF THE GRAPHS

Source: Author's analysis

IMPACTS ON KEY SECTORS

IMPACT OF SECTOR 1

Source: Author's analysis

IMPACT OF SECTOR 2

Source: Author's analysis

RECOMMENDATIONS

1

RECOMMENDATION 1

Source: Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis

2

RECOMMENDATION 2

Source: Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis

3

RECOMMENDATION 3

Source: Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis

4

RECOMMENDATION 4

Source: Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis

KONKAN

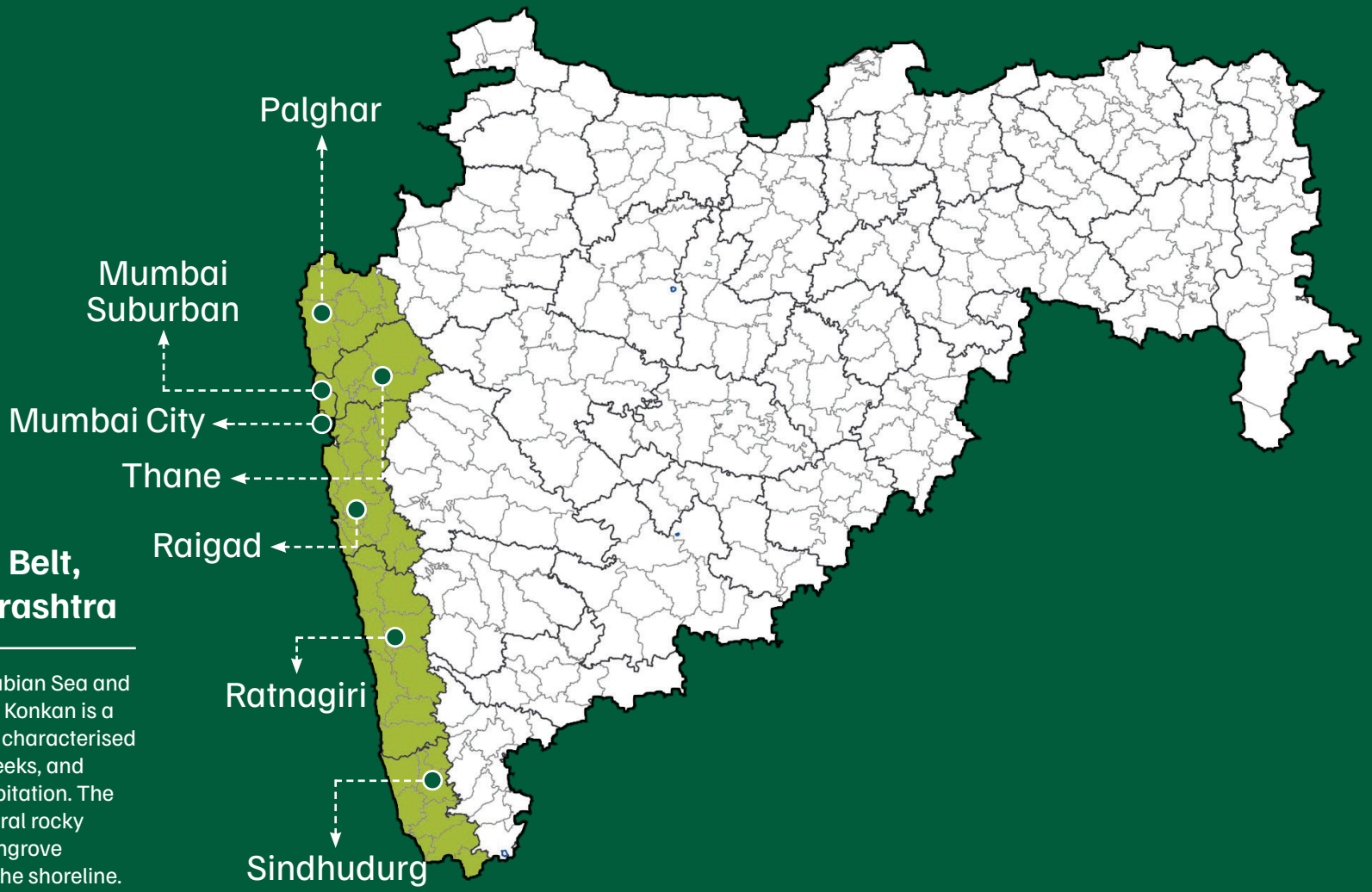
Konkan Division



Also known as

Sahyadri–Sea Belt, Coastal Maharashtra

Tucked between the Arabian Sea and the Sahyadri Range, the Konkan is a narrow coastal lowland characterised by rugged cliffs, tidal creeks, and heavy monsoonal precipitation. The terrain is defined by lateral rocky plateaus and dense mangrove ecosystems that shield the shoreline.



HISTORIC IMPORTANCE

This region gained strategic prominence under the Shilahara dynasty and later served as the naval backbone of the Maratha Empire under Chhatrapati Shivaji Maharaj, who established the coastal capital at Raigad. It functioned as a critical maritime gateway where fortified island ports like Janjira and Sindhudurg facilitated global trade and naval defence.

CUISINE

To counter the high humidity, the cuisine utilises cooling foods like **kokum and fresh coconut,** which grows in abundance along the coast. Staple meals consist of **rice and seafood,** reflecting the natural bounty provided by the high-rainfall tropical climate.



COMMUNITY AND OCCUPATION

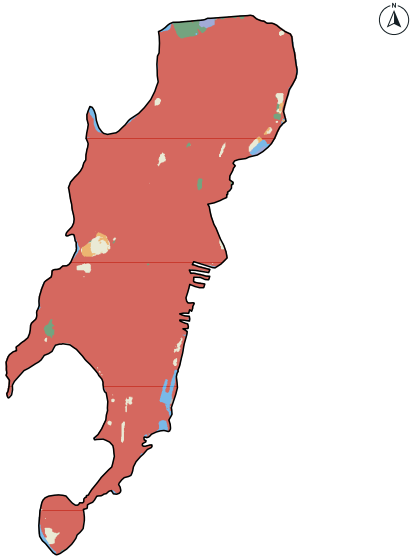
The region is home to the Koli (fisherfolk), Agri, and Konkanastha communities, whose lives are intrinsically tied to the rhythm of the sea and the orchards. Horticulture is the primary economic driver, with a global reputation for Alphonso mangoes, cashews, and betel nuts, alongside traditional deep-sea fishing.

CLOTHING

The humid, tropical climate of the coast dictates lightweight and breathable fabrics. Traditional men, particularly from the Koli community, wear a distinctive short dhoti for ease of movement in water, a waistcoat and a colourful, tilted cap. Women wear the Nauvari (nine-yard saree) tucked high in a “Kashtha” style, which allows for wading through water and working in rice paddies.

MUMBAI CITY

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
157 sq km	19,652.30	6,74,339	81.32%	♂ 16,84,176 | 54.6% ♀ 14,01,235 | 45.4%



FINANCIAL CAPITAL

Mumbai City serves as India's primary financial powerhouse, housing the nation's most critical institutions including the Reserve Bank of India, the Bombay Stock Exchange, and the National Stock Exchange.

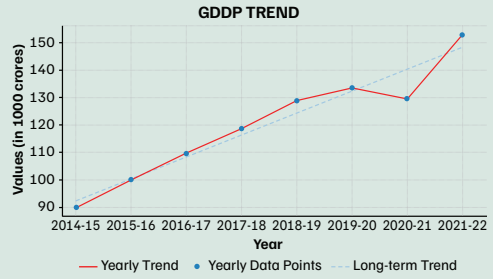
GLOBAL TRADE GATEWAY

Mumbai's strategic coastal location and its major port make it a vital gateway for international business, facilitating **70%** of the nation's maritime trade.

MUMBAI, INDIA'S FILM CAPITAL

Mumbai is the heart of India's film industry, producing over 1,000 Bollywood films each year. Many are shot in Film City, which borders a forest—making leopard sightings on set surprisingly common.

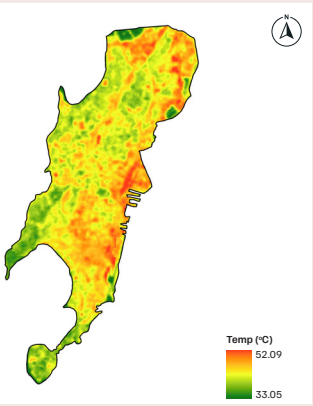
GDP GRAPH[2]



Mumbai City's GDDP increased from **₹89,996 crore** in 2014–15 to **₹1,52,753 crore** in 2021–22, an overall growth of **70%** over 8 years. Mumbai City contributed an average of **5.0%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **62%,** industry sector **37%** and agriculture and allied activities contributed **1%** to Mumbai City's GDDP.

EXTREME SUMMER HEAT[3]

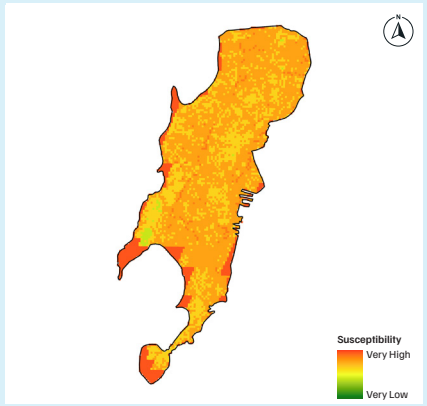
LAND SURFACE TEMPERATURE[3]



Mumbai district is one of the most highly urbanised district in the state. The range of surface temperature is between **33.05 and 52.09°C.**

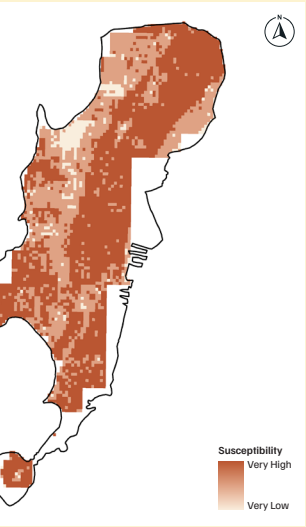
EXTREME RAINFALL[3]

FLOOD SUSCEPTIBILITY[3]



The district experiences **medium to high susceptibility to flooding.** Areas in close proximity to the coast are expected to witness more vulnerability to flooding.

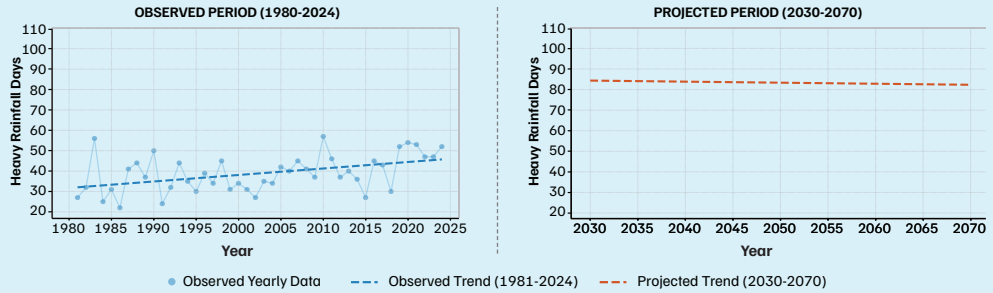
LANDSLIDE SUSCEPTIBILITY[4]



The Western Ghats and Konkan region exhibit a high susceptibility to landslides, induced by heavy rainfall patterns and anthropogenic activities, heavily impacting the districts. Mumbai overall has high to very high landslide susceptibility, with the eastern part more vulnerable. This is due to a combination of intense, concentrated monsoon rainfall, steep, unstable slopes in suburban hilly areas such as **Ghatkopar and Vikhroli,** and significant anthropogenic pressure. Some human and anthropogenic activities also causes these areas to be more susceptible to landslides.

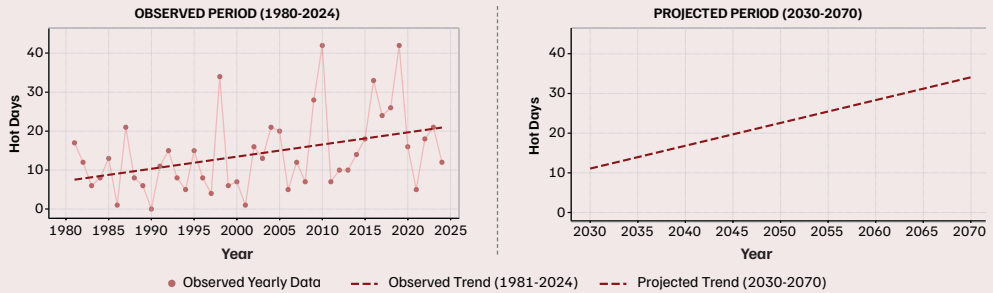
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution, [4]Indian Landslide Susceptibility Map (ILSM), Sharma, Saharia and Ramana (2023), IIT Delhi, at ~100 m resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



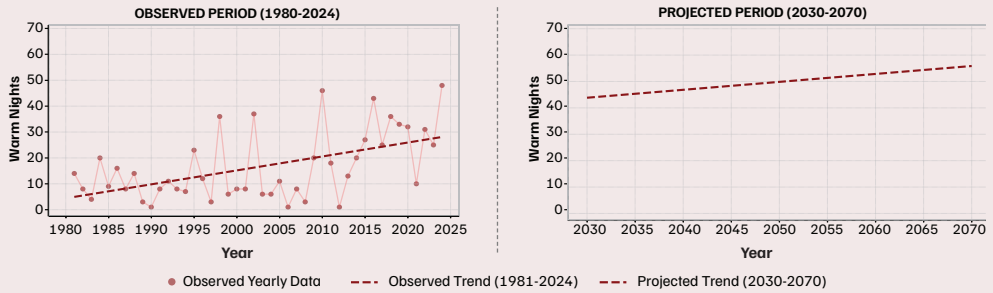
In Mumbai, the number of heavy rainfall days has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **44 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **82 days** in a year between **2030–2050** and **80 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In Mumbai, the number of hot days has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **18 days** in a year between **2011–2024.** Climate model projections show that this will initially **decrease** to an average of **16 days** in a year between **2030–2050** and later **increase** to **28 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In Mumbai, the number of warm nights has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **26 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **48 days** in a year between **2030–2050** and **51 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEAT RISK IN MUMBAI

Rising night temperatures strain urban health

Mumbai has observed an additional 14 warm nights per year between 2011-2024, which is projected to significantly rise in near future. As the warm night increases, it would impact the public health and drive up the energy demand

HEALTHCARE RISK IN MUMBAI

Healthcare density at risk from coastal hazards

Mumbai faces the highest level of healthcare exposure, as its dense network is situated in zones vulnerable to floods and cyclones

RECOMMENDATIONS[5]

1

EARLY WARNING SYSTEMS FOR HEAT RESILIENCE

Develop and disseminate robust early warning systems with last-mile connectivity, incorporating relative humidity and percentile-based temperature forecasts to prevent heat-related illnesses.

2

PUBLIC AWARENESS FOR HEAT HEALTH SAFETY

Educate and encourage the public to adopt heat-protective behaviours, including avoiding exposure, staying hydrated, and wearing appropriate clothing, especially for vulnerable groups.

3

HEALTHCARE FLOOD RISK ASSESSMENT

District health departments should conduct asset-level risk assessments to identify vulnerabilities and prioritise flood adaptation solutions for healthcare facilities.

4

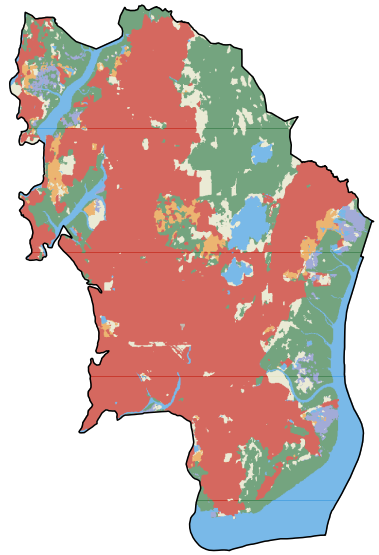
FLOOD-PROOFING HEALTHCARE INFRASTRUCTURE

Retrofit existing healthcare buildings and install flood-resistant infrastructure, such as elevated water supply outlets and high-capacity pumps in low-lying areas.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

MUMBAI SUBURBAN

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
446 sq km	20,979.74	21,05,604	80.96%	♂ 50,30,625 | 53.7% ♀ 43,26,337 | 46.3%



SANJAY GANDHI NATIONAL PARK

Covers **104 sq. km,** functioning as a major carbon sink, groundwater recharge zone and wildlife corridor within the metropolitan region.

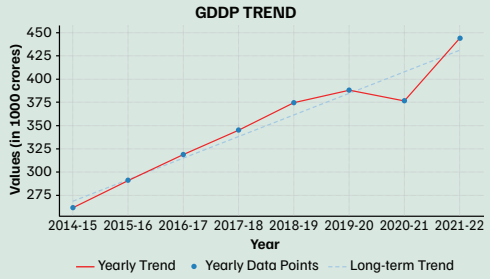
GLOBAL SERVICE HUB

Mumbai Suburban is a global services powerhouse, led by the Bandra Kurla Complex (BKC), driving India's software exports and financial leadership.

EXPORT INFRASTRUCTURE

Mumbai Suburban district operates as a global export engine, powered by specialised industrial zones like SEEPZ that offer world-class infrastructure and significant tax incentives.

GDP GRAPH[2]



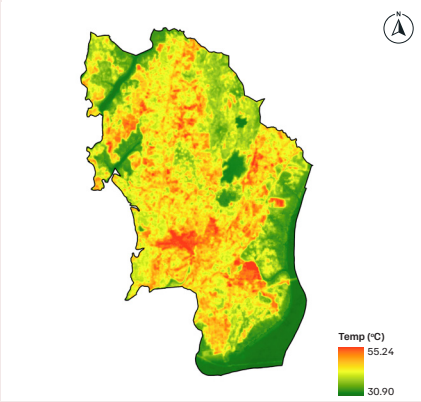
Mumbai Suburban's GDDP increased from **₹2,61,630 crore** in 2014-15 to **₹4,44,030 crore** in 2021-22, an overall growth of about **70%** over 8 years.

The district contributed an average of **14.6%** to Maharashtra's GSDP during this period, making it the **largest contributor**.

On average, service sector contributed **62%,** industry sector **37%** and agriculture and allied activities contributed **1%** to Mumbai Suburban's GDDP.

EXTREME SUMMER HEAT[3]

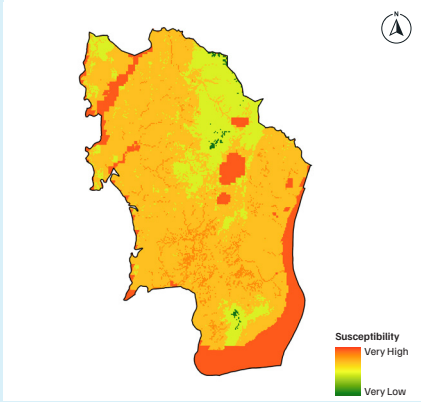
LAND SURFACE TEMPERATURE[3]



Due to dense built-up area in the city, the district has patches of very high surface temperature. This ranges from **30.90 to 55.24 °C.** However, coastal areas and areas near the water bodies are relatively cooler.

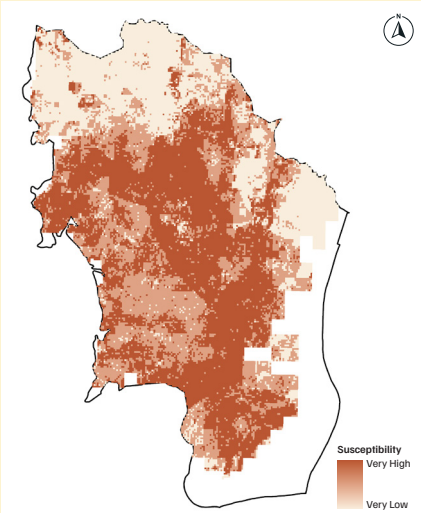
EXTREME RAINFALL[3]

FLOOD SUSCEPTIBILITY[3]



Since, the district has a close proximity to Arabian Sea, the coastal areas are **highly susceptible** to flooding events. Similarly, areas near water bodies also face significantly high vulnerability to flooding.

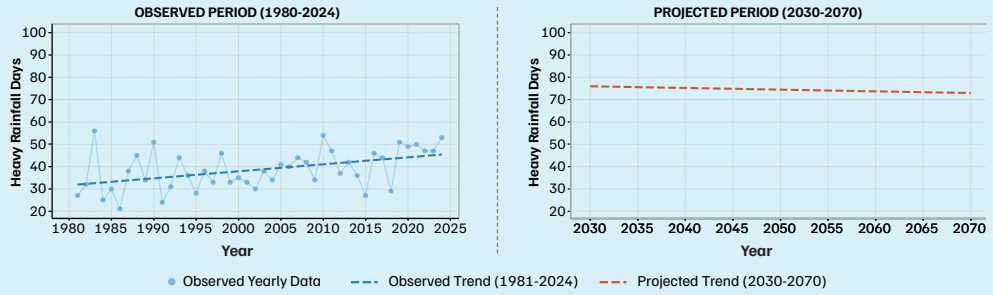
LANDSLIDE SUSCEPTIBILITY[4]



Mumbai Suburban faces very high risk of landslides. The vulnerability of the district is enhanced by the impact of climate change and extreme weather events. Mumbai Suburban is expected to witness about 60 days per year of heavy rainfall days in the near to long-term future(2030-2070). Climate change is likely to alter slope and bedrock stability through changes in precipitation and/or temperature. It is difficult to determine future locations and timing of large rock avalanches, as these depend on local geological conditions and other non-climatic factors.

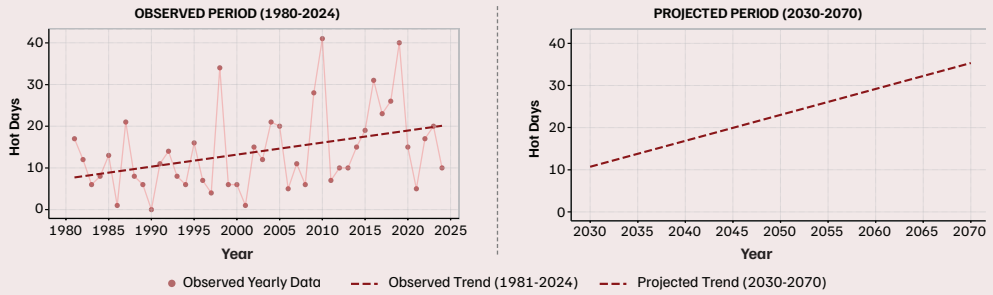
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution, [4]Indian Landslide Susceptibility Map (ILSM), Sharma, Saharia and Ramana (2023), IIT Delhi, at ~100 m resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



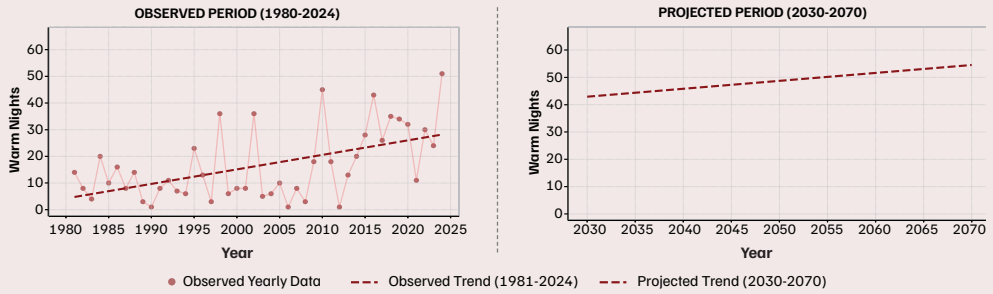
In Suburban Mumbai, the number of heavy rainfall days has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **43 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **75 days** in a year between **2030–2050** and **73 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In Suburban Mumbai, the number of hot days has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **18 days** in a year between **2011–2024.** Climate model projections show that this will initially **decrease** to an average of **16 days** in a year between **2030–2050** and increase to **29 days** in a year between **2050–2070**.

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In Suburban Mumbai, the number of warm nights has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **26 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **47 days** in a year between **2030–2050** and **50 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEALTHCARE RISK IN SUBURBAN MUMBAI

Healthcare facilities in landslide zones

Suburban Mumbai's healthcare network is highly vulnerable with 182 medical facilities situated in zones susceptible to landslides.

RISK TO INFRASTRUCTURE IN SUBURBAN MUMBAI

Severe infrastructure risk from floods and cyclones

Suburban Mumbai faces critical infrastructure threats due to its very high vulnerability to frequent floods and severe cyclones.

RECOMMENDATIONS[5]

1

REGULATING DEVELOPMENT IN LANDSLIDE-PRONE AREAS

Implement stringent land use regulations and development controls for critical infrastructure, including healthcare facilities, in landslide-prone areas to prevent slope destabilisation and ensure structural safety.

2

STRENGTHENING IPHS FOR HEALTH NETWORK RESILIENCE

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility accessibility and network capacity in landslide-prone regions through an online portal for real-time data-driven management.

3

CYCLONE- AND HEAT-RESILIENT INFRASTRUCTURE SYSTEMS

Mandate cyclone- and heat-resilient building standards and strengthen power, water, transport, and telecom infrastructure with elevated, wind-resistant, and heat-tolerant materials to ensure service continuity.

4

ECOSYSTEM-BASED COASTAL PROTECTION

Restore mangroves, coastal forests, and green buffers to reduce cyclone impacts while lowering ambient temperatures.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

PALGHAR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
5,344 sq km	559.53	6,64,470	66.65%	♂ 15,45,779 | 51.7% ♀ 14,44,337 | 48.3%



WARLI TRIBAL CULTURAL HERITAGE ZONE

The district is a birthplace of Warli tribal art, representing one of Maharashtra's richest indigenous cultural identities.

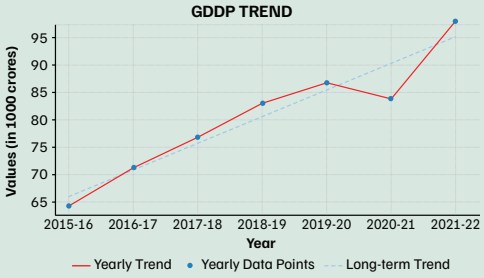
TUNGARESHWAR WILDLIFE SANCTUARY

The sanctuary is a protected forest region with rich biodiversity and high potential for the eco-tourism in the state.

CHIKOO PRODUCTION HUB

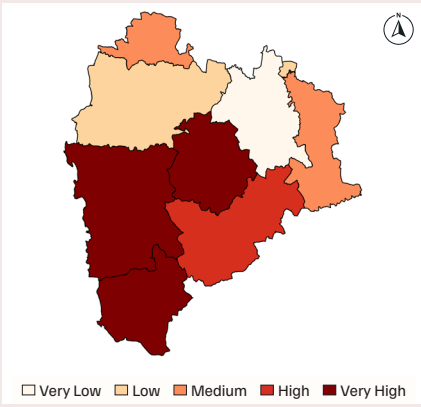
Palghar is Maharashtra's largest chikoo producer, contributing to horticulture-based income and processing potential.

GDP GRAPH[2]



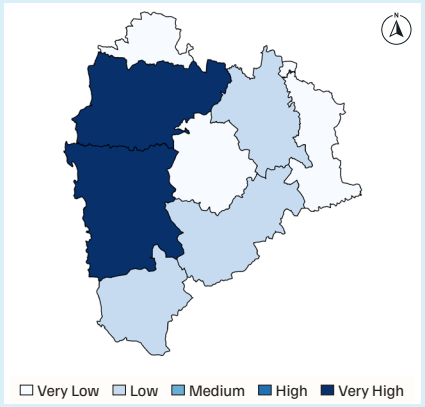
Palghar's GDDP increased from **₹64,162 crore** in 2015–16 to **₹97,926 crore** in 2021–22, an overall growth of **53%** over the period. Palghar contributed an average of **3.2%** to Maharashtra's GSDP between 2015–16 and 2021–22. On average, service sector contributed **63%**, industry sector **28%** and agriculture and allied activities contributed **9%** to Palghar's GDDP.

EXTREME SUMMER HEAT[3]



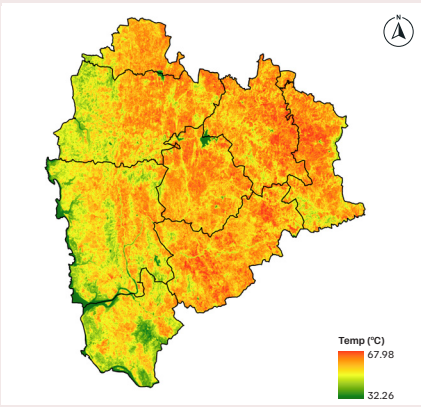
The tehsils of **Vasai, Palghar, and Vikramgad** observes high exposure to heat, expecting a **4-fold** increase in the number of warm nights and a **1.5-fold** increase in the number of hot days respectively in the future period (2030–2050) compared to the past

EXTREME RAINFALL[3]



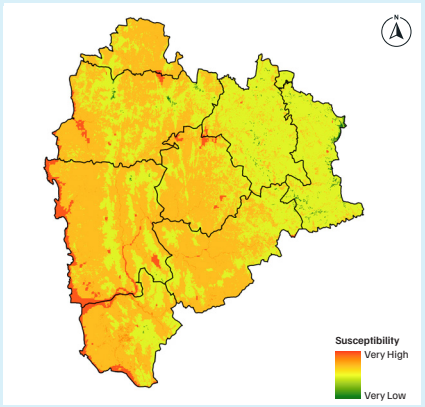
The tehsils of **Palghar and Dahanu** observe high exposure to extreme rainfall. Climate model shows a **2-fold** increase in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past (1981-2010)

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **32.26 to 67.98 °C.** The western part of the district exhibits high surface temperature primarily in **Mokhada, Wada, and Jawhar** tehsils.

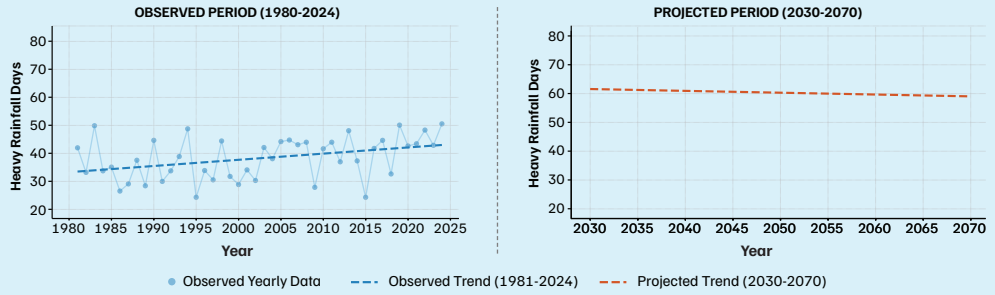
FLOOD SUSCEPTIBILITY[3]



The district has majority of very low flood susceptible areas concentrated in the north-eastern part. However some areas across the western borders in **Vasai, Palghar and Dahanu** tehsil have very high flood susceptibility.

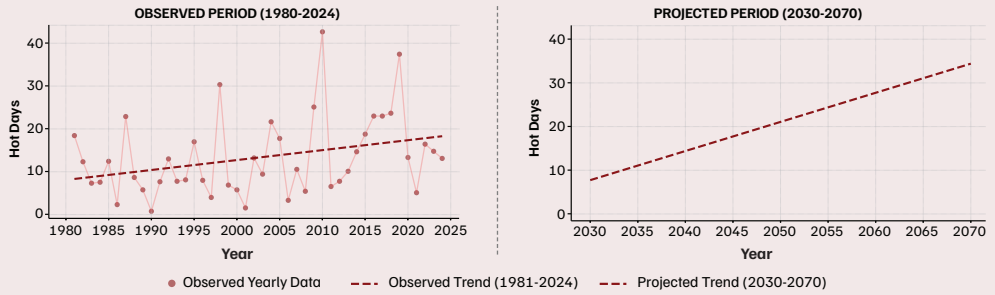
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



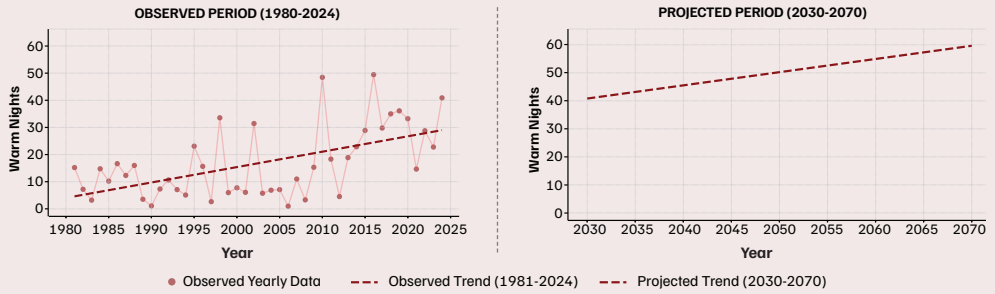
In Palghar, the number of heavy rainfall days has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **42 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **60 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In Palghar, the number of hot days has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will initially **decrease** to an average of **14 days** in a year between 2030–2050 and later **increase** to **28 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In Palghar, the number of warm nights has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **27 days** in a year between 2011–2024. Climate model projections show that this will increase further to an average of **46 days** in a year between **2030–2050** and **53 days** in a year between **2050–2070**.

IMPACTS ON KEY SECTORS

CLIMATE RISK IN PALGHAR

Climate risk for vulnerable communities

Palghar's vulnerable communities face increased exposure to climate risks that threaten their daily lives and local environment.

MANUFACTURING AT RISK IN PALGHAR

Manufacturing industry at extreme flood risk

Palghar's manufacturing sector faces severe threats as the district experiences flood occurrences four times more than the state average.

RECOMMENDATIONS[5]

1

HEAT ACTION PLAN FOR PALGHAR

Implement Heat Action Plans in Palghar with early warnings, heat-safe work timings, drinking water access, cooling shelters, and income support during extreme heat periods.

2

REDUCING HEAT STRESS IN INFORMAL SETTLEMENTS

Upgrade housing, health outreach, and electricity reliability in vulnerable settlements using heat-resilient designs and mobile health services to reduce heat stress impacts.

3

BUILDING CLIMATE-READY INDUSTRIAL ECOSYSTEMS

With the help of MIDC develop climate-resilient industrial clusters and estates in Palghar with shared stormwater drainage, flood protection, water storage, and backup power to reduce monsoon-related disruptions.

4

MONSOON PREPAREDNESS FOR MSMES

Educate and incentivise monsoon contingency planning for MSME industries—early warnings, supply-chain diversification, climate-proof logistics, and business continuity plans to manage erratic rainfall.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

RAIGAD

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
7,152 sq km	368.32	6,11,790	73.65%	♂ 13,44,666 | 51% ♀ 12,89,534 | 49%



Water (3.60%) Built-up (7.97%) Crops (11.77%)
Trees (29.16%) Range Land (46.53%)

RICE PRODUCTION HUB

Large-scale paddy cultivation, supporting food security and local agrarian economy.

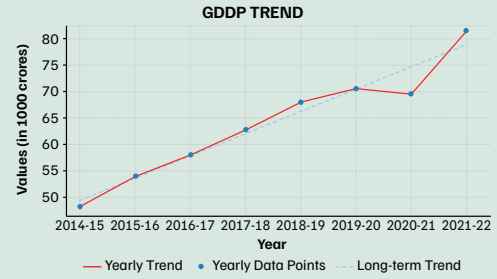
MURUD-JANJIRA FORT

A historic sea fort undefeated in history, a major heritage tourism attraction.

MATHERAN ECO-SENSITIVE TOURISM ZONE

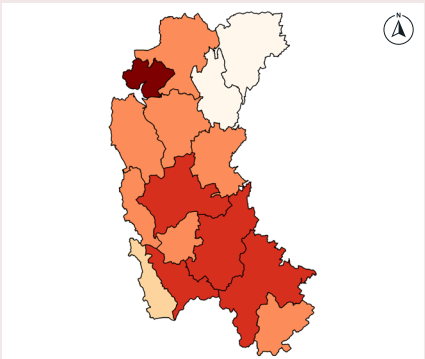
Declared an eco-sensitive hill station, featuring zero-vehicle policy and high tourism footfall.

GDP GRAPH[2]



Raigad GDDP increased from **₹48,080 crore** in 2014–15 to **₹81,160 crore** in 2021–22, an overall growth of **69%** over 8 years. Raigad contributed an average of **2.7%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, service sector contributed **56%,** industry sector **34%** and agriculture and allied activities contributed **10%** to Raigad GDDP.

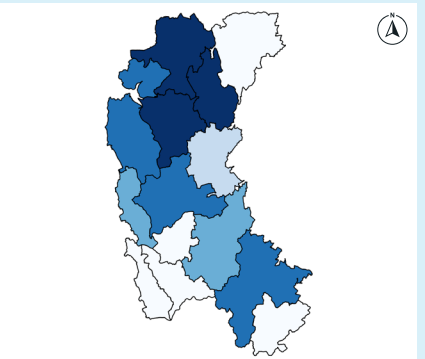
EXTREME SUMMER HEAT[3]



Very Low Low Medium High Very High

The tehsil of **Uran** observes an increase in exposure to extreme heat. It is expected to see a rise in warm nights and hot days in for the future period (2030–2050) compared to the past (1981-2010).

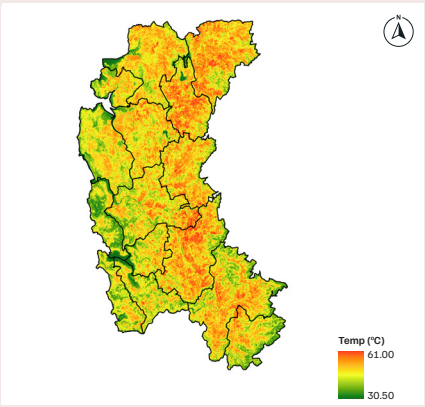
EXTREME RAINFALL[3]



Very Low Low Medium High Very High

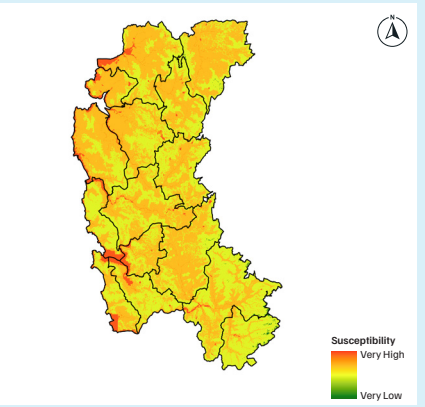
The tehsils of **Pen, Khalapur, and Panvel** observe highest exposure to extreme rainfall, and are expected to witness a **2-fold** increase in the number of heavy rainfall days in the future period.

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **30.50 to 61.00 °C.** The district has low to medium surface temperature. **Mangaon, Sudhagad, Khalapur, and Karjat** tehsils shows high surface temperature.

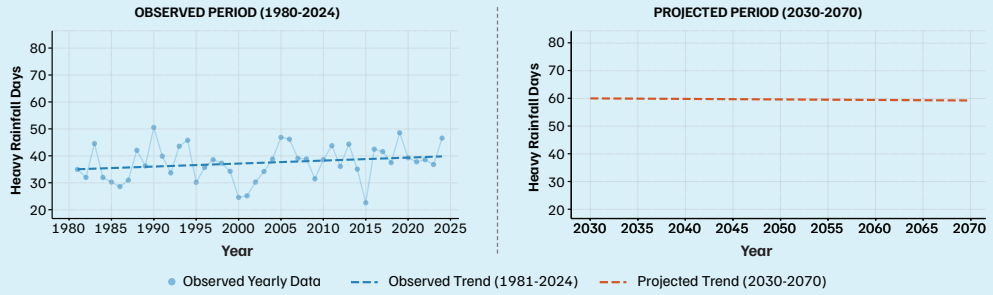
FLOOD SUSCEPTIBILITY[3]



The district has very l**ow to medium flood susceptibility** primarily due to presence of vast green cover. However, some of the tehsils, such as **Mhasala, Tara, and Murud** have high flood susceptibility due to water bodies in the area

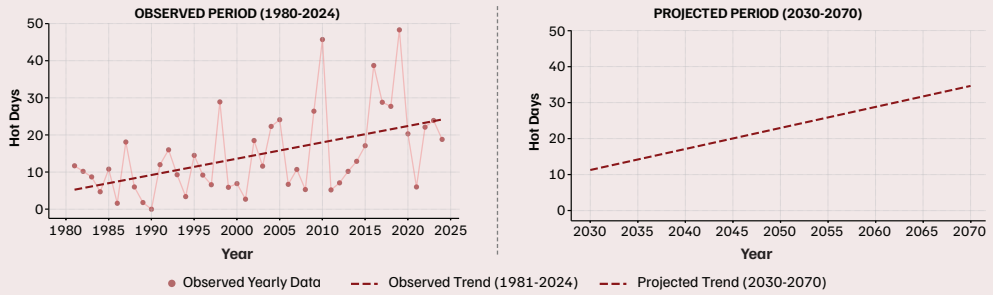
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satellite data.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



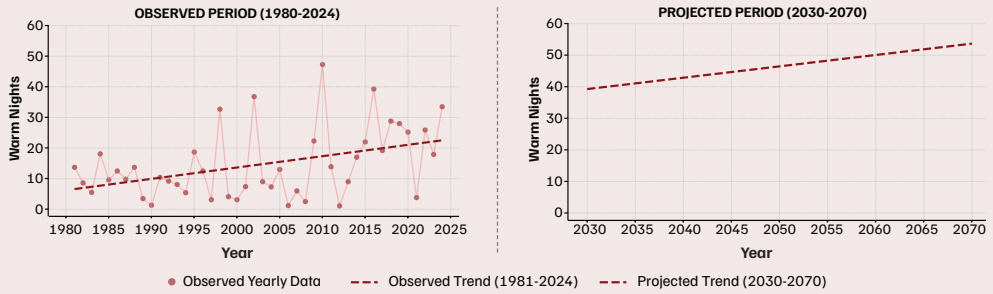
In **Raigad,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **39 days** in a year between **2011–2024.** Climate model projections show that this will increase further to an average of **60 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Raigad,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **21 days** in a year between **2011–2024.** Climate model projections show that this will initially **decrease** to an average of **17 days** in a year between **2030–2050** and increase to an average of **29 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Raigad,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **20 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **43 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEALTHCARE RISK IN RAIGAD

Healthcare facilities in landslide zones

Raigad's healthcare network is highly vulnerable with 70 medical facilities situated in zones susceptible to landslides.

INFRASTRUCTURE RISK IN RAIGAD

Severe infrastructure risk from cyclones

Raigad faces extreme infrastructure vulnerability as evidenced by Cyclone Nisarga, which damaged nearly 140,000 houses across the district.

RECOMMENDATIONS[5]

1

LANDSLIDE-SAFE LAND USE CONTROLS

Implement stringent land-use regulations and development controls for critical infrastructure, including healthcare facilities, in landslide-prone areas to prevent slope destabilisation and ensure structural safety.

2

STRENGTHENING IPHS FOR HEALTH NETWORK RESILIENCE

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility accessibility and network capacity in landslide-prone regions through an online portal for real-time data-driven management.

3

CYCLONE- AND HEAT-RESILIENT INFRASTRUCTURE SYSTEMS

Mandate cyclone- and heat-resilient building standards and harden power, water, transport, and telecom infrastructure with elevated, wind-resistant, and heat-tolerant materials to ensure service continuity.

4

ECOSYSTEM-BASED COASTAL PROTECTION

Restore mangroves, coastal forests, and green buffers to reduce cyclone impacts while lowering ambient temperatures.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

RATNAGIRI

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
8,208 sq km	196.77	3,97,115	74.26%	♂ 7,61,107 | 47.1% ♀ 8,53,962 | 52.9%



MANGO PRODUCTION HUB

The district is famous for its Alphonso mango cultivation. Ratnagiri has 1.5 lakh hectares of mango plantation which is exported globally.

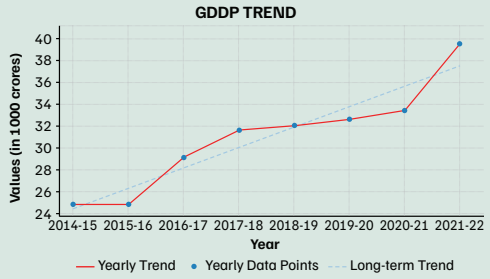
MARINE FISHERIES & SEAFOOD PROCESSING

The district is also a major hub for marine fish and seafood processing. The processed seafood exporting contributes strongly to regional employment.

RATNADURG FORT

The district also houses a historic coastal fort built in the 16th century, overlooking the Arabian Sea. It is an important heritage tourism site attracting large footfall.

GDP GRAPH[2]

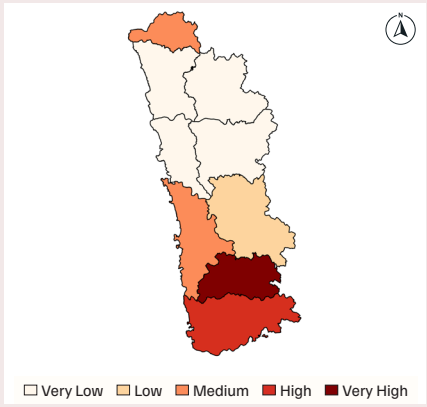


Ratnagiri's GDDP increased from **₹24,932 crore** in 2014-15 to **₹39,611 crore** in 2021-22, an overall growth of **59%** over 8 years.

Ratnagiri contributed an average of **1.3%** to Maharashtra's GSDP between 2014–15 and 2021–22.

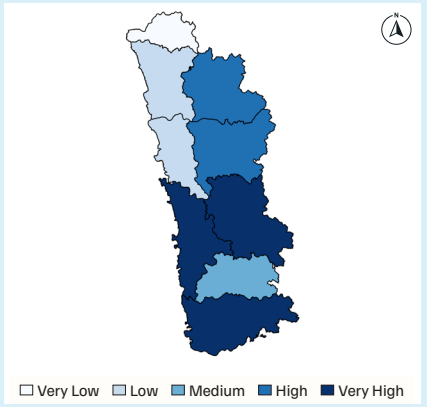
On average, the service sector contributed **49%,** industry sector **23%** and agriculture and allied activities contributed **28%** to Ratnagiri GDDP.

EXTREME SUMMER HEAT[3]



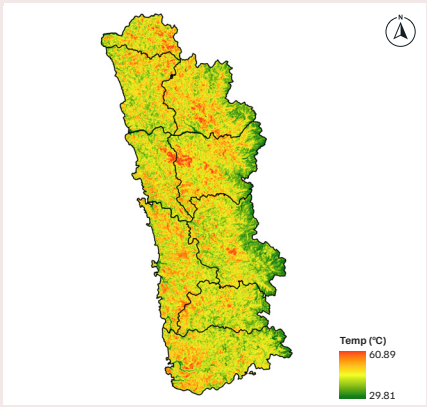
The tehsil of **Lanja** observes the highest exposure to extreme heat. It is expected to witness a **significant increase** in warm nights and hot days is projected for the near future period (2030–2050) compared to the past (1981–2010).

EXTREME RAINFALL[3]



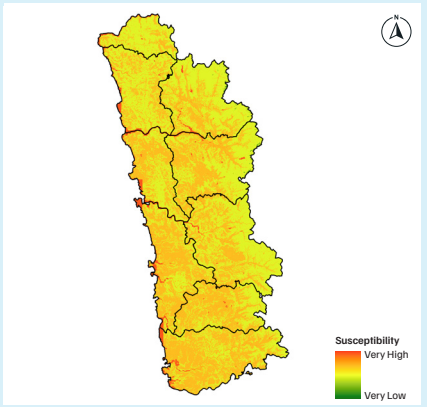
The tehsils of **Sangmeshwar, Ratnagiri, and Rajapur** observe the highest exposure to extreme rainfall, and are expected to witness a **1.5-fold** increase in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **29.81 to 60.89 °C.** The district has low surface temperature due to large tree cover (mango cultivations).

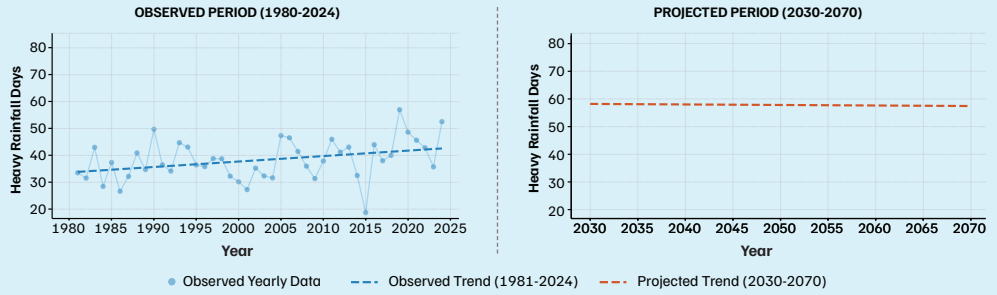
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility** primarily due to presence of vast green cover, while some areas across the western borders observes high susceptibility to flooding.

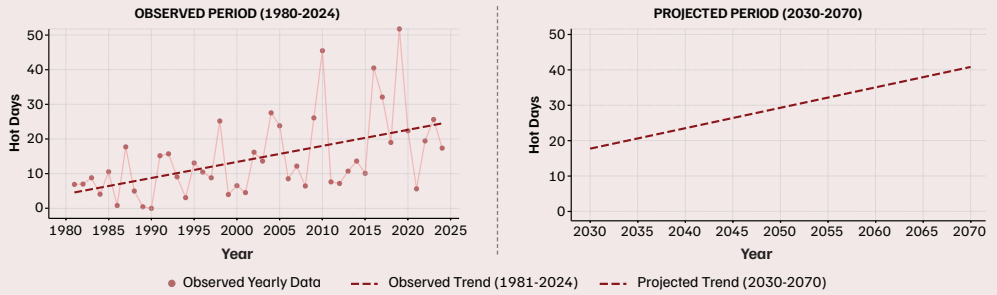
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



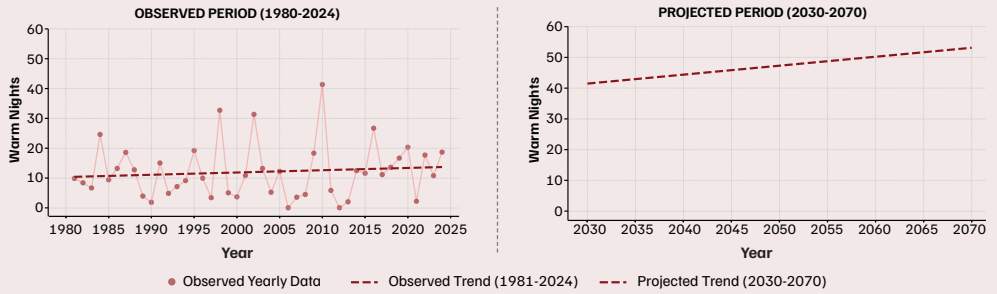
In **Ratnagiri,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **42 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **58 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Ratnagiri,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **20 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **23 days** in a year between **2030–2050** and **35 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In Ratnagiri, the number of **warm nights** has remained steady in recent decades from an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **45 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

ESCALATING HEAT RISK IN RATNAGIRI

Record heat in dense forest zones

Ratnagiri's vast forest industry faces severe wildfire and ecological risks after recording the state's highest historical average maximum temperature.

MANGO CULTIVATION AT RISK IN RATNAGIRI

Climate risks threaten Alphonso mango industry

Ratnagiri's global Alphonso mango industry faces severe risks from shifting weather patterns and extreme climate events.

RECOMMENDATIONS[5]

1

REDUCING HEAT-DRIVEN FOREST FIRE RISK

Reduce heat-driven forest fire risk by expanding early warning systems, fuel-load management, and rapid response capacity. Restore forests using native, heat- and drought-tolerant species to maintain canopy cover and ecosystem cooling.

2

COMMUNITY-LED CLIMATE-RESILIENT FOREST MANAGEMENT

Enhance forest connectivity and buffer zones to reduce heat stress, support species movement, and preserve microclimates and empower local and tribal communities in heat-resilient forest management through incentives, training, and co-management frameworks.

3

REGULATING DEVELOPMENT IN LANDSLIDE ZONES

Implement stringent land use regulations and development controls for critical infrastructure, including healthcare facilities, in landslide-prone areas to prevent slope destabilisation and ensure structural safety.

4

STRENGTHENING IPHS FOR HEALTH NETWORK RESILIENCE

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility accessibility and network capacity in landslide-prone regions through an online portal for real-time data-driven management.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

SINDHUDURG

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
5,207 sq km	163.17	2,09,839	78.39%	♂ 4,17,314 | 49.1% ♀ 4,32,337 | 50.9%



Water (2.17%) Built-up (3.25%) Crops (3.69%)
Trees (57.39%) Range Land (33.41%)

CASHEW & COCONUT PRODUCTION HUB

Sindhudurg contributes significantly to cashew nut and coconut production, supporting agro-processing industries.

MALVAN MARINE SANCTUARY

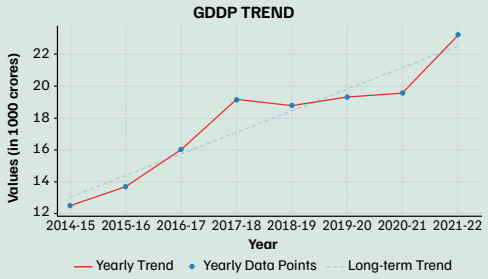
Houses rich coral biodiversity, marine life and has high ecotourism potential; one of Maharashtra's prime marine conservation zones.

LIVESTOCK ECONOMY SUPPORT

853,000 cattle recorded in district livestock census.

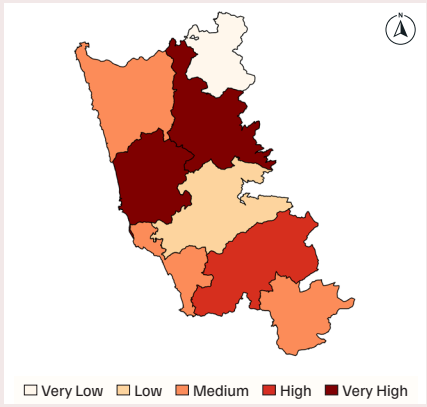
Source: MSDB Latur (msdb.gov.in)

GDP GRAPH[2]



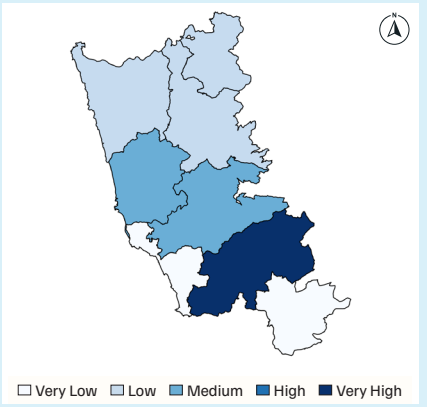
Sindhudurg's GDDP increased from **₹12,527 crore** in 2014–15 to **₹23,205 crore** in 2021–22, an overall growth of **85%** over 8 years. Sindhudurg contributed an average of **0.7%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **39%,** industry sector **22%** and agriculture and allied activities contributed **40%** to Sindhudurg's GDDP.

EXTREME SUMMER HEAT[3]



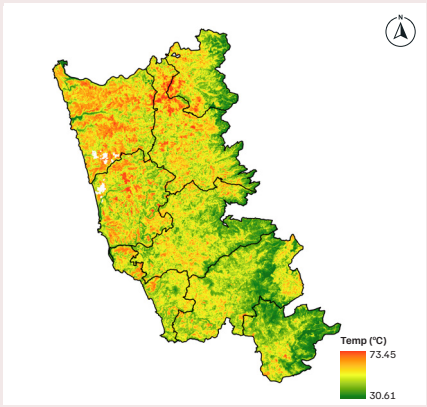
The tehsils of **Malwan and Kankavli** have the highest heat exposure, and can expect a **4-fold** increase in the number of warm nights and a **1.5** increase in the number of hot days in the future period (2030–2050).

EXTREME RAINFALL[3]



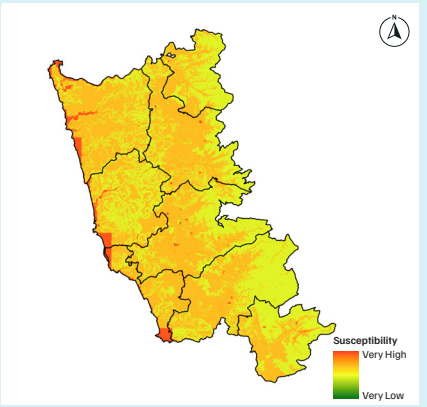
The tehsil of **Sawantwadi** has the highest exposure to extreme rainfall, and can expecting a **1.50-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past.

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **30.61 to 73.45 °C.** The district overall has low surface temperature with some areas like **Malwan and Devgad** exhibiting high surface temperatures.

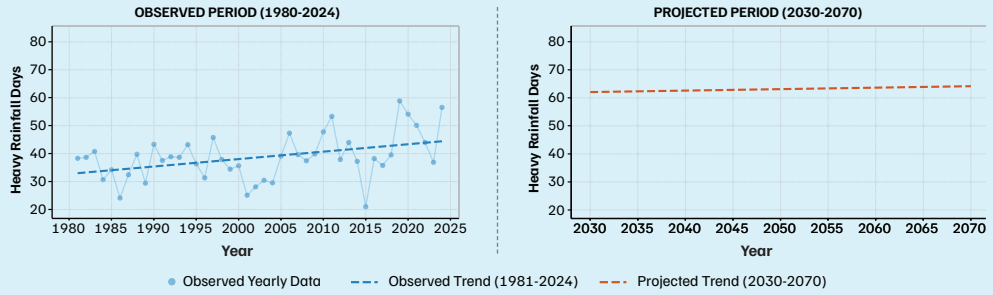
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility.** The western borders observes high susceptibility due to presence of water body in the region. The eastern coast observes low susceptibility.

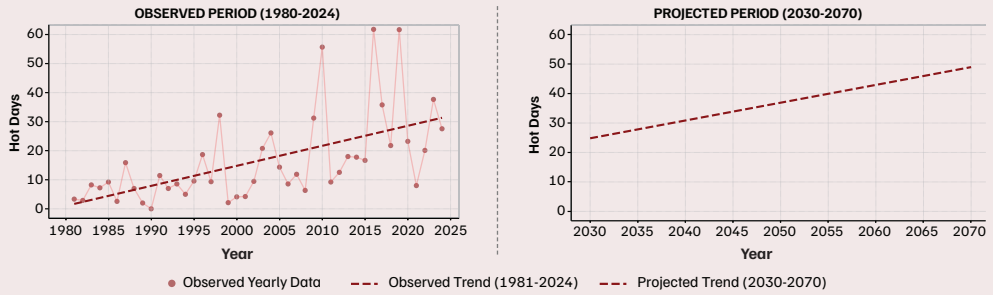
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



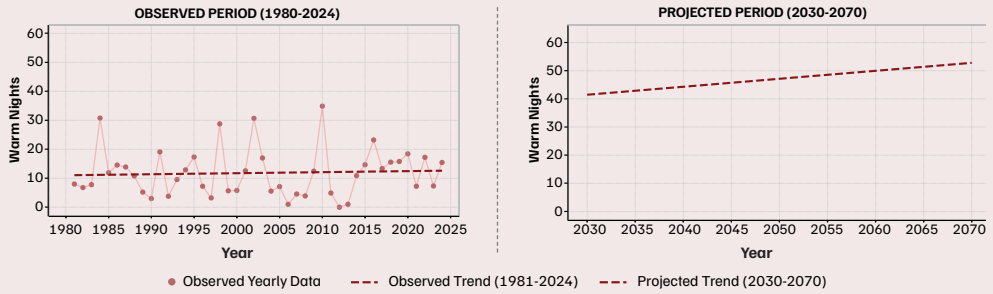
In **Sindhudurg,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **43 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **62 days** in a year between **2030–2050** and **64 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Sindhudurg,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **27 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **30 days** in a year between **2030–2050** and **43 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Sindhudurg,** the number of **warm nights** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **44 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

ESCALATING HEAT RISK IN SINDHUDURG

Agriculture facing rising temperatures

Sindhudurg has been facing a surge in extreme heat since 1971, which threatens the stability of its agriculture and allied sectors.

FOREST AREA AT RISK IN SINDHUDURG

Rising heat and coastal risks threaten forests

Sindhudurg faces threats to its forest cover as it records the state's highest increase in extreme heat days alongside risks from floods and cyclones.

RECOMMENDATIONS[5]

1

SUSTAINABLE COASTAL LIVELIHOODS

Empower coastal communities to undertake sustainable livelihoods like mariculture and ecotourism.

2

SCALING AQUACULTURE FOR LIVELIHOOD DIVERSIFICATION

Benefit from the new Aquaculture Mission to be launched to increase marine and fish production by 10x to 6 MMT, utilising inland, brackish water, and marine zones. Creating job opportunities in this allied sector will reduce dependence on traditional agriculture.

3

MANGROVE PROTECTION AND RESTORATION

Map vulnerable areas for trash entry into creeks and devise waste management strategies to protect mangroves. Evaluate carbon sequestration potential of wetlands and mangroves and explore restorative technologies.

4

RESTORING COASTAL ECOSYSTEMS THROUGH REGULATION

Design interventions to restore mangroves, wetlands, and corals by regulating tourism and waste disposal. Incorporate training on monitoring protocols into community-based monitoring designs.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

THANE

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
4,214 sq km	2,624.62	24,57,811	84.53%	♂ 58,65,078 | 53% ♀ 51,95,070 | 47%



Water (4.54%) Built-up (12.89%) Crops (17.08%)
Trees (17.47%) Range Land (47.87%)

LIVESTOCK BASED RURAL LIVELIHOODS

The district has about 1.25 million livestock which supports dairy-linked rural income.

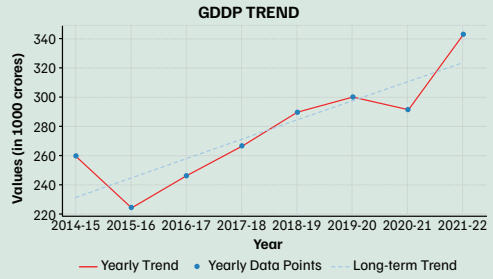
THANE CREEK FLAMINGO SANCTUARY

Wetlands serve as storm surge buffers, carbon sinks and migratory bird habitats, strengthening coastal ecosystem resilience.

INDUSTRIAL AND MANUFACTURING HUB

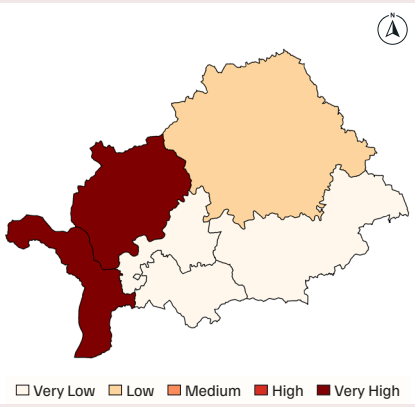
According to socio-economic statistics, Thane is the third most industrialised district in Maharashtra.

GDP GRAPH[2]



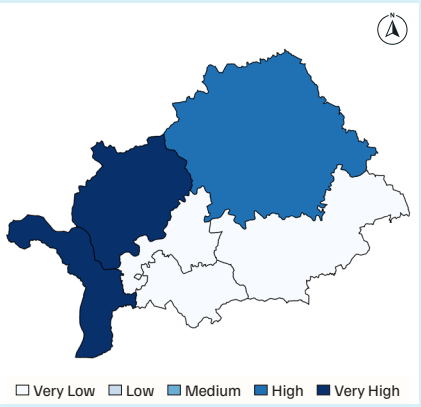
Thane's GDDP increased from **₹2,59,748 crore** in 2014-15 to **₹3,42,443 crore** in 2021-22, an overall growth of **32%** over 8 years. Thane contributed an average of **11.3%** to Maharashtra's GSDP, making it the **second-largest contributor.** On average, the service sector contributed **68%,** industry sector **31%** and agriculture and allied activities contributed only **1%** to Thane's GDDP.

EXTREME SUMMER HEAT[3]



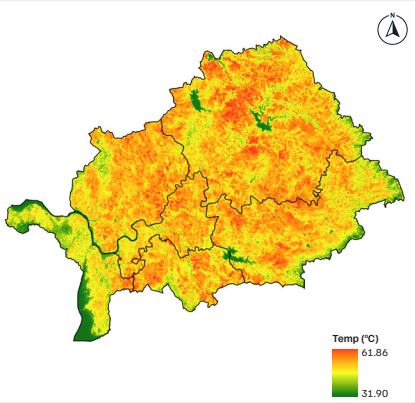
The tehsils of **Thane and Bhiwandi** have the highest exposure to extreme heat, witnessing a **4-fold** increase in the number of warm nights and a **1.5-fold** increase in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



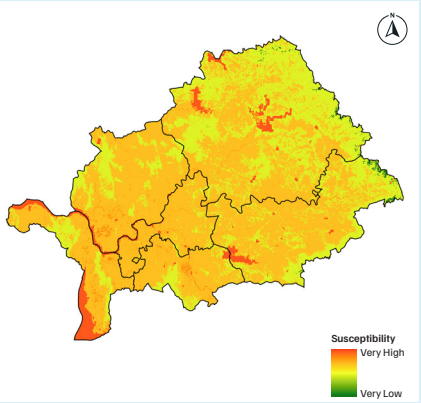
The tehsils of **Thane and Bhiwandi** have the highest exposure to extreme rainfall, witnessing a **2-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **31.90 to 61.86 °C.** Overall, it has **medium to high** surface Temperature, primarily observed due to urbanised areas in **Thane, Kalyan, Bhiwandi, and Ambarnath,** and vast rangelands in **Shahapur and Murbad**.

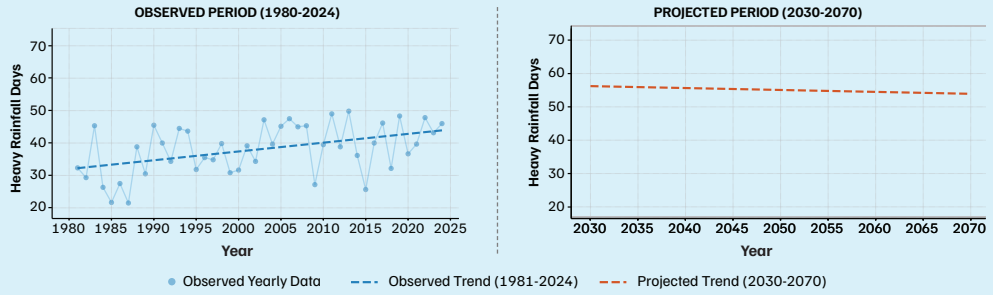
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility.** Tehsils near the Thane Creek observe high flood susceptibility due to low elevation. Tehsils such as **Thane** observe high susceptibility due to its proximity to the creek. A few areas in **Shahpur and Murbad** are also vulnerable due to the presence of water bodies.

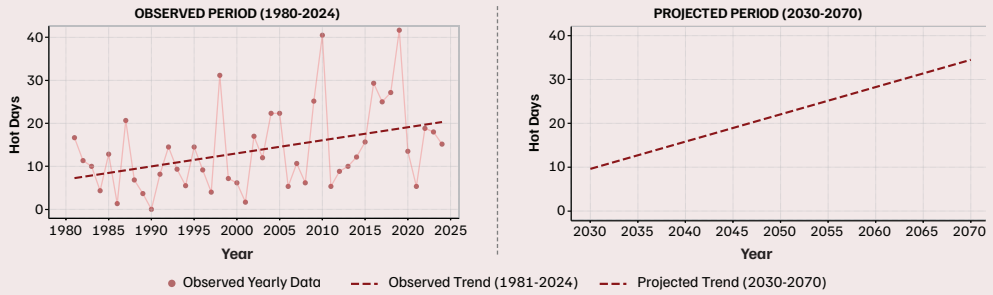
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



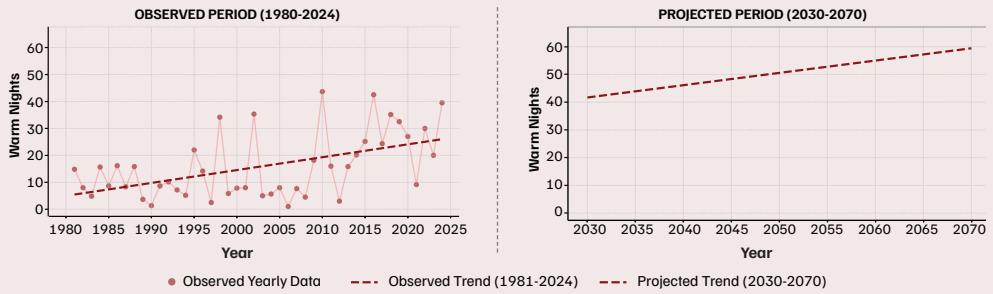
In **Thane,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **41 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **55 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Thane,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **18 days** in a year between **2011–2024.** Climate model projections show that this will initially **decrease** to an average of **16 days** in a year between **2030–2050** and increase to **28 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Thane,** the number of warm nights has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **24 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **47 days** in a year between **2030–2050** and **54 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEALTHCARE RISK IN THANE

Healthcare facilities in landslide zones

Thane's healthcare network is highly vulnerable with 47 medical facilities situated in zones susceptible to landslides.

HEAT RISK IN THANE

Urbanisation drives rising night temperatures

Thane's high urbanisation is accompanied by a trend of increasingly warm nights that impact the entire district.

RECOMMENDATIONS[5]

1

LANDSLIDE RISK-BASED PLANNING

Implement stringent land-use regulations and development controls for critical infrastructure, including healthcare facilities, in landslide-prone areas to prevent slope destabilisation and ensure structural safety.

2

STRENGTHENING IPHS FOR HEALTH NETWORK RESILIENCE

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility accessibility and network capacity in landslide-prone regions through an online portal for real-time data-driven management.

3

ENERGY-EFFICIENT COOLING UPGRADES

Replace or retrofit inefficient cooling equipment in public and private buildings. Conduct impact assessments of efficiency programmes and feasibility studies for district cooling.

4

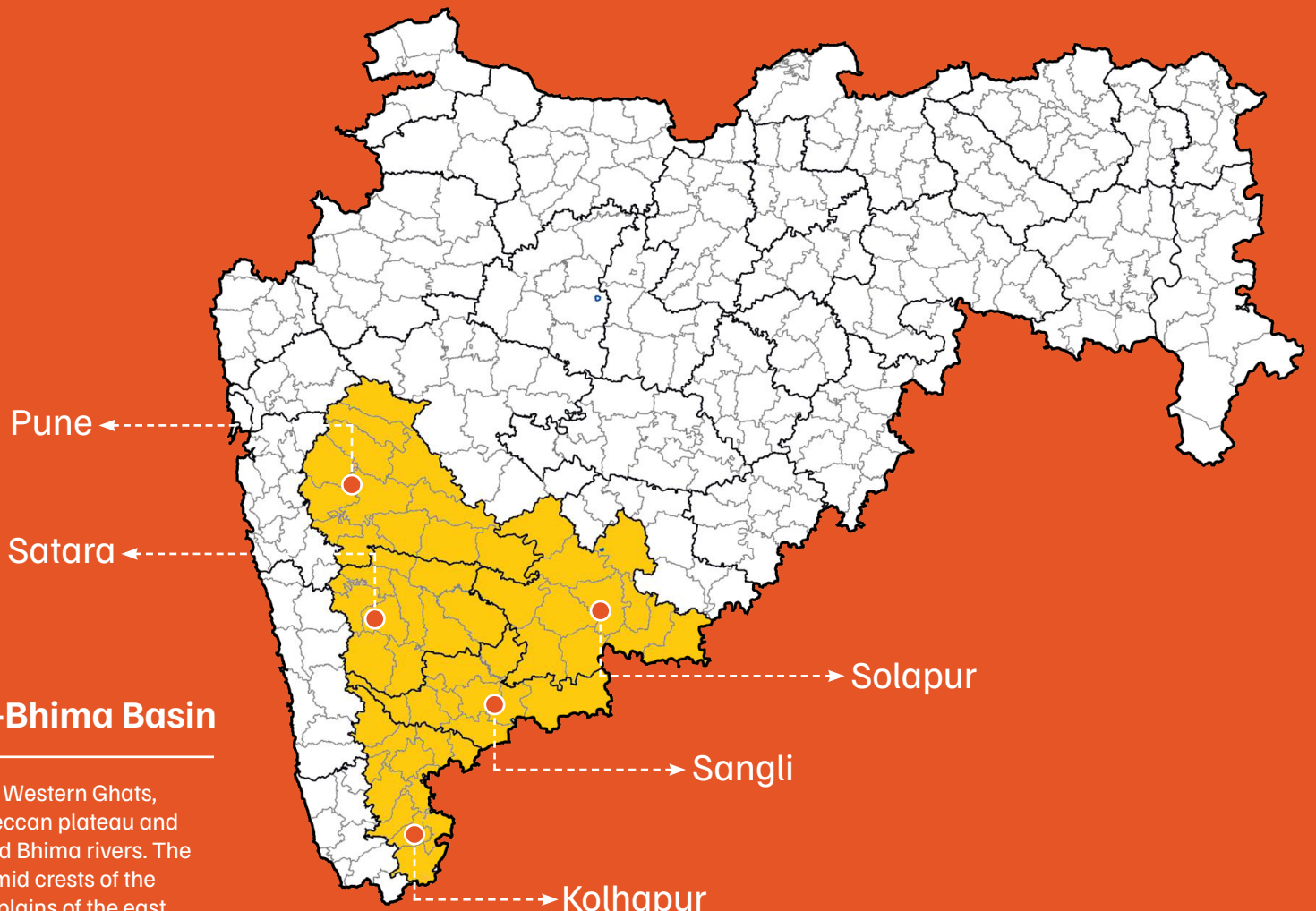
PASSIVE COOLING IN URBAN PLANNING

Integrate passive cooling solutions like cool roofing, cooling shelters, cool pavements in town planning to reduce urban heat islands.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

PASCHIM MAHARASHTRA (WESTERN MAHARASHTRA)

Pune Division



Also known as

Sugar Belt, Krishna–Bhima Basin

Located on the leeward side of the Western Ghats, this division consists of the high Deccan plateau and the fertile valleys of the Krishna and Bhima rivers. The landscape transitions from the humid crests of the Sahyadris to the semi-arid, rolling plains of the east.

HISTORIC IMPORTANCE

The region flourished as the administrative heart of the Peshwas, with Pune serving as the de facto capital of the Maratha Confederacy in the 18th century. It became a focal point for social reform in the 19th century under leaders like Mahatma Jyotirao Phule and Savitribai Phule, laying the groundwork for modern Indian education.

CUISINE

The food is practical and energy-dense, featuring bhakri (millet bread) and pithla, which suit the temperate climate and the physical demands of plateau farming. The use of peanut-based gravies provides the necessary proteins for a hardworking population.



COMMUNITY AND OCCUPATION

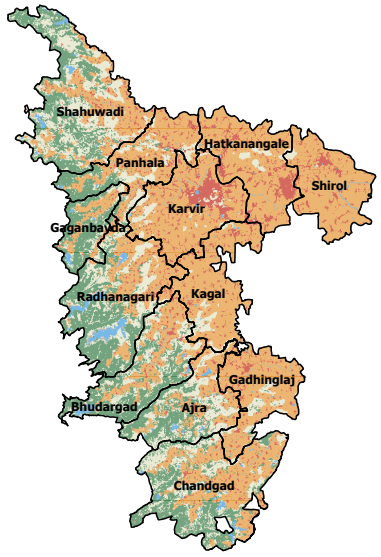
A robust agrarian and entrepreneurial class, including the Maratha and Dhangar communities, drives the region's economy. This is the nation's 'Sugar Belt', where advanced irrigation supports massive sugarcane cooperatives, alongside a global hub for the automobile and IT industries.

CLOTHING

The men's Puneri Pagadi (a stiff, ornate turban) is a symbol of intellect and status, often paired with a crisp white kurta and dhoti. Women traditionally favour the Paithani or high-quality silk sarees with the 'brahmani' tuck, which is designed for the temperate plateau weather.

KOLHAPUR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
7,692 sq km	503.90	8,40,240	72.91%	♂ 19,80,583 | 51.1% ♀ 18,95,418 | 48.9%



Water (2.24%) Built-up (7.28%) Crops (49.95%)
Trees (21.25%) Range Land (19.18%)

SUGARCANE PRODUCTION HUB

Kolhapur has one of the highest concentrations of **sugarcane cultivation,** with **43.56%** of the area under this crop.

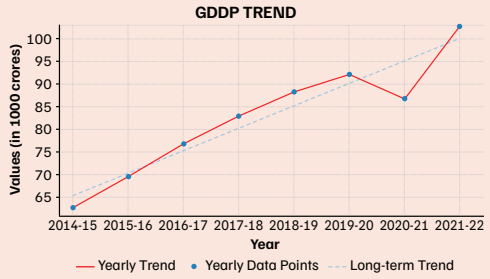
ICHALKARANJI: TEXTILE PRODUCTION HUB

Ichalkaranji, the 'Manchester of Maharashtra', is known for its high-quality textile production, especially in cotton.

PANHALA FORT

Nestled in the Sahyadris, **Panhala Fort** is a testament to Maharashtra's valour and glorious past, having played a key role in the iconic **Battle of Pavan Khind**.

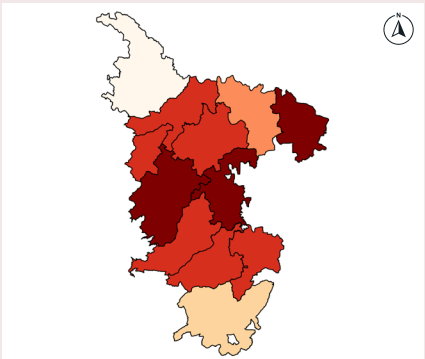
GDP GRAPH[2]



Kolhapur's GDDP increased from **₹62,746 crore** in 2014–15 to **₹1,02,515 crore** in 2021–22, an overall growth of **63%** over 8 years. Kolhapur contributed an average of **3.5%** to Maharashtra's GSDP between 2014–15 and 2021–22.

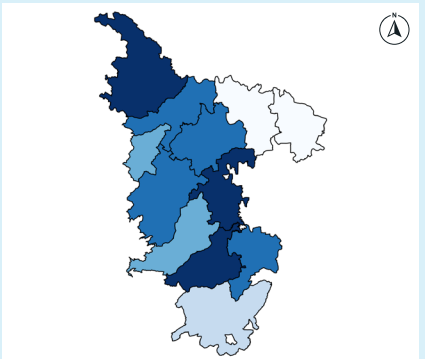
On average, the service sector contributed **58%,** industry sector **27%,** and agriculture and allied activities contributed **15%** to Kolhapur's GDDP.

EXTREME SUMMER HEAT[3]



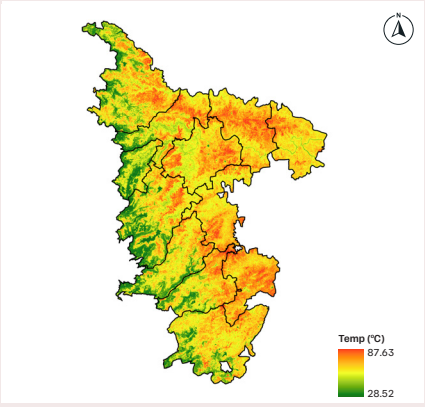
Radhanagari, Kagal, and Shirol experience the highest exposure to heat, and can expect a **3.5-fold increase** in the number of warm nights and a **2-fold increase** in the number of hot days in the future.

EXTREME RAINFALL[3]



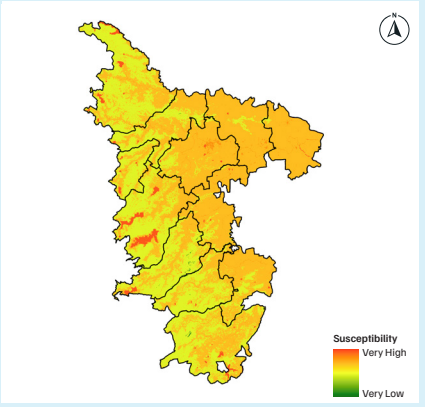
Ajra, Shahuwadi, and Kagal experience the highest exposure to rainfall, and can expect a **1.85-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past.

LAND SURFACE TEMPERATURE[3]



The district exhibits a thermal range from **28.52 to 87.63 °C**. High surface temperature are dominant in the **Shirol, Hatkanangale, and Karvir** tehsils due to intense urbanisation activities.

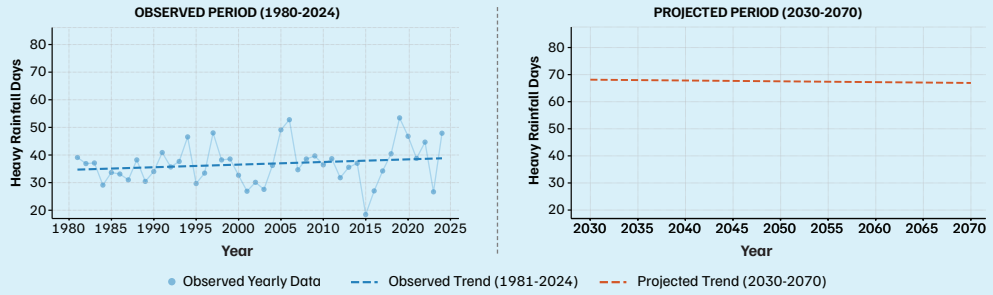
FLOOD SUSCEPTIBILITY[3]



Most of the tehsils have **low to medium flood susceptibility.** A few tehsils such as **Radhanagari, and Shahuwadi** have areas which observes high flood susceptibility due to presence of water bodies in the area and high rainfall, in Shahuwadi specially.

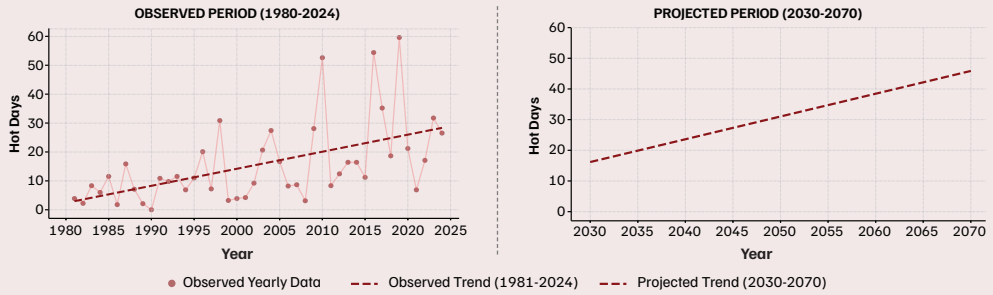
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



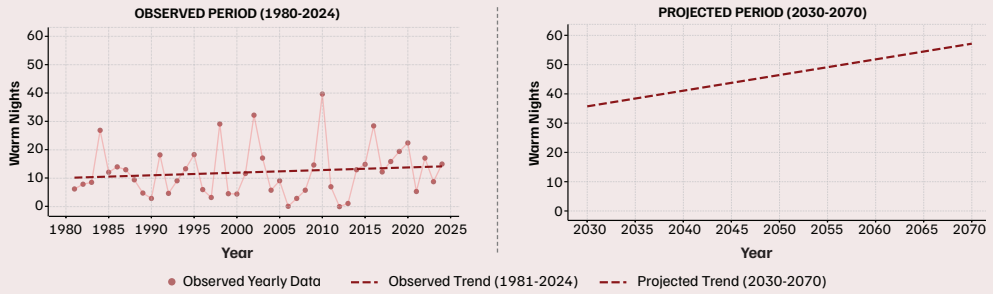
In **Kolhapur,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981-2024.** Climate model projections show that this will **increase** further and remain steady to an average of **68 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Kolhapur,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **24 days** in a year between **2011–2024.** Climate model projections show that this is expected to **remain steady** initially from an average of **23 days** in a year between **2030–2050** and later **increase** to an average of **38 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Kolhapur,** the number of warm nights has **remained steady** in recent decades with an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **41 days** in a year between **2030–2050** and **51 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEAT RISK IN KOLHAPUR

Agricultural risks from drought vulnerability

Kolhapur recorded the state's highest rate of increase in mean daytime temperatures, creating challenges for its agricultural industry.

URBAN GROWTH RISK IN KOLHAPUR

Urban growth drives rising heat risk

Rapid urban expansion and the growth of built-up areas between 2005 and 2023 have significantly increased heat risks across Kolhapur.

RECOMMENDATIONS[5]

1

PARAMETRIC INSURANCE FOR FARMERS

Expand parametric insurance with early-season dry-spell triggers to provide automatic payouts when rainfall fails immediately after sowing.

2

PROMOTING CLIMATE-RESILIENT FARMING PRACTICES

Subsidise short-duration, drought-tolerant seeds and promote soil-moisture conservation practices like mulching, ridge–furrow, farm ponds to farmers, in order to protect crops during post-sowing dry spells.

3

COMPREHENSIVE URBAN HEAT RISK MANAGEMENT

Mandate the strengthening of Heat Action Plans (HAPs) to comprehensively address urban-specific heat risk drivers, including warm nights, humidity, and building density, beyond just daytime temperatures.

4

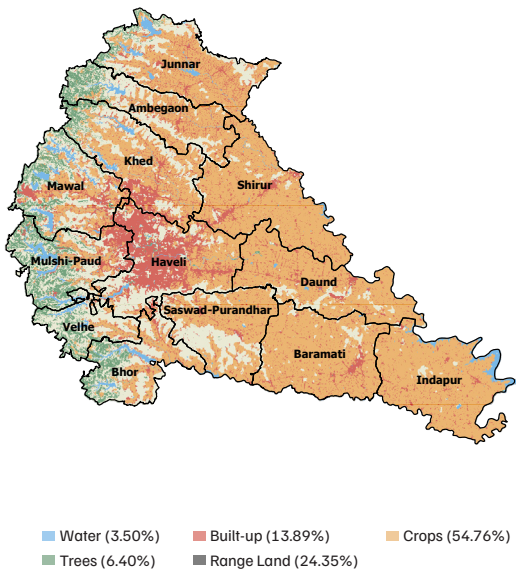
CLIMATE-RESPONSIVE URBAN PLANNING

Implement climate-responsive urban planning and design policies that integrate green infrastructure, cool surfaces, and optimised urban geometry to mitigate the urban heat island effect.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

PUNE

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
15,642 sq km	602.83	21,51,503	76.06%	♂ 49,23,973 | 52.2% ♀ 45,05,435 | 47.8%



INFORMATION TECHNOLOGY AND KNOWLEDGE ECONOMY

Pune is a major **IT and knowledge hub,** with large IT parks in **Hinjewadi, Hadapsar, Magarpatta etc.**

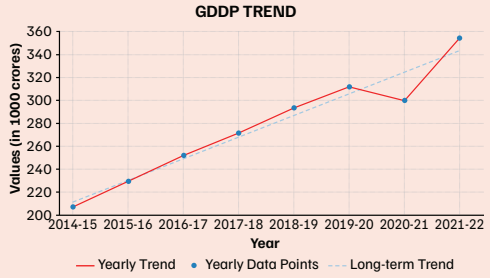
AUTOMOBILE AND MANUFACTURING HUB

Pune has emerged as a major multi-sector production and services hub in automobiles and auto components, engineering, electronics and electricals, pharmaceuticals and food processing.

AGRICULTURE AND AGRO-PROCESSING CLUSTER

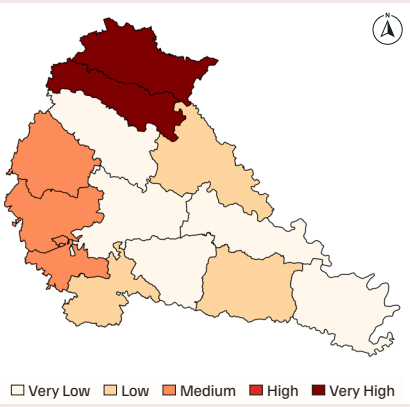
Pune has a diversified agricultural base with cereals taking up **71% of total crop area** and also hosts a strong network of agro-processing units.

GDP GRAPH[2]



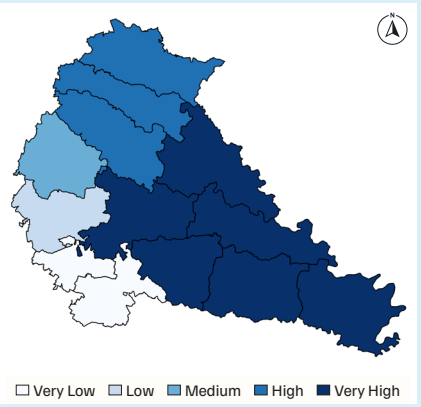
Pune district's GDDP increased from **₹2,06,930 crore** in 2014-15 to **₹3,54,299 crore** in 2021-22, an overall growth of **71%** over 8 years. Pune district contributed an average of **11.6%** to Maharashtra's GSDP, making it the **third-largest contributor.** On average, the service sector contributed **63%,** industry sector **29%** and agriculture and allied activities contributed **8%** to Pune's GDDP.

EXTREME SUMMER HEAT[3]



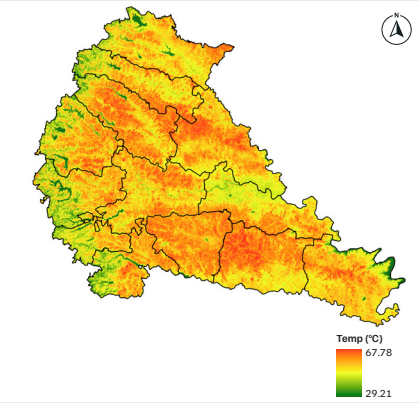
The tehsils of **Junnar and Ambegaon** observe the highest exposure to extreme heat. It is expected to witness a **3.5-fold increase** in the number of warm nights and a **1.25-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



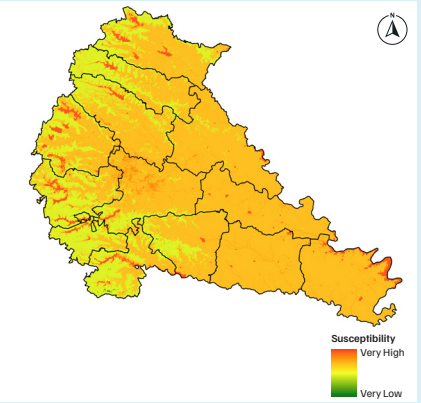
The tehsils of **Shirur, Daund, Haveli, Saswad-Purandhar, Baramati, and Indapur** observe highest exposure to extreme rainfall. Climate models show a **2.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010.

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **29.21 to 67.78 °C.** Most of the tehsils have medium to high surface temperature like in **Saswad-Purandhar, Shirur, and Baramati.** However, the western part of the district has low surface temperature due to the presence of forest and water bodies.

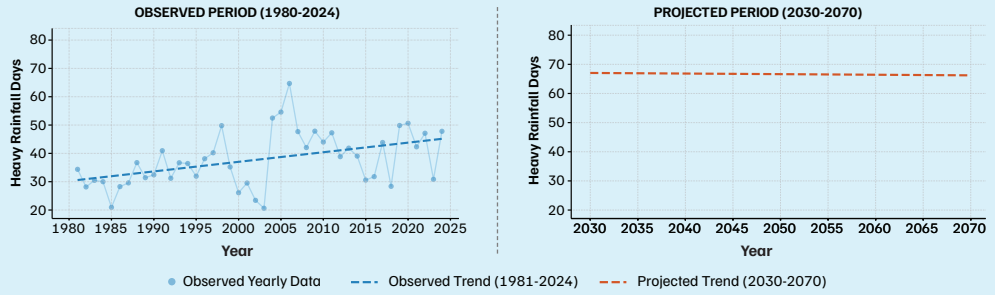
FLOOD SUSCEPTIBILITY[3]



Most of the district has very low to medium flood susceptibility. However, the north-western part of the district, close to the water bodies, has **high flood susceptibility** areas in **Junnar, Ambegaon, Khed, Mawal, Mulshi-Paud, Velbe, and Bhor tehsils.**

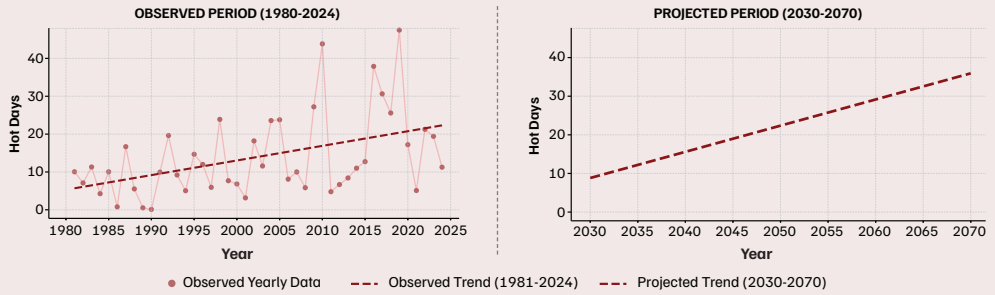
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



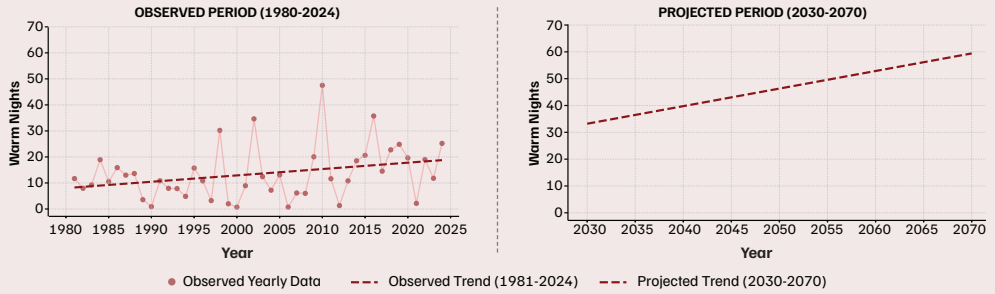
In **Pune,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **41 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **67 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Pune,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **19 days** in a year between **2011–2024.** Climate model projections show that this will initially **decrease** to an average of **15 days** in a year between **2030–2050** and later **increase** to an average of **29 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Pune,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **17 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **40 days** in a year between **2030–2050** and **52 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

URBAN GROWTH RISK IN PUNE

Urban growth intensifies heat risk

Pune's rapid urban expansion and increase in built-up areas have significantly intensified the district's exposure to heat risks.

TOURISM AT RISK IN PUNE

Warming nights impact local tourism

Pune's growing frequency of warm nights and rising temperatures threatens the viability of its significant tourism sector.

RECOMMENDATIONS[5]

1

CLIMATE-RESPONSIVE URBAN PLANNING

Implement climate-responsive urban planning and design policies that integrate green infrastructure, cool surfaces, and optimised urban geometry to mitigate the urban heat island effect.

2

STRENGTHENING HEAT EARLY WARNING SYSTEMS

Develop and disseminate robust early warning systems with last-mile connectivity, incorporating relative humidity and percentile-based temperature forecasts to prevent heat-related illnesses.

3

SHIFTING TOURISM TO COOLER MONTHS

Reorient Pune's tourism strategy to prioritise non-heat months through curated festivals, heritage walks, and nature experiences aligned with cooler seasons. Use differential pricing, event calendars, and promotional incentives to shift tourist demand away from peak summer months and reduce heat exposure.

4

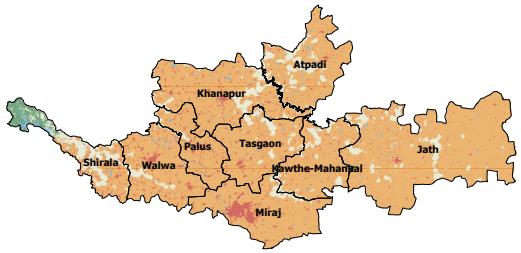
PUBLIC-PRIVATE PARTNERSHIPS FOR TOURISM INFRASTRUCTURE

Establish PPP-based tourism management organisations to manage operations, end-to-end infrastructure, ensuring all-weather connectivity and world-class amenities.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

SANGLI

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
8,572 sq km	329.23	5,98,386	72.62%	♂ 14,35,475| 50.9% ♀ 13,86,668 | 49.1%



Water (0.98%) Built-up (5.87%) Crops (81.15%)
Trees (1.39%) Range Land (10.61%)

YASHWANTRAO CHAVAN SAGARESHWAR WILDLIFE SANCTUARY

Spanning approximately **10.87 sq. km.,** this is one-of-a-kind man-made sanctuary with rich biodiversity.

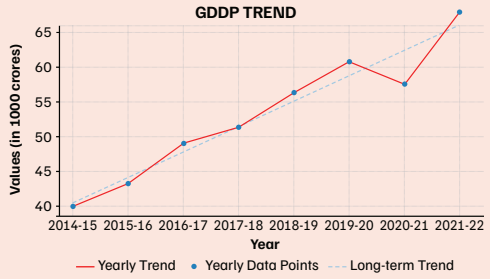
GRAPE & RAISIN PRODUCTION HUB

Tasgaon and **Miraj talukas** lead the district in grape production and are even known for exports.

TURMERIC BASE OF MAHARASHTRA

The district, known for its turmeric production, has developed dedicated cultivation clusters.

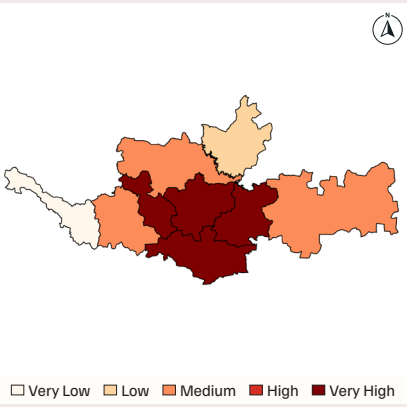
GDP GRAPH[2]



Sangli's GDDP increased from **₹39,953 crore** in 2014-15 to **₹67,844 crore** in 2021-22, an overall growth of **70%** over 8 years.

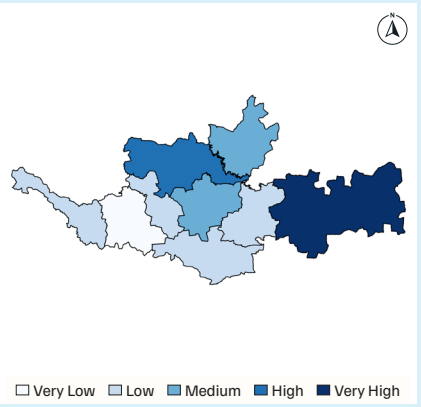
Sangli contributed an average of **2.2%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **51%,** industry sector **24%,** and agriculture and allied activities contributed **26%** to Sangli's GDDP.

EXTREME SUMMER HEAT[3]



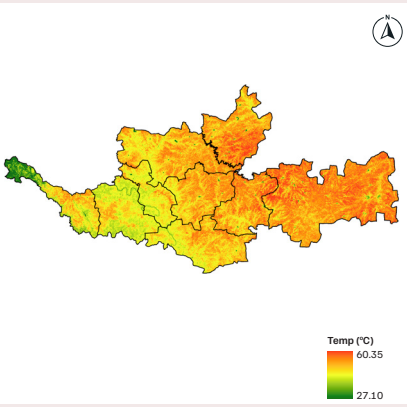
The tehsils of **Miraj, Kawthe-Mahankal, Tasgaon, and Palus** observe the highest exposure to extreme heat. Climate models show that these tehsils will witness a **4-fold increase** in the number of warm nights and a **1.5 to 2-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



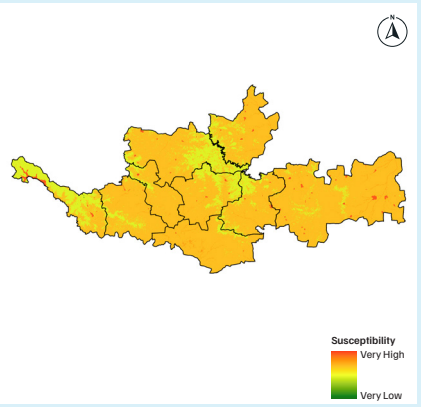
The tehsil of **Jath** observes the highest exposure to extreme rainfall. It is expected to witness a **2.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **27.10 to 60.35 °C.** The district has medium to high surface temperature. **Jath and Atpadi** tehsils have areas which observes high surface temperature temperature primarily driven by vast agricultural fields.

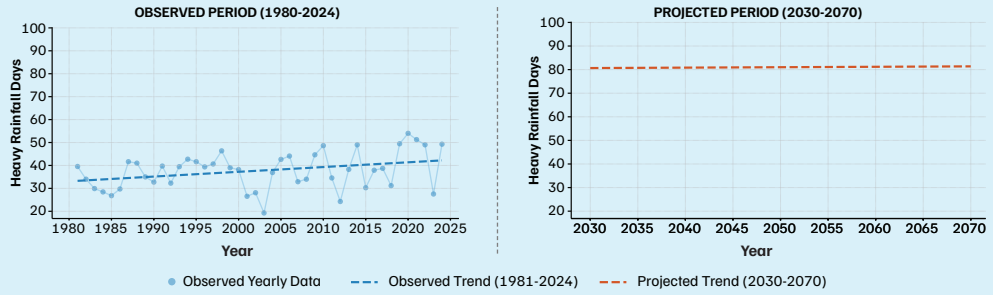
FLOOD SUSCEPTIBILITY[3]



The district has very **low to medium flood susceptibility.** The central and the eastern part of the district observed very low flood susceptibility. Few areas in close proximity to water bodies in **Jath** tehsil have high flood susceptibility.

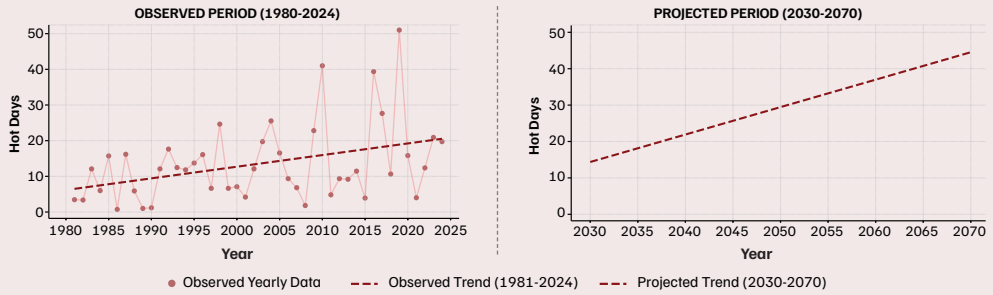
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



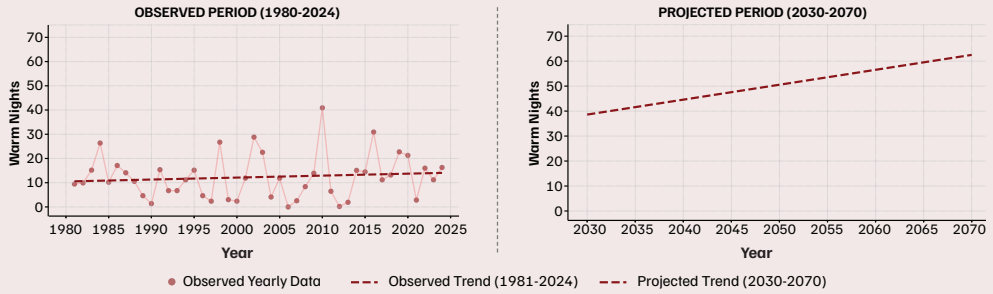
In **Sangli,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **40 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **81 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Sangli,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **17 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **21 days** in a year between **2030–2050** and **37 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Sangli,** the number of **warm nights** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **45 days** in a year between **2030–2050** and **55 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

AGRICULTURAL RISK IN SANGLI

Erratic rainfall destabilises agriculture

Sangli's agricultural industry faces instability due to a high frequency of both severe rainfall deficits and damaging excess rainfall years.

MANUFACTURING AT RISK IN SANGLI

Manufacturing risks from severe drought

Sangli's manufacturing sector faces significant operational risks due to the district's very high vulnerability to prolonged drought.

RECOMMENDATIONS[5]

1

PARAMETRIC INSURANCE FOR FARMERS

Expand parametric insurance with early-season dry-spell triggers and severe extreme rainfall to provide automatic payouts when rainfall fails immediately after sowing or damages the crop.

2

PROMOTING CLIMATE-RESILIENT FARMING PRACTICES

Subsidise short-duration, drought-tolerant seeds or flood-tolerant crop varieties and promote soil-moisture conservation practices like mulching, ridge–furrow, farm ponds to farmers in order protect crops during post-sowing dry spells.

3

INDUSTRIAL PREPAREDNESS FOR WATER RISKS

Require industries to adopt water-scarcity contingency plans, including production flexibility, supplier diversification, and insurance against water-related disruptions.

4

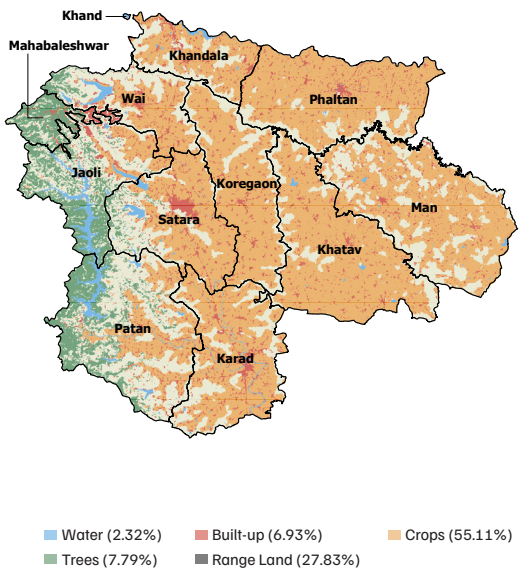
SMART WATER ALLOCATION AND MONITORING SYSTEMS

Introduce priority-based water allocation and real-time monitoring for industrial use during scarcity periods to prevent over-extraction and conflicts.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

SATARA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
10,480 sq km	286.62	6,53,735	74.1%	♂ 15,10,936 | 50.3% ♀ 14,92,805 | 49.7%



MAHABALESHWAR STRAWBERRY AGRO-TOURISM

A former summer capital of Old Bombay Presidency, Mahabaleshwar remains a popular tourist destination for urban escape, blending tourism with its well-known strawberry growing heritage.

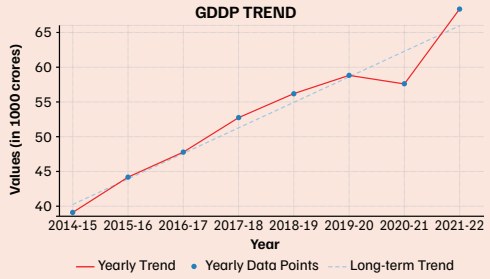
KAS PATHAR : PLATEAU OF FLOWERS

39 flowering species are found in the region, accounting for around **6% of red data species,** making it an ecologically sensitive zone to be safeguarded for its rare and endangered flora.

LONAND ONION MARKET YARD

Lonand Market Yard in Khandala taluka is one of Maharashtra's prominent onion trading hubs. It plays a key role in regional procurement, storage, and price formation.

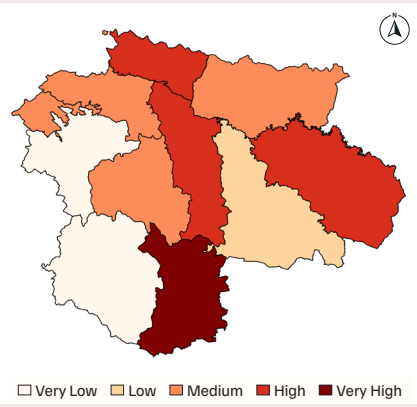
GDP GRAPH[2]



Satara's GDDP increased from **₹39,085 crore** in 2014–15 to **₹68,343 crore** in 2021–22, an overall growth of **75%** over 8 years.

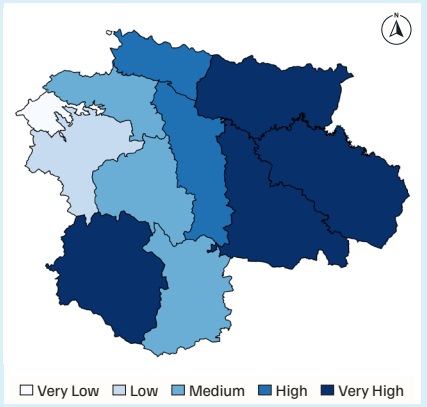
Satara contributed an average of **2.2%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **54%,** industry sector **25%** and agriculture and allied activities contributed **21%** to Satara's GDDP.

EXTREME SUMMER HEAT[3]



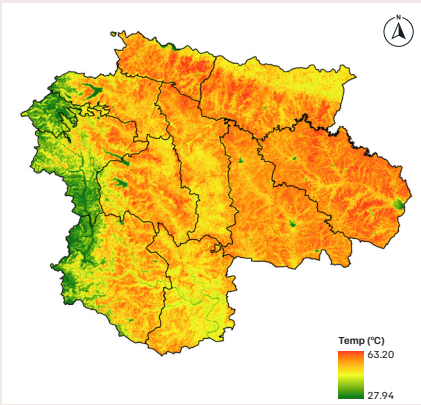
The tehsil of **Karad** has the highest exposure to extreme heat, expected to witness a **4-fold increase** in the number of warm nights and a **1.5-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



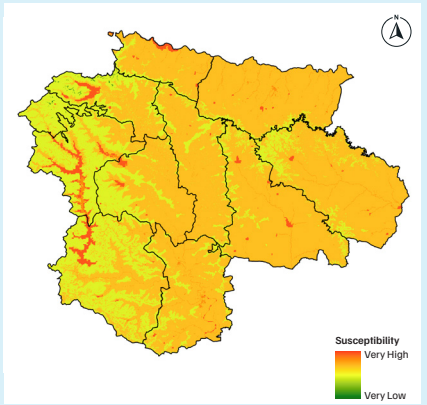
The tehsils of **Man, Khatav, and Phaltan,** observe the highest exposure to extreme rainfall. These tehsils are expected to witness a **2.5-fold increase, while Patan can expect** a **2-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **27.94 to 63.20 °C.** The district has **medium to high surface temperature. Khanldala, Phaltan, Man, and Khatav** tehsil observes high surface temperature. Due to presence of large tree cover on the western borders of the district, low surface temperatures are experienced in **Patan, Jaoli,** and **Mahabaleshwar**.

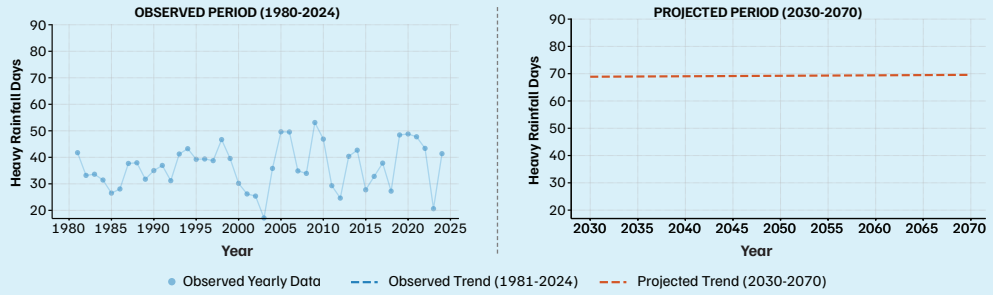
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility.** The western borders have very low susceptibility due to presence of green cover in the region. A few areas along the river are highly susceptible to floods due to their low elevation in the flood plains.

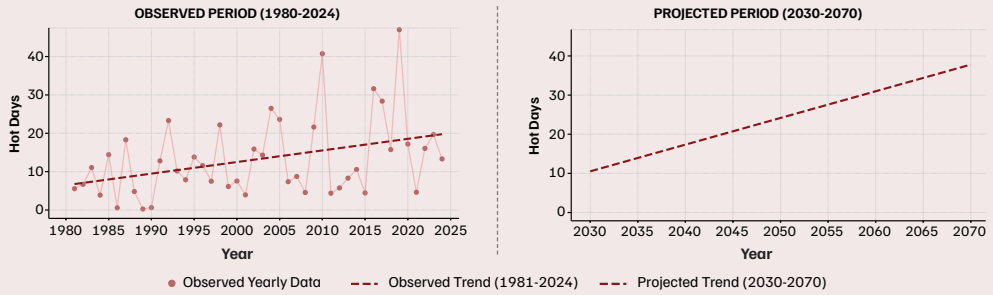
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



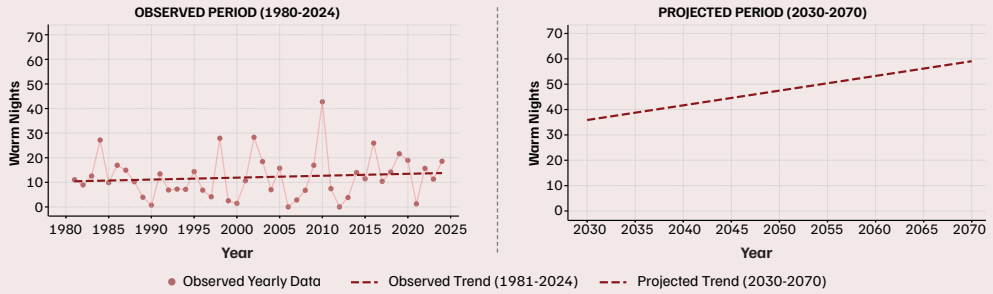
In **Satara,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **36 days** in a year between **1981–2010** to **37 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **70 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Satara,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will **remain steady** initially to an average of **17 days** in a year between **2030–2050** and **increase** to an average of **31 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Satara,** the number of **warm nights** has **remained steady** in recent decades from an average of **12 days** in a year between **1981-2024.** Climate model projections show that this will **increase** further to an average of **42 days** in a year between **2030–2050** and **52 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEALTHCARE RISK IN SATARA

Healthcare facilities in landslide zones

Satara's healthcare network is highly vulnerable with 23 medical facilities situated in zones susceptible to landslides.

DROUGHT RISK IN SATARA

Drought risk to manufacturing industry

Satara's manufacturing sector faces high operational risks due to the district's significant vulnerability to recurring drought conditions.

RECOMMENDATIONS[5]

1

STRENGTHENING IPHS FOR HEALTH NETWORK RESILIENCE

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility accessibility and network capacity in landslide-prone regions, through an online portal for real-time data-driven management.

2

REGULATING DEVELOPMENT IN LANDSLIDE ZONES

Implement stringent land-use regulations and development controls for critical infrastructure, including healthcare facilities, in landslide-prone areas to prevent slope destabilisation and ensure structural safety.

3

ALTERNATIVE WATER SOURCES FOR INDUSTRY

Promote alternative water sources for industries—treated wastewater, rainwater harvesting, and shared storage—through cluster-based infrastructure and pricing incentives.

4

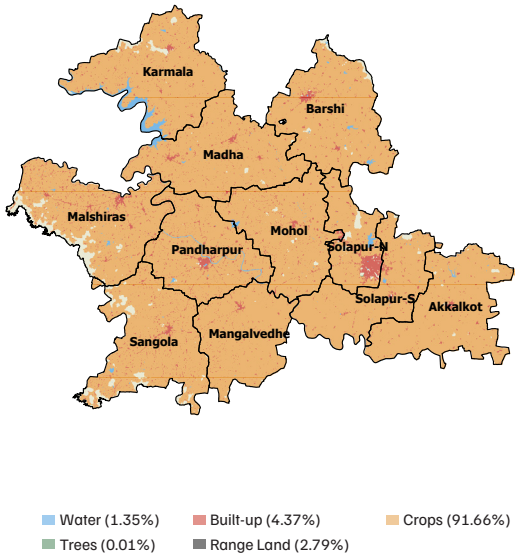
INDUSTRIAL WATER EFFICIENCY

Mandate water audits and incentivise recycling, reuse, and zero-liquid-discharge systems, to reduce industrial dependence on scarce freshwater.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

SOLAPUR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
14,895 sq km	289.88	8,73,167	67.41%	♂ 22,27,944 | 51.6% ♀ 20,89,812 | 48.4%



HANDLOOM AND POWERLOOM INDUSTRY

There are around **6,000 powerloom industries,** which sustain the district's iconic **Solapuri Chaddar** weaving tradition.

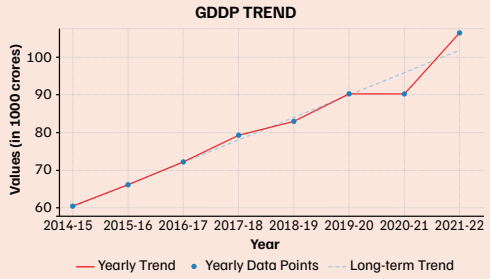
POMEGRANATE EXPORT CONTRIBUTION

Solapur district contributes almost **50% of India's pomegranate exports,** and produces the **'Bhagwa'** variety in large volume.

AKKALKOT – PILGRIMAGE TOURISM HUB

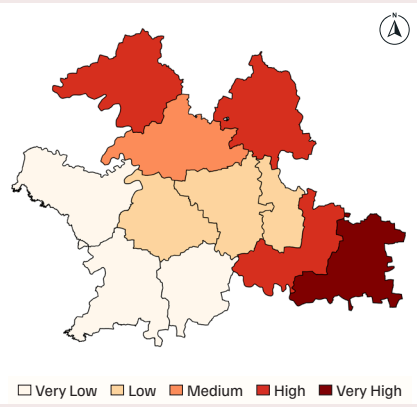
Akkalkot is a major pilgrimage centre anchored by the Shri Swami Samarth Maharaj Temple, attracting thousands of devotees daily and significantly larger footfall during festivals.

GDP GRAPH[2]



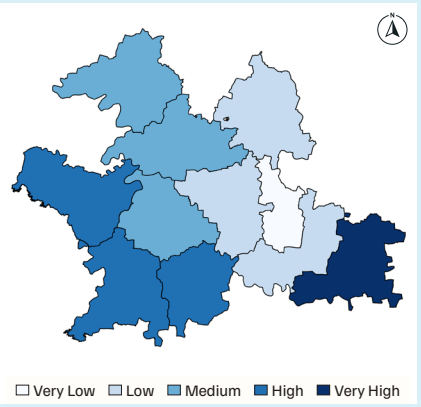
Solapur's GDDP increased from **₹60,447 crore** in 2014–15 to **₹1,06,408 crore** in 2021–22, an overall growth of **76%** over 8 years. Solapur contributed an average of **3.4%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **54%,** industry sector **26%,** and agriculture and allied activities contributed **20%** to Solapur's GDDP.

EXTREME SUMMER HEAT[3]



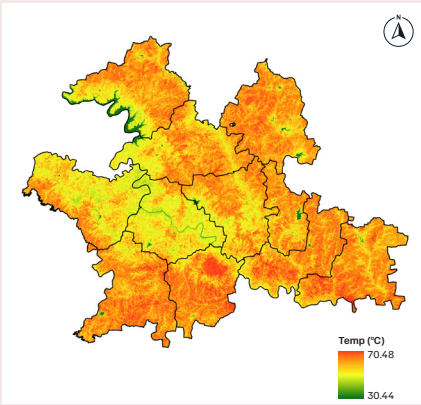
The tehsil of **Akkalkot** experiences the highest exposure to extreme heat. Climate models project that it is expected to witness a **4.5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



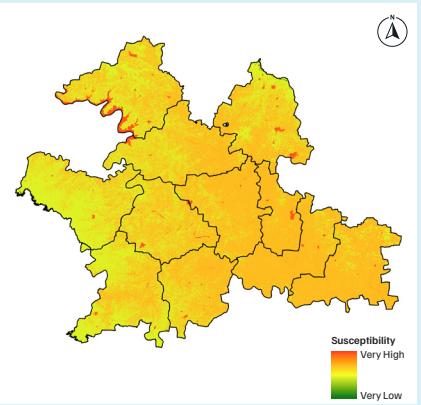
The tehsil of **Akkalkot** also has the highest exposure to extreme precipitation, and is expected to witness a **3-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **30.44 to 70.48 °C.** The district overall has high to very high surface temperature, especially in **Akkalkot, Solapur-South, Solapur-North, Sangola, and Mangalvedhe.** This might be due to the presence of vast agricultural land with high solar absorption soils.

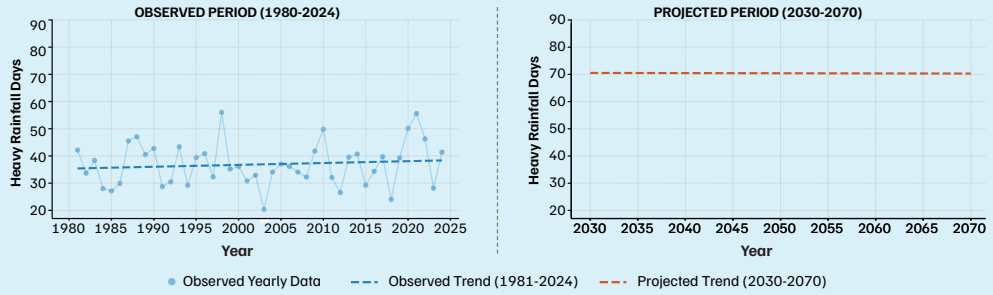
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility.** The western borders have low susceptibility. Flood susceptible areas are predominantly observed in the south-western part of the district.

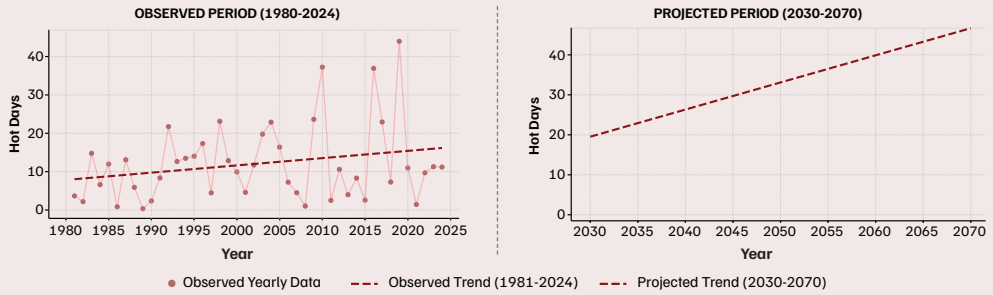
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



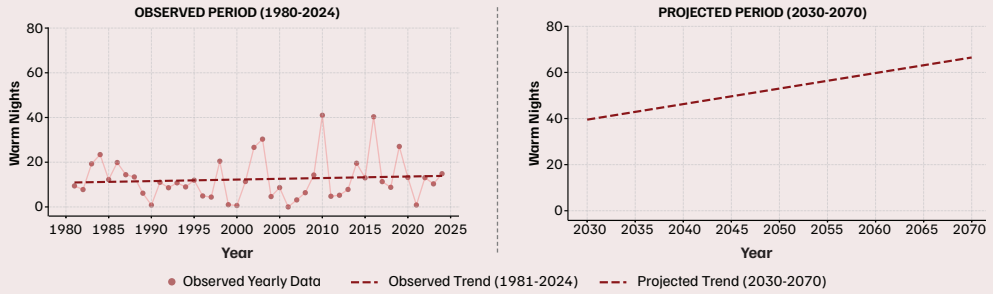
In **Solapur,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **36 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **71 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Solapur,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **26 days** in a year between **2030–2050** and **40 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Solapur,** the number of **warm nights** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **46 days** in a year between **2030–2050** and **59 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

WATER RISK IN SOLAPUR

Severe drought and water scarcity risk

Solapur faces severe systemic challenges as a district with very high water risk and extreme vulnerability to prolonged drought.

AGRICULTURE RISK IN SOLAPUR

Extreme rainfall variability threatens agriculture

Solapur's agricultural industry faces instability due to a high frequency of both severe rainfall deficits and damaging excess rainfall years.

RECOMMENDATIONS[5]

1

RESTORING WATER STORAGE AND RECHARGE SYSTEMS

Restore tanks and reservoirs, promote groundwater recharge, and improve canal efficiency, to stabilise water availability during consecutive low-rainfall years.

2

REDUCING DROUGHT VULNERABILITY IN AGRICULTURE

Reduce drought vulnerability through water-efficient crops, and diversified livelihoods supported by early- warnings and risk insurance. Ensure income stability under prolonged dry conditions.

3

PROMOTING MICRO-IRRIGATION FOR CASH CROPS

Scale up micro-irrigation systems for cash crops, like sugarcane in Marathwada and central Maharashtra as it is the second largest sugarcane producer in India.

4

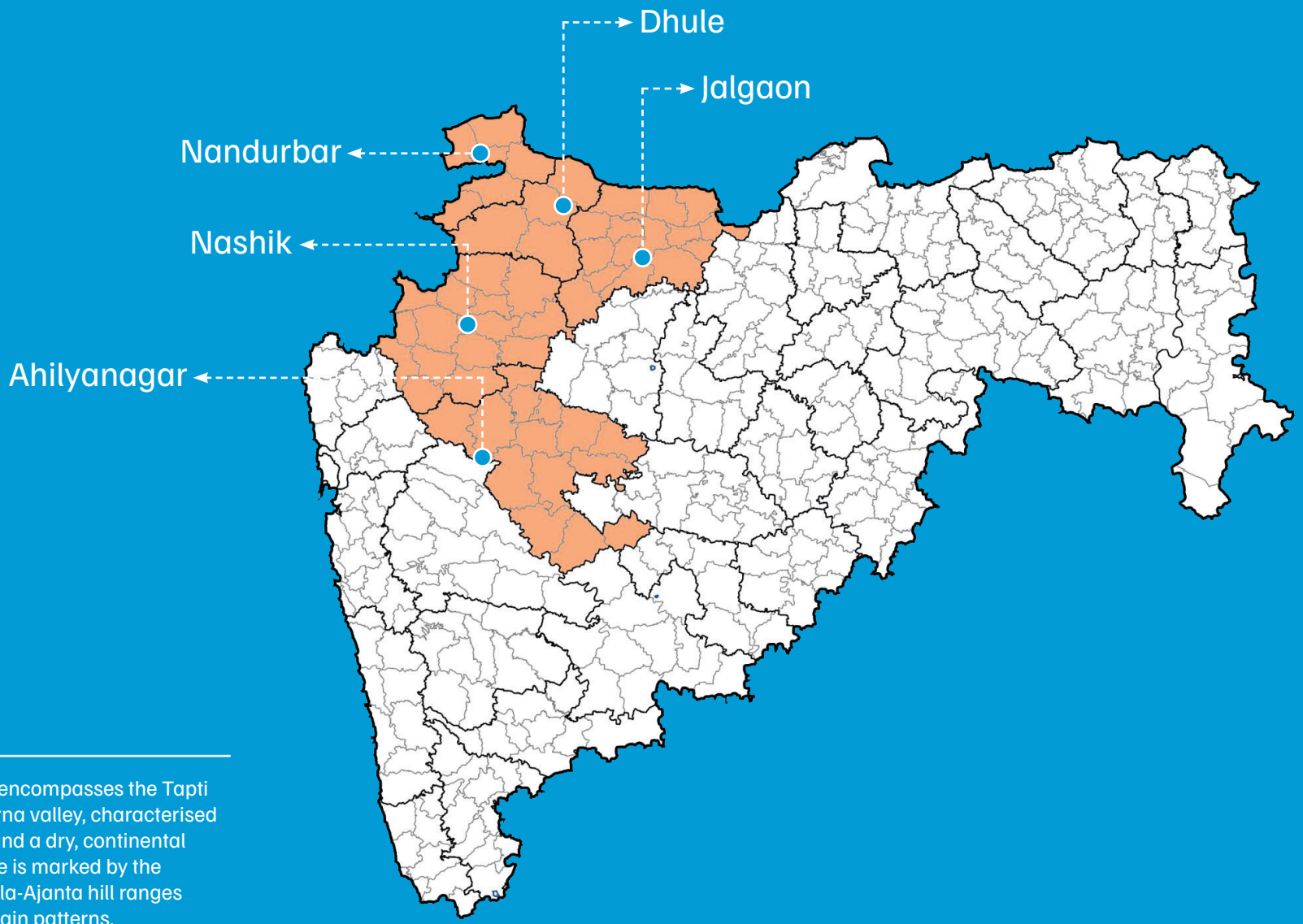
RESILIENT AGRICULTURE AND ALLIED LIVELIHOODS

Spread the adoption of heat-tolerant pulses and millets while promoting allied livelihoods like pisciculture and cattle farming and strengthening the industrial ecosystem with a focus on cotton, sugar, and, oil-cake manufacturing.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

KHANDESH (UTTAR MAHARASHTRA)

Nashik Division



Also known as

Tapti Basin

This northern division encompasses the Tapti River basin and the Girna valley, characterised by black basaltic soil and a dry, continental climate. The landscape is marked by the presence of the Satmala-Ajanta hill ranges which influence local rain patterns.

HISTORIC IMPORTANCE

Historically known as Khandesh, the region prospered under the Farooqui dynasty and later became a vital administrative centre under the Mughal Empire due to its location on the trade route to Delhi. Nashik itself gained immense importance as a cultural and Vedic learning centre on the banks of the holy Godavari river.

CUISINE

The cuisine is famous for its 'Khandeshi' spice profile, notably the fiery Kala Masala, which helps regulate body temperature in the dry heat. Sun-dried staples and legumes are preferred, as they are easily preserved in the low-humidity environment.



COMMUNITY AND OCCUPATION

The division is a mosaic of Leva Patil farmers and various Adivasi communities like the Bhils and Pawras in the hilly tracts. It is the premier hub for viticulture (grapes) and onion production in India, benefitting from the well-drained volcanic soil.

CLOTHING

Men often wear a Munda (a simpler, sturdy turban) and a long-sleeved sadra to protect against the sun. The women's sarees are often draped in a way that provides a pocket for carrying harvest tools, using earthy tones that mirror the basaltic landscape. In the tribal belts of the Satpura, colourful beadwork and heavy silver jewellery are common.

AHILYANAGAR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
17,048 sq km	266.49	9,30,024	69.38%	♂ 23,43,042 | 51% ♀ 22,00,117 | 48%



SUGARCANE AND COOPERATIVE MILLS

Ahilyanagar is a leading sugarcane producing district with multiple cooperative sugar factories supporting rural employment.

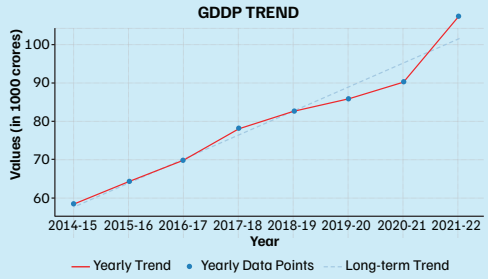
AHMEDNAGAR FORT HERITAGE

Ahmednagar Fort is an important historical fort significant in medieval Deccan history and later colonial periods.

KALSUBAI PEAK

It is the highest peak in Maharashtra, at about 1,646 metres in the Sahyadri ranges and is often called the **"Everest of Maharashtra."**

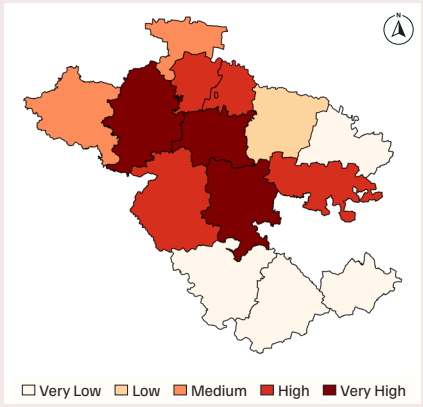
GDP GRAPH[2]



Ahilyanagar's GDDP increased from **₹58,256 crore** in 2014–15 to **₹1,07,479 crore** in 2021–22, an overall growth of **85%** over 8 years.

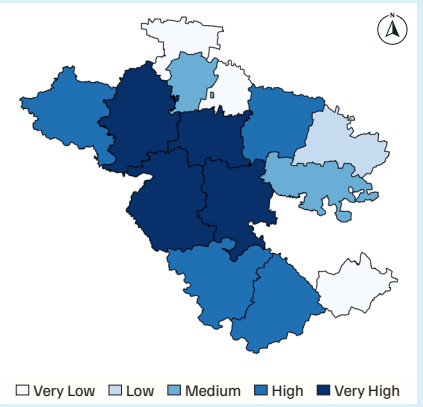
The district contributed an average of **3.3%** to Maharashtra's GSDP between 2014-15 and 2021-22. On average, the service sector contributed **49%,** agriculture and allied activities **28%** and industry sector contributed **23%** to Ahilyanagar's GDDP.

EXTREME SUMMER HEAT[3]



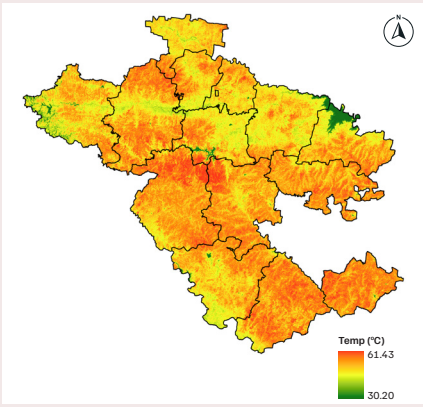
Nagar, Rahuri, and Sangamner tehsils have the highest exposure to heat, expected to witness a **4-fold increase** in the number of warm nights and **2-fold increase** in the number of hot days in the near future period (2030–2050) compared to the past trends (1981-2010).

EXTREME RAINFALL[3]



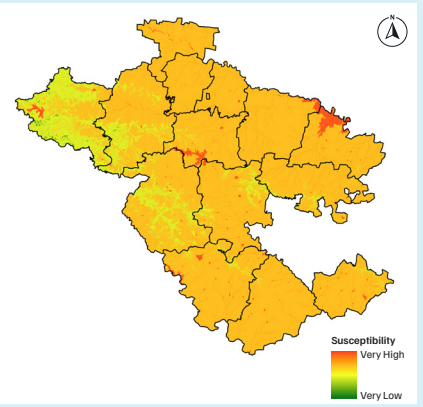
Rahuri, Parner, and Sangamner tehsils have the highest exposure to extreme rainfall. These tehsils are expected to witness a **2.5-fold increase** in the number of heavy rainfall days in the near future (2030–2050) compared to the past trends (1981-2010).

LAND SURFACE TEMPERATURE[3]



The average surface temperature in the district varies between **30.20 and 61.43 °C.** Tehsils such as **Nagar, Parmer and Karjat** exhibit highest surface temperature due to low forest cover, extensive basaltic rocky plains that retain heat and high levels of urban concrete saturation.

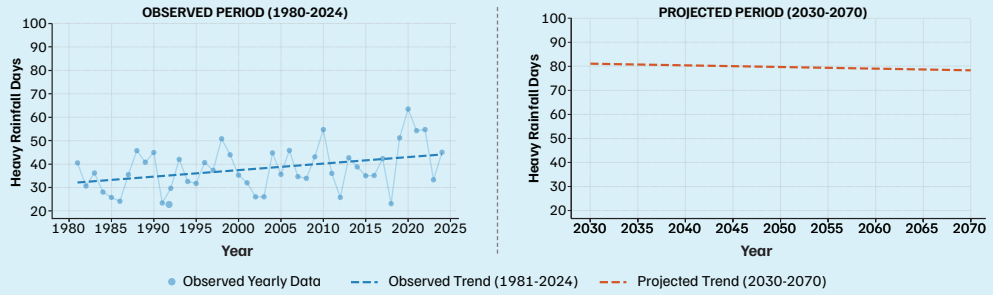
FLOOD SUSCEPTIBILITY[3]



Few areas in **Shevgaon, Rahuri, Newasa, and Akole** observes the highest flood susceptibility as compared to other tehsils. This is primarily due to their close proximity to the water bodies present in the areas.

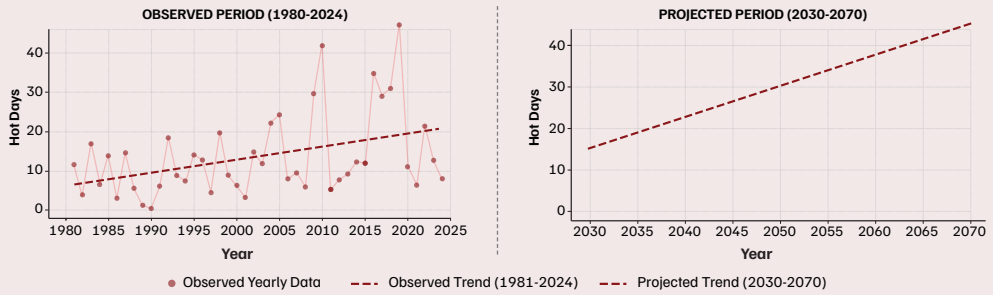
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



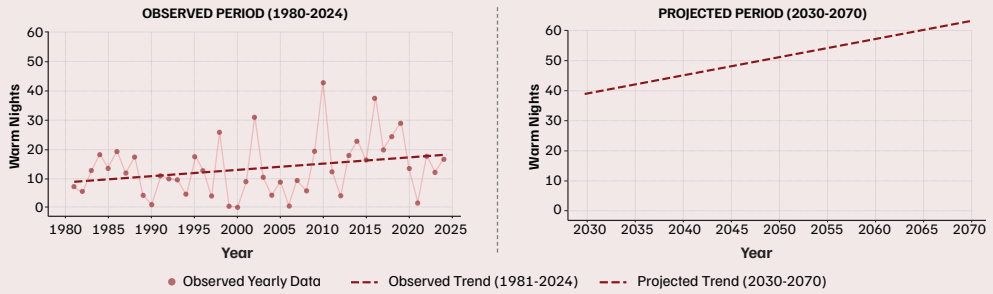
In **Ahilyanagar,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **41 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **80 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Ahilyanagar,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **18 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **22 days** in a year between **2030–2050** and **37 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Ahilyanagar,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **18 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **46 days** in a year between **2030–2050** and **56 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

DROUGHT RISK IN AHILYANAGAR

Dairy production at risk

Severe drought vulnerability in Ahilyanagar now threatens the district's status as a top dairy producer in Maharashtra.

PRODUCTIVITY RISK IN AHILYANAGAR

Livestock and poultry under climate stress

Rising temperatures and diminishing water resources are creating a shortage of fodder and drinking water, impacting livestock health and output.

RECOMMENDATIONS[5]

1 STRENGTHENING FARMERS

Utilise of **National Livestock Mission,** helping farmers to apply online via the NLM Udyamimitra portal.

2 SUBSIDISING FODDER AND FEED

Strengthening **fodder and animal feed distribution programme** gives fodder seeds (e.g., for grass/ herbage) with 100% subsidy up to a certain limit per hectare at the local Zilla Parishad Animal Husbandry office.

3 PARAMETRIC INSURANCE FOR CATTLE

Launch a government **heat-stress parametric insurance for cattle,** where if temperature in a taluka exceeds a pre-defined threshold for 6 or more consecutive days, there is automatic payout per animal, without loss assessment.

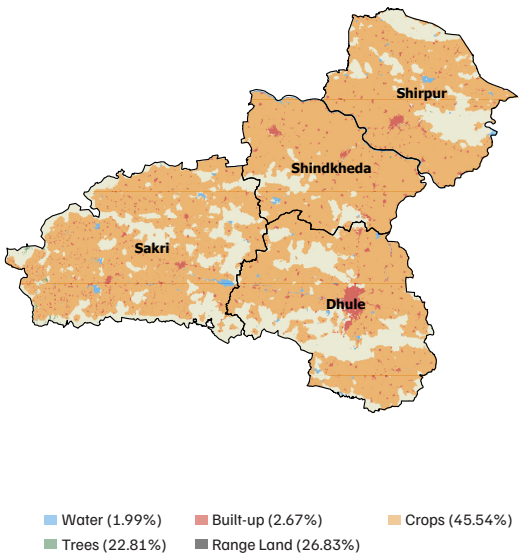
4 BUILDING WATER RESILIENCE

Spread awareness about water-related schemes like **Jalyukt Shivar or PMKSY** by block agriculture/ watershed officer for water security during summer months.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

DHULE

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
7,195 sq km	285.04	4,08,874	63.09%	♂ 10,53,886 | 51.4% ♀ 9,96,976 | 48.6%



LALING FORT

Laling Fort in Dhule is an old hilltop fort in ruins, once used for defence: now visited for its scenic views and trekking.

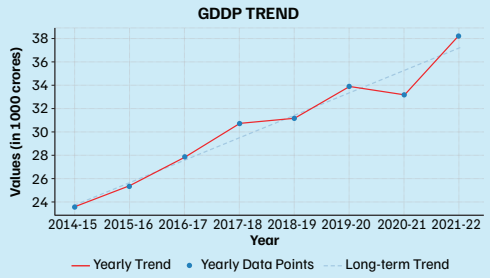
ANER DAM SANCTUARY

Aner Dam Sanctuary in Shirpur taluka of Dhule district covers around **83 sq km** and supports many **wildlife and bird species,** including migratory birds. Visitors come for birdwatching, wildlife sightings and nature walks.

RENEWABLE ENERGY HUB

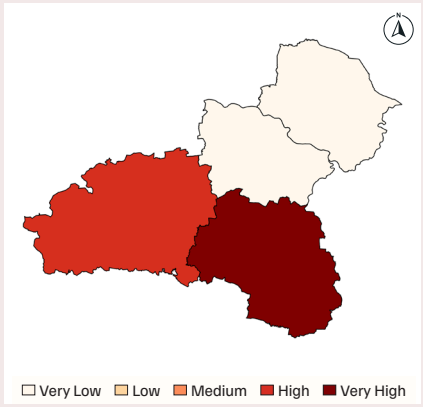
Dhule district is emerging as a **renewable energy hub,** with projects such as the Sakri solar project and other hybrid wind-solar installations due its high solar potential and available land.

GDP GRAPH[2]



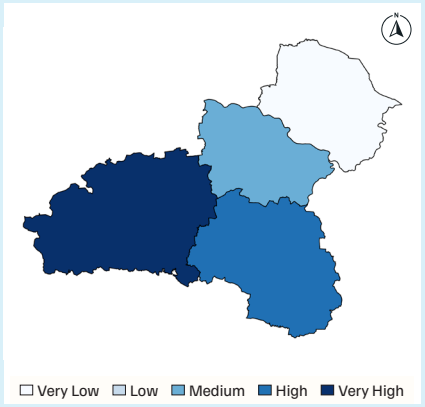
Dhule's GDDP increased from **₹23,620 crore** in 2014–15 to **₹38,304 crore** in 2021–22, an overall growth of **62%** over 8 years. Dhule contributed an average of **1.3%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **53%,** industry sector **25%** and agriculture and allied activities contributed **22%** to Dhule's GDDP.

EXTREME SUMMER HEAT[3]



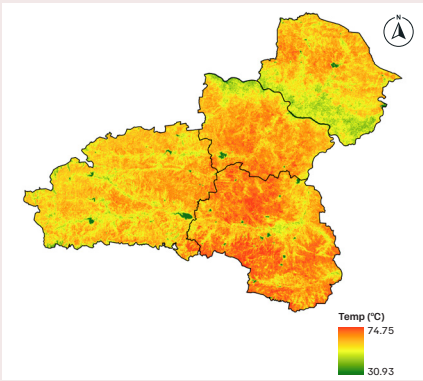
Dhule tehsil observed the highest exposure to heat. The number of **warm nights** is expected to witness **4 fold increase,** and the number of **hot days** is projected to rise by **1.5-fold** in the near future period (2030-2050) compared to the past (1981-2010)

EXTREME RAINFALL[3]



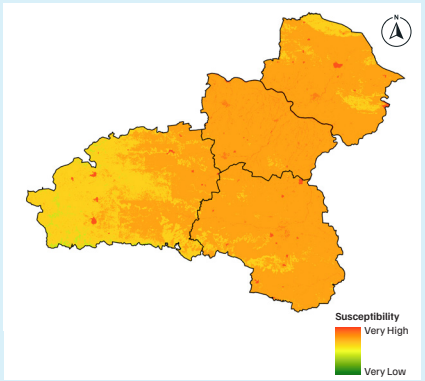
In the **Sakri** tehsil, there is a projected **increase** in extreme rainfall events. The number of **heavy rainfall days** is expected to **increase** by **1.5-fold** in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits the surface temperature range from **30.93 to 74.75 °C.** Tehsils like **Dhule and Shindkheda** experience 'Very High' surface temperature due to their location in the **Tapi Valley,** where deep black cotton soils absorb intense solar radiation.

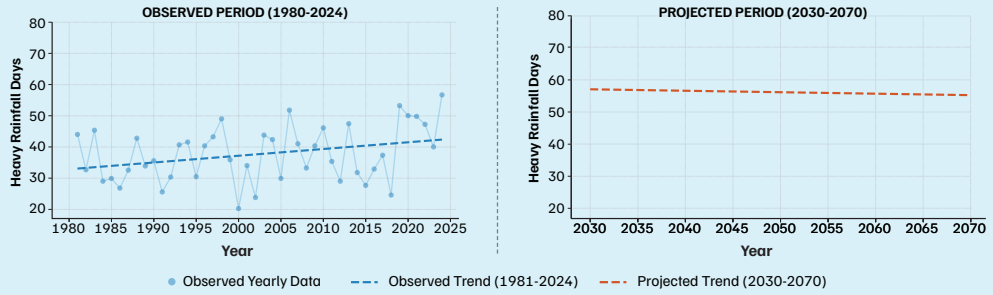
FLOOD SUSCEPTIBILITY[3]



Shirpur, Dhule, and Shindkheda tehsils are the most susceptible because they occupy the low-lying, flat alluvial plains that receive massive runoff from the steep Satpura ranges. These areas face severe inundation during monsoon peaks because the impermeable basaltic lithology and highly silted river beds limit natural drainage.

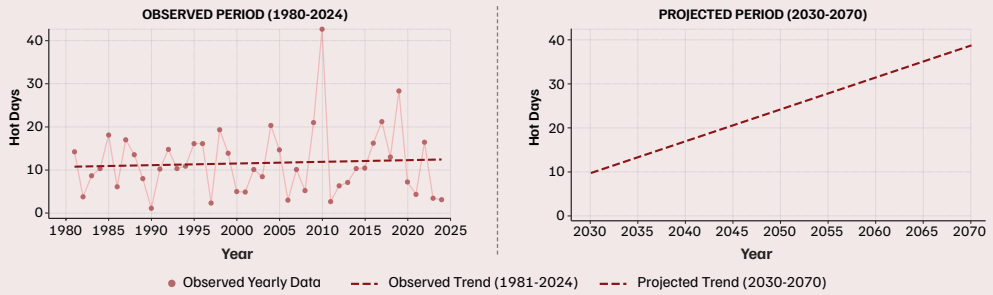
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



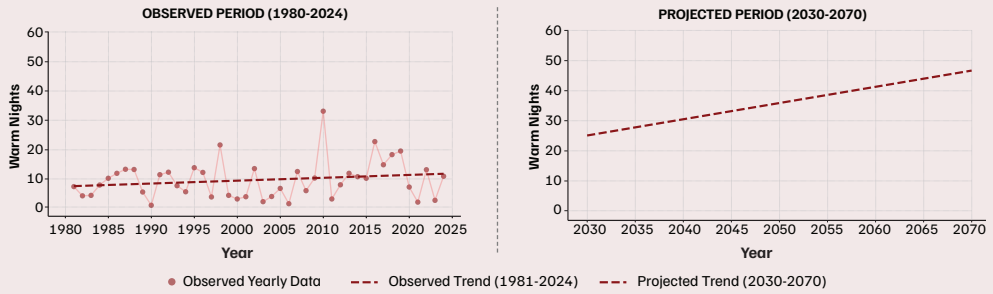
In **Dhule,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **40 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **57 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Dhule,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **16 days** in a year between **2030–2050** and **32 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Dhule,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **15 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **44 days** in a year between **2030–2050** and **59 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

HEALTHCARE RISK IN DHULE

Healthcare infrastructure lacks disaster preparedness

Dhule is a vulnerable district for healthcare, as its facilities face drought risk while lacking essential disaster management plans.

MANUFACTURING AT RISK IN DHULE

Manufacturing productivity under heat stress

Dhule's prominent manufacturing sector faces increasing operational risks due to the district's status as a high-heat zone.

RECOMMENDATIONS[5]

1

WATER CONSERVATION

Implement water conservation and alternative water supply systems within healthcare facilities to ensure continuous water availability during droughts.

2

HEALTHCARE INFRASTRUCTURE UP GRADATION

Channel climate risk-based financing through the National Health Mission (NHM) to strengthen healthcare infrastructure resilience against droughts, prioritising regions identified by sub-district-level risk assessments.

3

SUBSIDISE COOLING STRATEGIES

Incentivise heat-resilient manufacturing units through subsidies for cool roofs, energy-efficient cooling, shaded logistics areas, and backup power to maintain productivity during heatwaves.

4

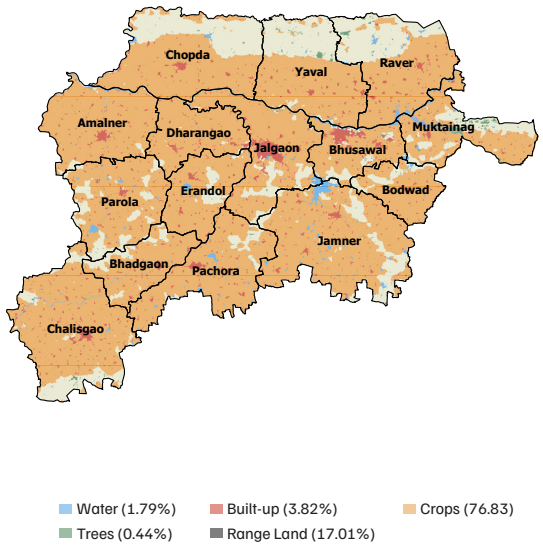
HEAT ACTION PLANS

Mandate district-level heat-action guidelines for factories in Dhule—adjust shifts, enforce paid heat breaks, hydration and cooling access during extreme heat days.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

JALGAON

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
11,765 sq km	359.53	9,03,643	68.37%	♂ 21,97,359 | 52% ♀ 20,32,558 | 48%



BANANA PRODUCTION HUB

This district is the **seventh largest banana producer** in the world, accounting for **3%** of world production, and **16%** of India's output.

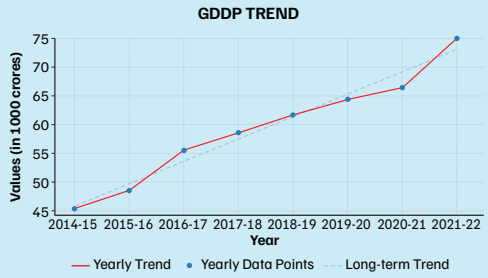
GOLD TRADING HUB

The gold market in Jalgaon is well-known and people from all over the country come here to buy gold.

PULSES & COTTON CULTIVATION

Pulses and cotton are significant arable crops in Jalgaon.

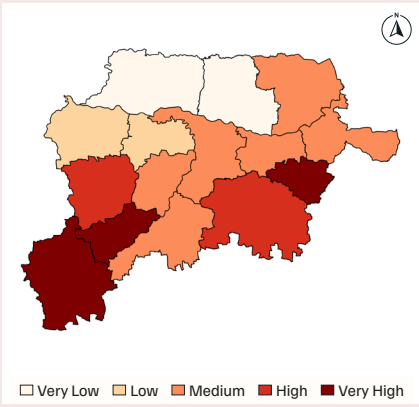
GDP GRAPH[2]



Jalgaon's GDDP increased from **₹45,445 crore** in 2014–15 to **₹75,016 crore** in 2021–22, an overall growth of **65%** over 8 years.

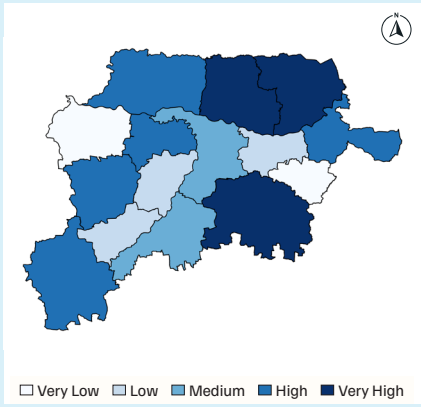
Jalgaon contributed an average of **2.5%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average,the service sector contributed **54%,** industry sector **26%,** and agriculture and allied activities contributed **20%** to Jalgaon's GDDP.

EXTREME SUMMER HEAT[3]



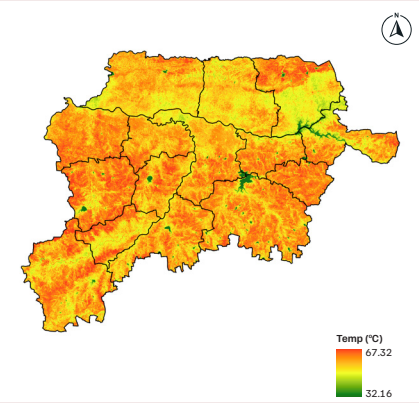
Chalisgao, Bodwad and Bhadgaon observe the highest heat exposure. Climate models show a **3.55-fold increase** in the number of warm nights and a **1.75-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



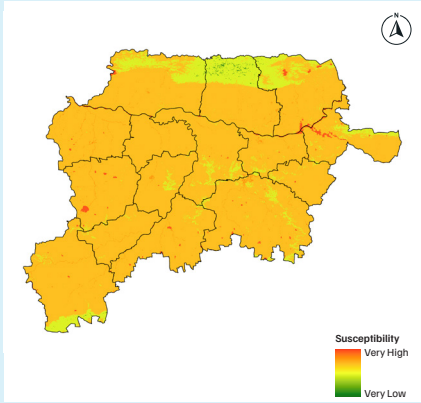
Jamner, Raver, and Yaval observe the highest exposure to rainfall, and are expected to witness a **1.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district observes LST range from **32.16 to 67.32 °C.** High LST zones are concentrated in the **Jalgaon, Bhusawal, and Amalner** tehsils, driven by the district's status as a major industrial hub with extensive urban concrete surfaces and vast stretches of dark, heat-absorptive deep black soils.

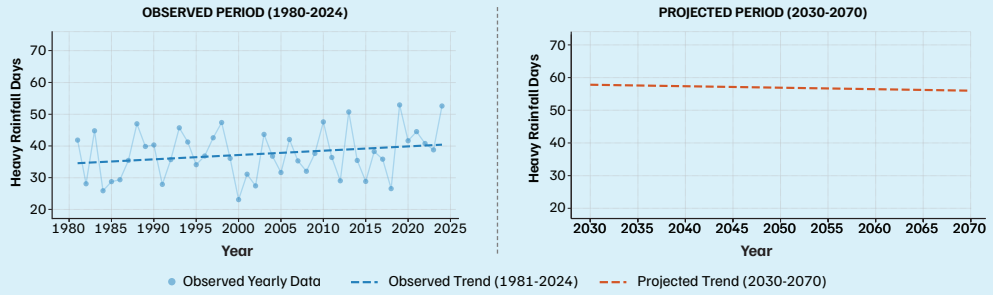
FLOOD SUSCEPTIBILITY[3]



Most of the tehsils have **medium flood susceptibility.** Some areas near water bodies observe high flood susceptibility and are prone to flooding in the future.

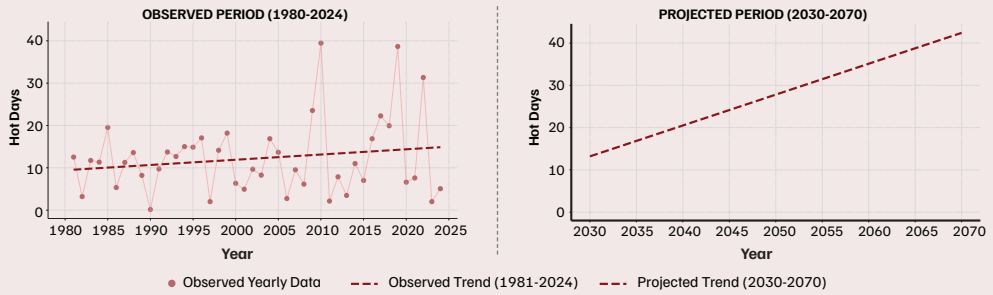
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



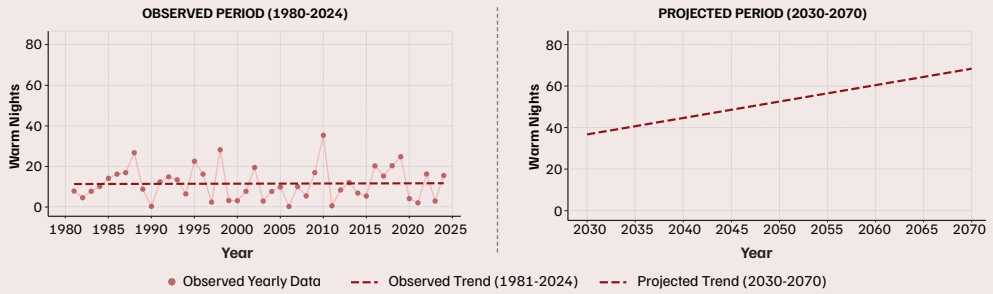
In **Jalgaon,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **39 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **57 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Jalgaon,** the number of **hot days** has **remained steady** in recent decades from an average of **13 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **20 days** in a year between **2030–2050** and **35 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Jalgaon,** the number of **warm nights** has **remained steady** in recent decades to an average of **11 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **44 days** in a year between **2030–2050** and **61 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

AGRICULTURAL RISK IN JALGAON

Multiple climate hazards threaten crop yields

Jalgaon is a vulnerable district as erratic rainfall, extreme temperatures, and floods combine to threaten crop productivity.

HEALTHCARE RISK IN JALGAON

Healthcare infrastructure exposed to climate extremes

Jalgaon is a vulnerable district for healthcare as its medical facilities face exposure to erratic rainfall, floods, and temperature fluctuations.

RECOMMENDATIONS[5]

1

MIXED CROPPING

Implement mixed cropping or intercropping like maize and legumes, niger, sorghum, millet varieties to provide a buffer against crop failure due to extreme weather. Utilise local and wild varieties of seeds that are drought-resistant, early maturing, and better suited to withstand monsoon unpredictability and dry conditions.

2

WATER EFFECTIVE IRRIGATION

Implement resource-efficient irrigation techniques such as drip and sprinkler irrigation, and the System of Crop Intensification.

3

HEALTHCARE RISK ASSESSMENT

District health departments should conduct asset-level risk assessments to identify vulnerabilities and prioritise drought adaptation solutions for healthcare facilities, like climate-controlled ICU and NICU, all-weather connecting roads, flood barriers and water pumps.

4

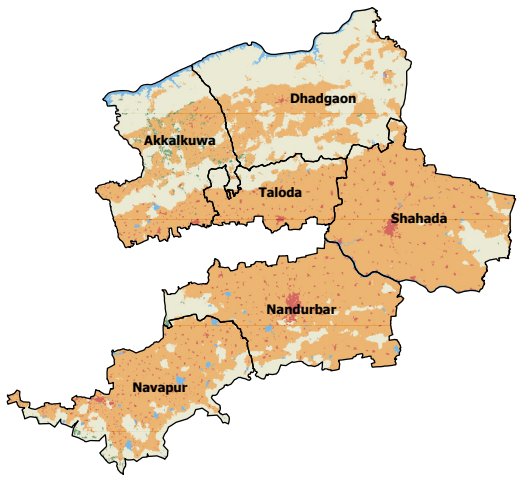
RESILIENT HEALTHCARE FACILITY

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility resilience against droughts through an online portal for real-time data-driven management.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

NANDURBAR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
5,955 sq km	276.79	3,23,521	55%	♂ 8,33,314 | 50.5% ♀ 8,14,981 | 49.5%



TRIBAL AGRICULTURE & MILLETS

Nandurbar district has substantial tribal farming activity with millets, maize, and kharif crops across its dryland regions.

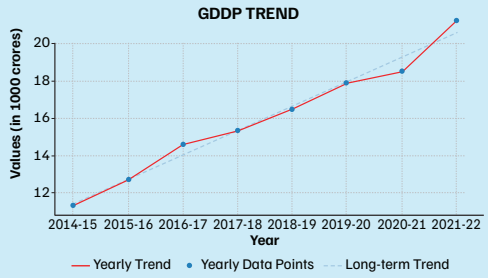
WIND FARM SITES

Nandurbar along with Dhule, has wind farms which are **among the largest in Asia** with an installed capacity in excess of **875 MW.**

SAHYADRI ECO-SENSITIVE ZONES

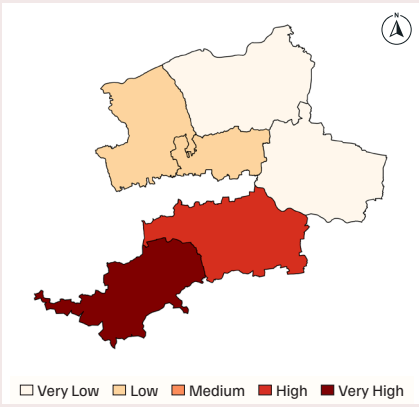
Eco-sensitive zones around the **Satpuda–Sahyadri corridor** in Nandurbar support forest biodiversity and watershed ecology.

GDP GRAPH[2]



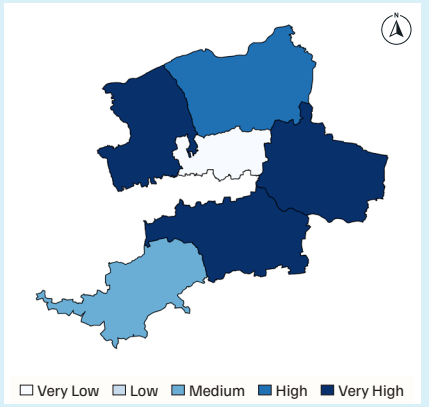
Nandurbar's GDDP increased from **₹11,230 crore** in 2014–15 to **₹21,252 crore** in 2021–22, an overall growth of **89%** over 8 years. Nandurbar contributed an average of **0.7%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **52%,** industry sector **25%** and agriculture and allied activities contributed **24%** to Nandurbar's GDDP.

EXTREME SUMMER HEAT[3]



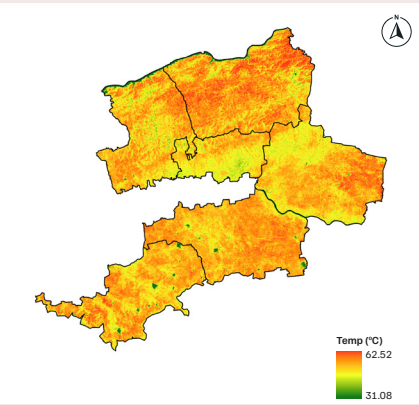
The tehsil of **Navapur** has the highest heat exposure. It is expected to witness a **3.5-fold increase** in the number of warm nights and a **1.5-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



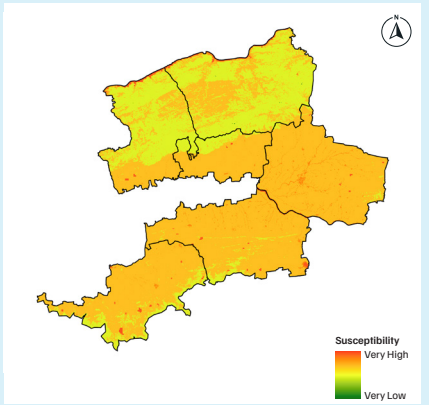
The tehsils of **Akkalkuwa, Nandurbar, and Shahada** observe the highest exposure to extreme rainfall, and are expected to witness a **1.5-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **31.08 to 62.52 °C. Dhadgaon** observes the highest surface temperature compared to other tehsils primarily due to the presence of vast rangeland.

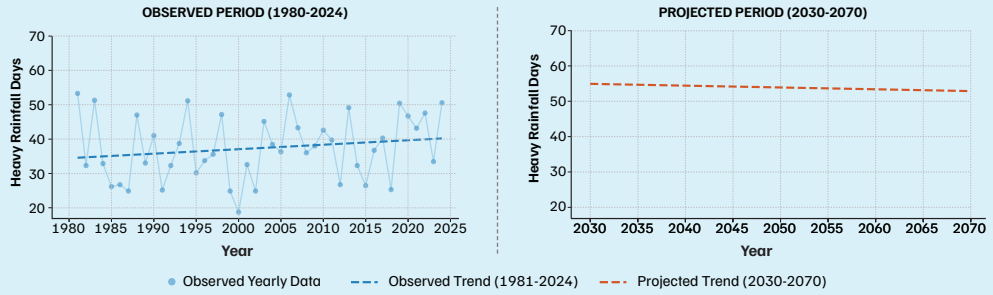
FLOOD SUSCEPTIBILITY[3]



The northern part of the tehsil observes very low flood susceptibility whereas, the **southern** part is more susceptible. Some areas in **Shahada** tehsil with scattered built-up areas and existing water bodies has high susceptibility and are more vulnerable to the flooding.

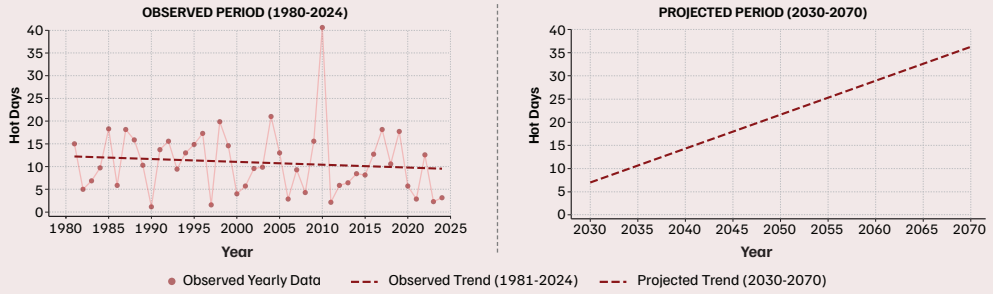
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



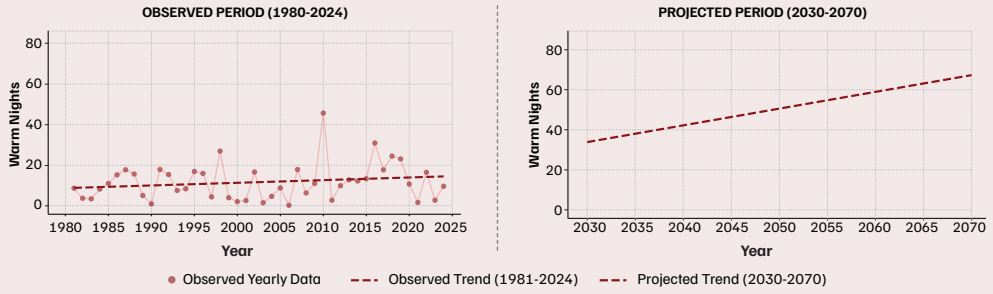
In **Nandurbar,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **39 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **54 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Nandurbar,** the number of **hot days** has **decreased** in recent decades from an average of **12 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **14 days** in a year between **2030–2050** and **29 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Nandurbar,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **15 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **43 days** in a year between **2030–2050** and **58 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

AGRICULTURAL RISK IN NANDURBAR

Agriculture threatened by rising heat

Nandurbar's agricultural industry faces future risks as it is projected to become one of the state's five warmest regions by the 2030s.

CLIMATE RISK IN NANDURBAR

Climate risk for vulnerable communities

Nandurbar's vulnerable population faces climate risk as the district faces high drought vulnerability and record-breaking temperatures by the 2030s.

RECOMMENDATIONS[5]

1

CAPACITY BUILDING OF FARMERS

Enhance 'Krishi Vigyan Kendras' (KVKs) collaboration capabilities to pilot initiatives and identify critical local issues.

2

CROPPING CALENDARS

Dynamically revise district's cropping calendars using climate forecasts to promote heat-tolerant crops, flexible sowing windows, and reduced exposure to peak heat periods.

3

COMMUNITY LEAD HEAT RESILIENCE

Implement community-led heat protection for tribal areas through village-level heat alerts, adjusted forest and farm work timings, shaded rest points, reliable drinking water, and seasonal livelihood support during extreme heat.

4

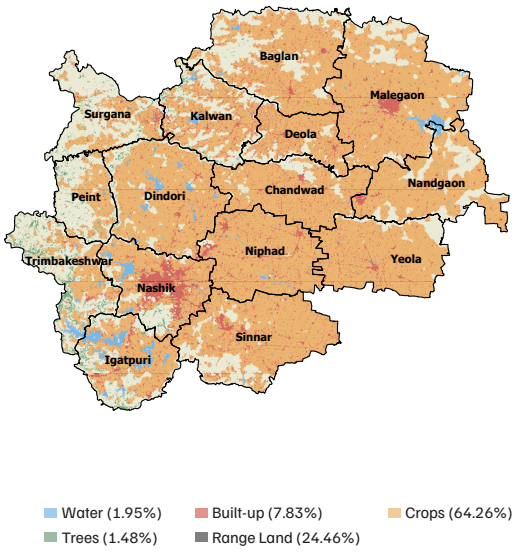
FOREST-BASED COOLING

Strengthen forest-based cooling through water conservation, fire prevention, and climate-resilient housing upgrades to reduce heat exposure for tribal communities.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

NASHIK

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
15,582 sq km	391.94	12,22,887	71.15%	♂ 31,57,801 | 51.7% ♀ 29,49,386 | 48.3%



ECO-TOURISM IN WESTERN GHATS

Igatpuri and Bhandardara in Nashik offer Western Ghats eco-tourism, hill station trekking, lake tourism and biodiversity.

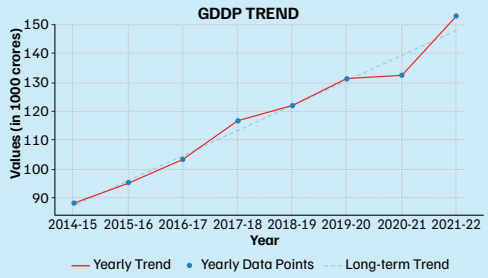
KUMBH MELA & RELIGIOUS TOURISM

Nashik hosts major Hindu pilgrimage fairs and locations like Kumbh at the Godavari ghats, Panchavati, Saptashrungi etc.

MAJOR INDUSTRIAL HUB

The district hosts a diverse manufacturing base including engineering, pharmaceuticals, textiles, food processing and electrical equipment.

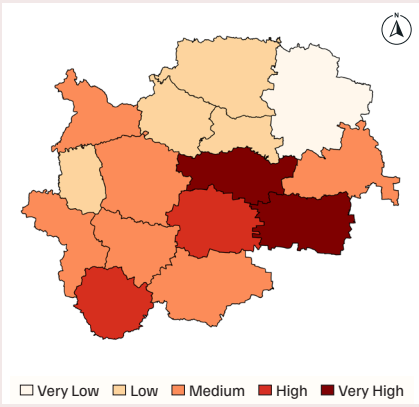
GDP GRAPH[2]



Nashik's GDDP increased from **₹87,927 crore** in 2014–15 to **₹1,53,198 crore** in 2021–22, an overall growth of **74%** over 8 years.

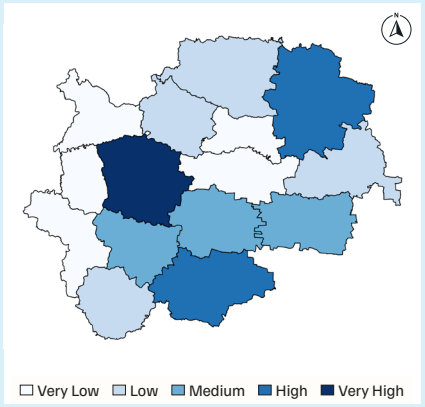
Nashik contributed an average of **4.9%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **57%,** industry sector **26%** and agriculture and allied activities contributed **17%** to Nashik GDDP.

EXTREME SUMMER HEAT[3]



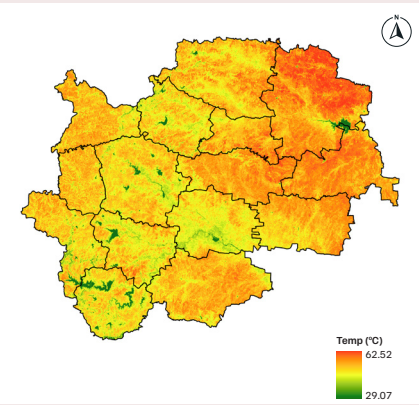
The tehsil of **Yeola and Chandwad** observe the highest exposure to heat, and are expected to witness **4-fold increase** in the number of warm nights and a **2-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



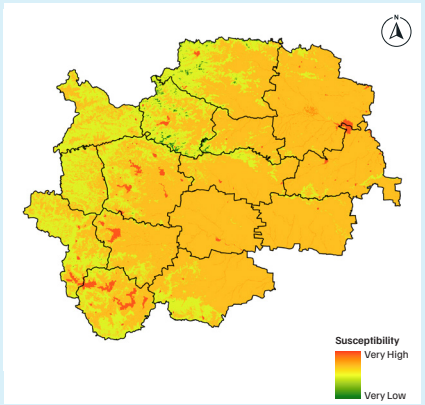
The tehsil of **Dindori** observes the highest exposure to rainfall. It is expected to witness a **1.75-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **29.07 to 62.52 °C. Malegaon** tehsil observes higher surface temperature than other tehsils, primarily in its northern part.

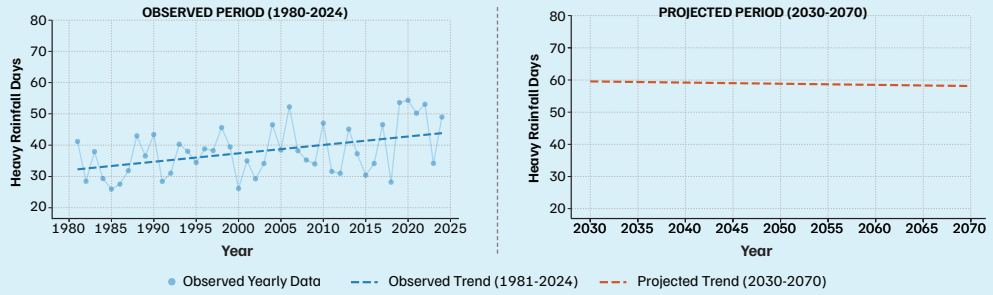
FLOOD SUSCEPTIBILITY[3]



The district observes **very low (in the western part) to medium flood susceptibility (eastern part).** A few areas in **Dindori, Nashik, and Igatpuri** have high flood susceptibility due to their low elevation plain and proximity to water bodies.

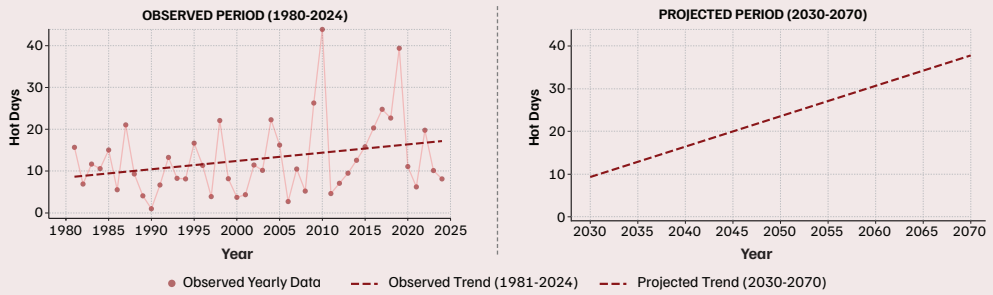
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



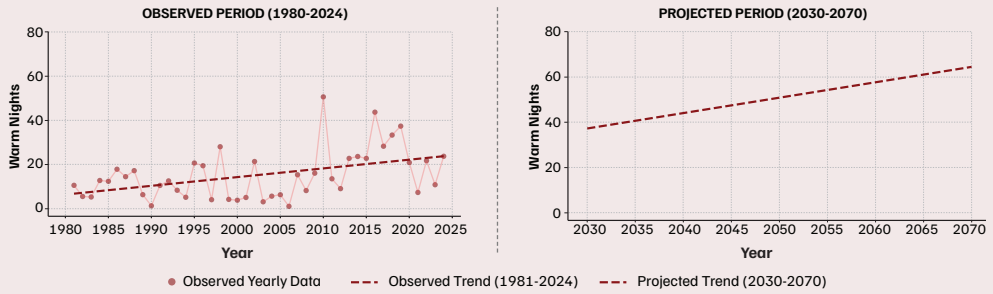
In **Nashik,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **41 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **59 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Nashik,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **15 days** in a year between **2011–2024.** Climate model projections show that this will remain steady initially to an average of **16 days** in a year between **2030–2050** and **increase** to **31 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Nashik,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **23 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **45 days** in a year between **2030–2050** and **56 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

AGRICULTURAL RISK IN NASHIK

Erratic climate impacts onion productivity

Nashik's agricultural sector faces severe losses as erratic rainfall and sudden temperature spikes have slashed kharif onion yields.

TOURISM RISK IN NASHIK

Heavy rainfall threatens regional tourism

Nashik's tourism sector faces growing challenges as the frequency of heavy rainfall events increases significantly across the district.

RECOMMENDATIONS[5]

1

CAPACITY BUILDING OF FARMERS

Train and implement farmers to inculcate practices like raised-bed planting, improved drainage, and short-duration varieties of onion to withstand erratic monsoon rainfall.

2

AGRO-ADVISORY SYSTEM

Strengthen real-time agro-advisories and weather-based insurance for onions to guide sowing, irrigation, and provide timely compensation under rainfall shocks.

3

PROMOTING AGRITOURISM

Strengthen climate-resilient horticulture through soil and micronutrient testing, efficient irrigation, improved drainage and climate-smart practices. Leverage Nashik's grape, wine and horticulture sectors to promote vineyard tourism, farm stays and fruit-picking experiences, diversifying farm incomes and building climate resilience.

4

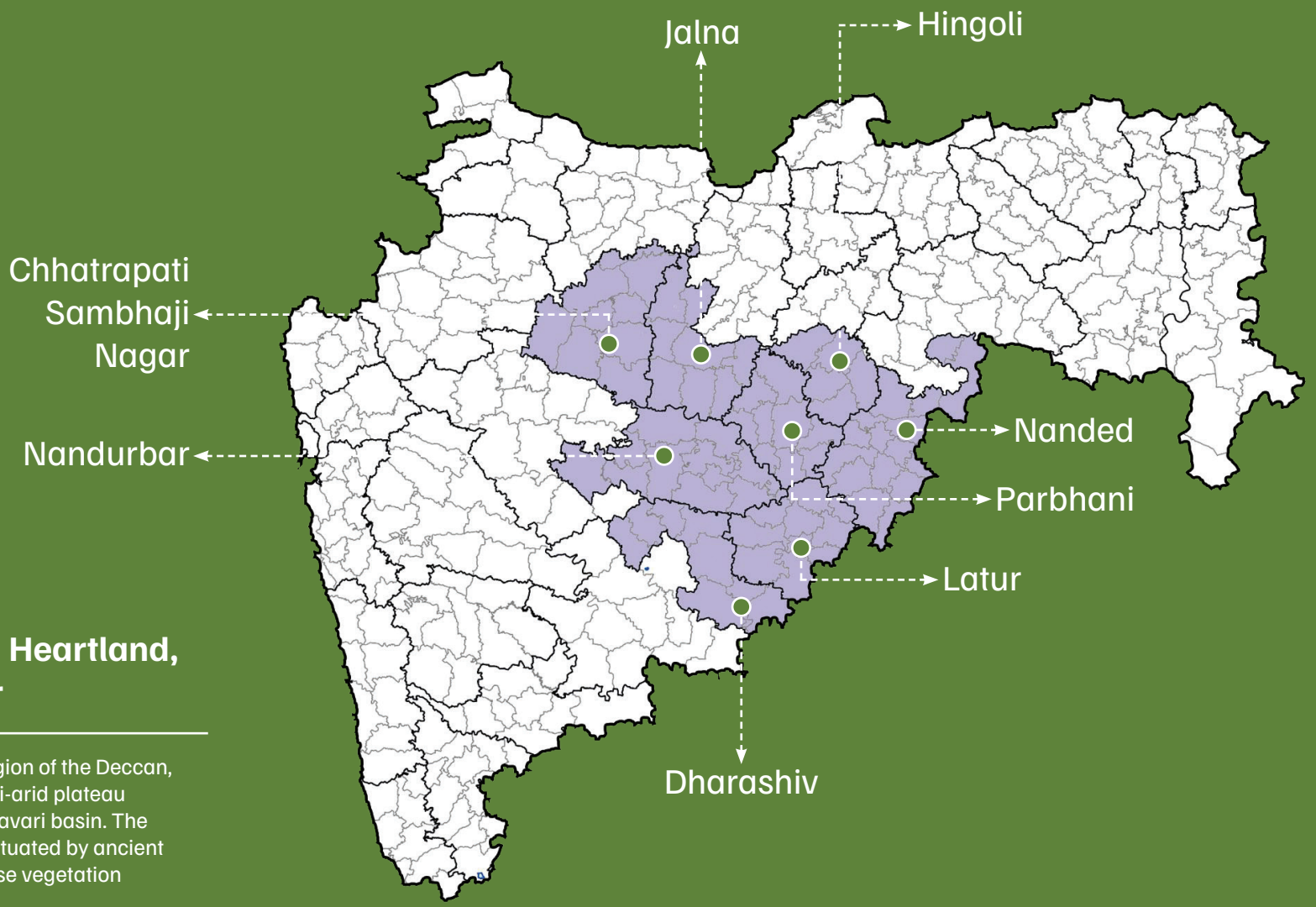
CLIMATE-RESILIENT TOURISM INFRASTRUCTURE

Upgrade the district's tourism and pilgrimage infrastructure — including the Godavari ghats, Trimbakeshwar and Kumbh Mela congregation sites — with improved drainage, all-weather shelters and crowd-safety and early-warning systems.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

MARATHWADA

Chhatrapati Sambhaji Nagar Division



Also known as

Godavari Basin Heartland, Deccan Interior

Set in the rain-shadow region of the Deccan, this division is a vast, semi-arid plateau drained by the upper Godavari basin. The terrain is mostly flat, punctuated by ancient rock formations and sparse vegetation adapted to low rainfall.

HISTORIC IMPORTANCE

The region reached a cultural zenith under the Yadava dynasty, with Devagiri (Daulatabad) serving as a magnificent capital. It later became a key province of the Nizam of Hyderabad, preserving a unique synthesis of Deccani architectural and administrative traditions before joining independent India.





CUISINE

The diet is centered on jowar bhakri and spicy chutneys, designed to provide hydration and nutrition in a landscape where water is traditionally scarce. The food is simple yet robust, mirroring the endurance required for life on the sun-drenched plains.

COMMUNITY AND OCCUPATION

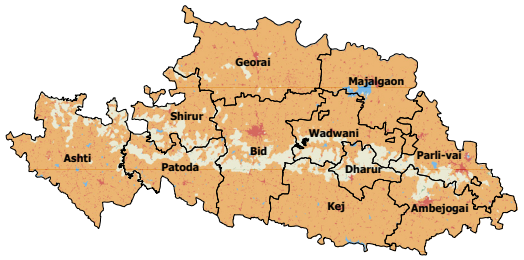
The social fabric is composed of resilient farming communities who have mastered dryland agriculture. The primary occupations revolve around the cultivation of drought-resistant crops like jowar, bajra, and cotton, which thrive in the region's deep black soil.

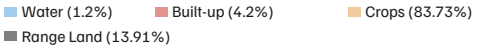
CLOTHING

In the semi-arid Marathwada region, clothing is designed for protection against the scorching sun and dusty winds. To keep the head cool men prefer the Gandhi topi or a large, protective pheta (turban) made of several meters of cloth. Women wear heavy-duty cotton sarees in deep maroons and greens, colours that hold up well against the fine dust of the plains.

BEED

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
10,693 sq km	241.75	5,35,835	66.48%	♂ 13,49,191 | 52% ♀ 12,35,858 | 48%





SUGAR PRODUCTION

Beed's seven operational sugar factories form the backbone of the district's economy, providing essential livelihoods for a massive population of seasonal sugarcane workers.

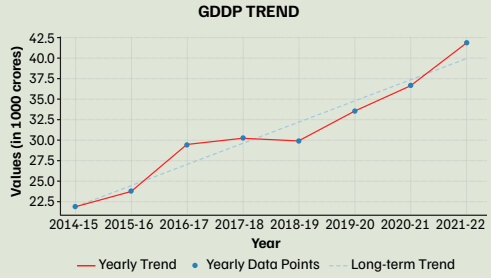
COTTON HUB

Beed has established itself as a major cotton hub, supporting 36 operational ginning factories that process one of the district's most vital commercial crops.

CUSTARD APPLE RESEARCH STATION AND PRODUCTION HUB

With measurement of 24.49 Brix TSS, Beed custard apple is one of the sweetest in the world. The Sitaphal Research Centre in Ambajogai has pioneered in custard apple seed research.

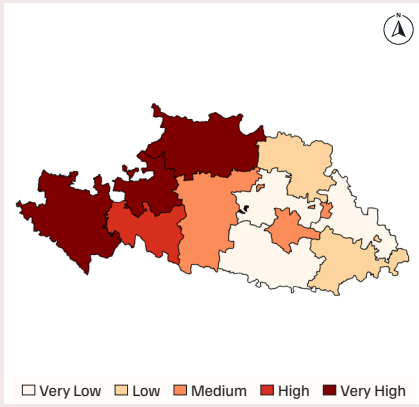
GDP GRAPH[2]



Beed's GDDP increased from **₹21,845 crore** in 2014-15 to **₹41,801 crore** in 2021-22, an overall growth of **91%** over 8 years.

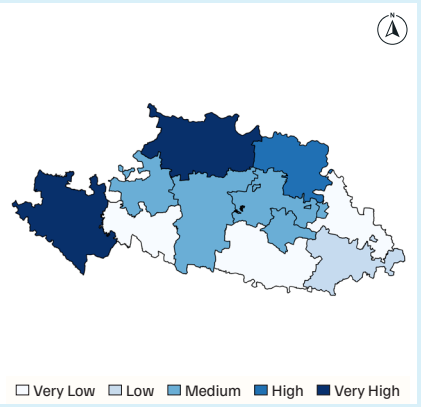
The district contributed an average of **1.3%** to Maharashtra's GSDP between 2014-15 and 2021-22. On average, the service sector contributed **54%,** the industry sector **26%** and agriculture and allied activities contributed **20%** to Beed's GDDP.

EXTREME SUMMER HEAT[3]



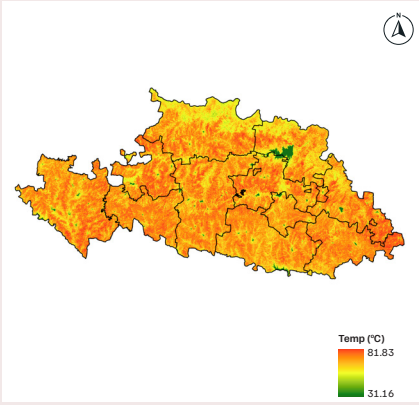
Georai, Shirur, and Ashti tehsils have the highest exposure to heat expected to witness a **4-fold increase** in the number of warm nights and a **2.5-fold increase** in the number of hot days respectively in the near future period (2030–2050) compared to past trends (1981–2010).

EXTREME RAINFALL[3]



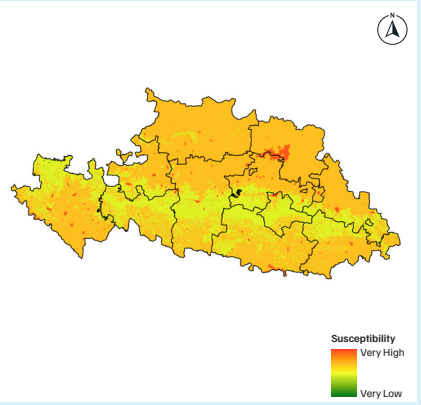
Ashti and Georai tehsils have the highest exposure to extreme rainfall. The climate projection shows that these tehsils are expected to observe a **2-fold increase** in the number of heavy rainfall days in the near-future period (2030–2050) compared to the past trends (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits one of the highest land surface temperatures of **81 °C.** The southern part of the district has the major concentration of medium to high land surface temperatures due to vast agricultural fields and range land, with parts of east **Ambejogai** exhibiting high surface temperature compared to other tehsils.

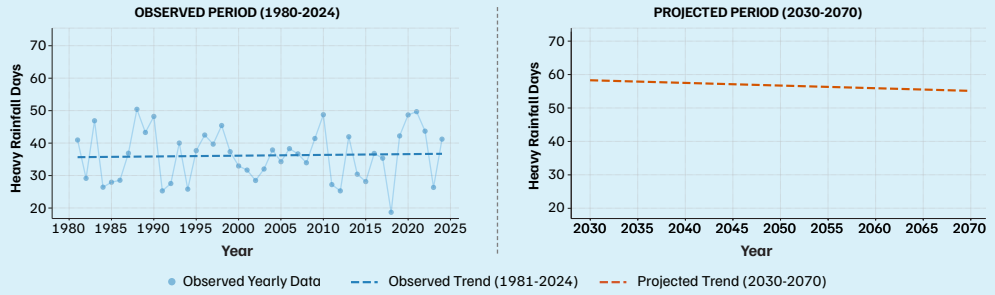
FLOOD SUSCEPTIBILITY[3]



Most of the district has **very low to medium flood susceptibility.** This is primarily due to the presence of flat rangeland running east-west through the district. However, **Majalgaon** tehsil has a few highly susceptible areas due to low-elevation plains near water bodies.

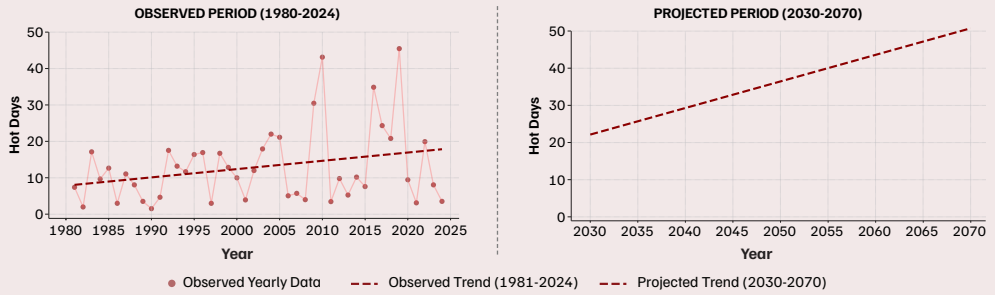
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



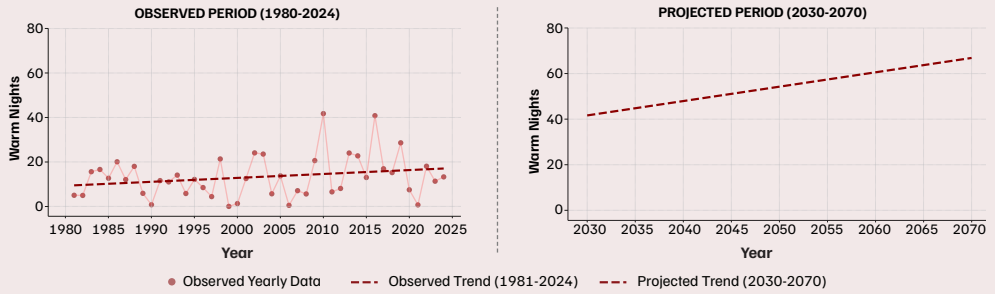
In **Beed,** the number of **heavy rainfall days** has **remained steady** in recent decades to an average of **36 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **58 days** in a year between **2030–2050** and **56 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Beed,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **15 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **29 days** in a year between **2030–2050** and **44 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Beed,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **48 days** in a year between **2030–2050** and **61 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

DROUGHT RISK IN BEED

Agriculture under drought stress

With its history as a drought hotspot and high current vulnerability, Beed faces an urgent crisis in its agricultural sector.

WATER RISK IN BEED

Critical gaps in water storage and monitoring

Beed is vulnerable as it lacks reservoir storage to buffer against dry years and the monitoring stations needed to track water patterns.

RECOMMENDATIONS[5]

1

CLIMATE-RESILIENT MILLET PROMOTION

Promote cultivation of jowar (sorghum) and bajra (pearl millet), which are naturally adapted to low-moisture conditions, making them resilient options.

2

COMMUNITY-BASED MICRO IRRIGATION EXPANSION

Introduce Group Micro Irrigation initiatives with smallholder farmers to expand coverage without compromising water security.

3

DECENTRALISED WATER HARVESTING & STORAGE

Construct water harvesting structures like check dams to capture runoff in detention. Additionally, subsidy should be provided on community level rainwater harvesting initiatives.

4

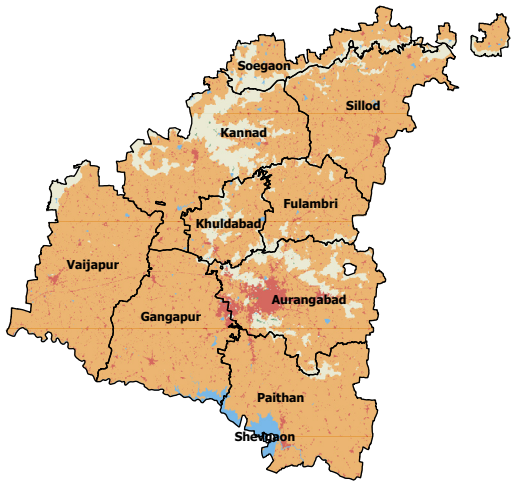
RURAL DRINKING SUPPLY SYSTEM

Leverage surface water-based drinking water schemes in rural Marathwada and Vidarbha to reduce groundwater dependence.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

CHHATRAPATI SAMBHAJINAGAR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
10,100 sq km	366.46	7,51,915	67.65%	♂ 19,24,744 | 52% ♀ 17,76,538 | 48%



AJANTA & ELLORA CAVES TOURISM

The Ajanta and Ellora caves date back to 480CE. The rock engraved caves are the testament to Indian craft, culture, and heritage. They are is one of the UNESCO world heritage.

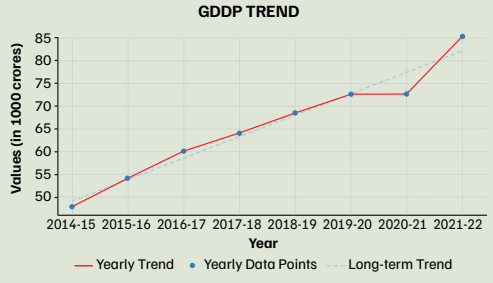
INDUSTRIAL HUB OF MARATHWADA

Shendra, Chikalthana and Waluj MIDC form a major industrial belt with leading units in automotive, pharmaceuticals, aluminium and renewable energy.

HIMROO FABRIC & PAITHANI SAREES

The Himroo fabric and sarees have reached a global clientele, with potential for diversifying fashion and heritage markets.

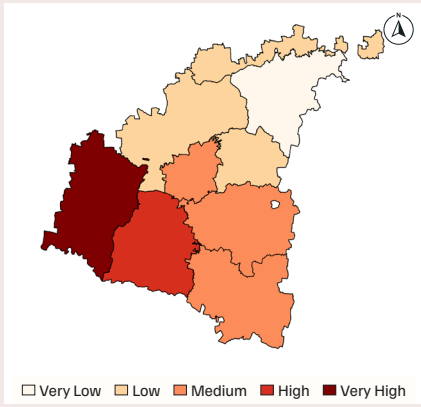
GDP GRAPH[2]



Chhatrapati Sambhaji Nagar's GDDP increased from **₹47,989 crore** in 2014-15 to **₹85,318 crore** in 2021-22, an overall growth of **78%** over 8 years.

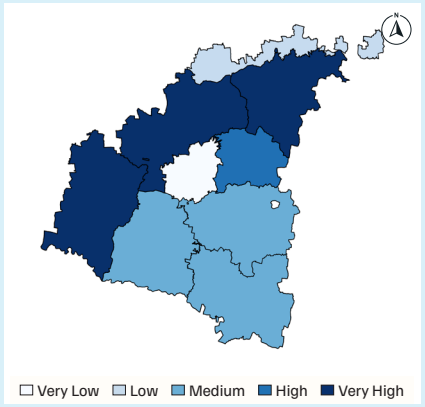
The district contributed an average of **2.7%** to Maharashtra's GSDP between 2014-15 and 2021-22. On average, the service sector contributed **59%,** industry sector **28%** and agriculture and allied activities contributed **13%** to the district's GDDP.

EXTREME SUMMER HEAT[3]



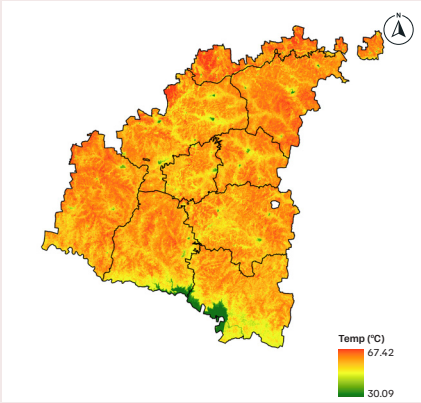
Vaijapur tehsil observed the highest exposure to heat, expected to witness a **4-fold increase** in the number of warm nights and a **2-fold increase** in the number of hot days in the near future period (2030–2050) compared to the past trends (1981–2010).

EXTREME RAINFALL[3]



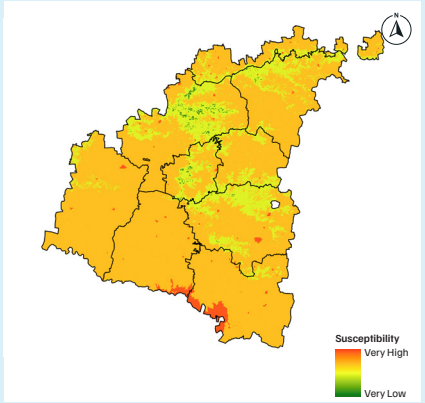
Vaijapur, Kannad, and Sillod tehsils have the highest exposure to rainfall, and are expected to witness a **1.5-fold increase** in the number of heavy rainfall days, respectively, in the future period (2030–2050) compared to the past trends (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district experiences surface temperature in the range of **30.09 to 67.42 °C.** Tehsils like **Aurangabad and Gangapur** experience the highest surface temperature due to the presence of urban areas and the heat-retentive properties of dark basaltic soils.

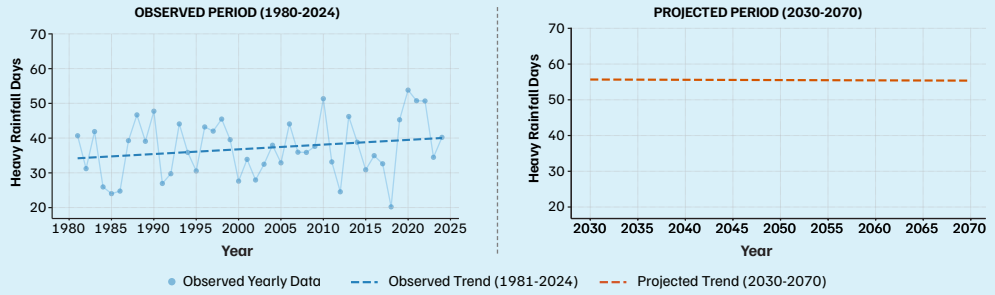
FLOOD SUSCEPTIBILITY[3]



Flood risk is primarily concentrated in the south and west along the Godavari and Shivana river basins. **Shevgaon and Gangapur** tehsils have some areas near existing water bodies that are highly vulnerable to flooding events.

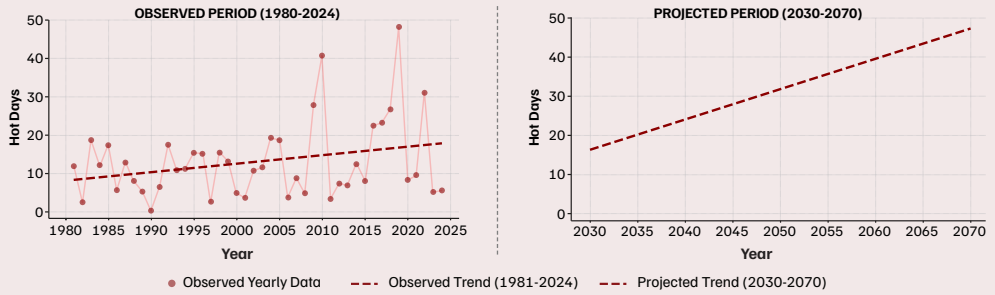
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



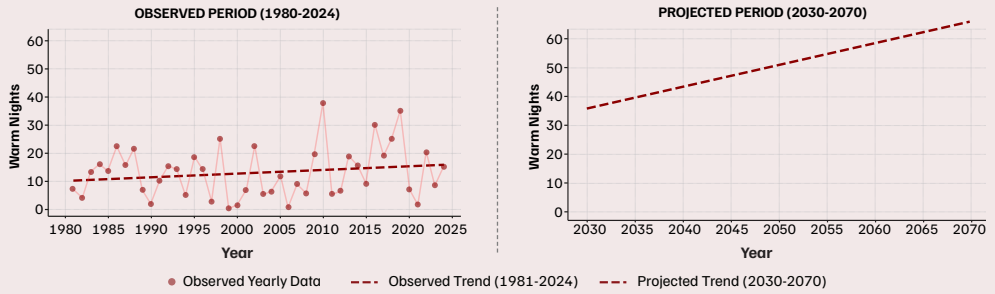
In **Chatrapati Sambhaji Nagar,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **56 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Chatrapati Sambhaji Nagar,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **24 days** in a year between **2030–2050** and **39 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Chatrapati Sambhaji Nagar,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **44 days** in a year between **2030–2050** and **58 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

CLIMATE RISK IN CHHATRAPATI SAMBHAJI NAGAR

Shifting extremes straining services

Shifting from floods to frequent droughts, Chhatrapati Sambhaji Nagar faces a threat to its services sector and worker productivity.

TOURISM FACING RISK IN CHHATRAPATI SAMBHAJI NAGAR

Tourism contributes significantly to the local economy

The vital tourism sector faces significant exposure to hydro-meteorological disasters.

RECOMMENDATIONS[5]

1

CLIMATE-RESILIENT CROP INNOVATION & DATABANK

Create a comprehensive database of crop cultivars with climate-resilient traits and develop new drought/heat-resistant varieties.

2

INDUSTRIAL HEAT-SAFETY PROTOCOLS

Mandate heat-action protocols for industries—adjust work hours, ensure shaded rest areas, drinking water, cooling access, and enforce paid heat breaks during extreme heat days to safeguard the workforce.

3

INTEGRATED CLIMATE-RESILIENT TOURISM CIRCUITS

Develop five priority tourism circuits with end-to-end infrastructure, ensuring all-weather connectivity and world-class amenities focusing on safeguarding tourism in religious (Shirdi, Jyotirlinga) and heritage (Ajanta-Ellora) locations.

4

HEAT-RESPONSIVE TOURISM

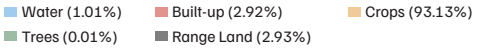
Promote season-smart tourism by planning and promoting tourism during low-heat and rainfall months and develop evening/night experiences to reduce heat risk.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

DHARASHIV

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
7,569 sq km	219	3,51,281	68.64%	♂ 8,61,526 | 52% ♀ 7,96,050 | 48%





PILGRIMAGE HUB

Tuljapur serves as Dharashiv's premier tourist destination, drawing millions of pilgrims annually to the historical Tulja Bhavani Temple.

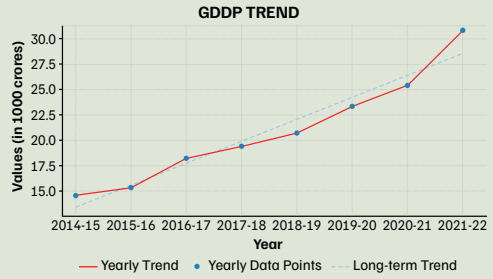
AGRICULTURAL FOUNDATION

Agriculture is an important source of livelihood in Dharashiv, utilising 584,400 hectares (78% of the land) supported by the Manjra, Therna, and Seena river irrigation systems.

KHAWA (KHOYA) UNITS

The district has a large volume of milk production and availability of 1000 *khawa* units.

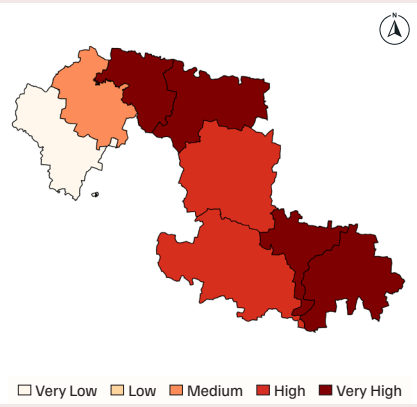
GDP GRAPH[2]



Dharashiv's GDDP increased from **₹14,511 crore** in 2014–15 to **₹30,791 crore** in 2021–22, an overall growth of **112%** over 8 years.

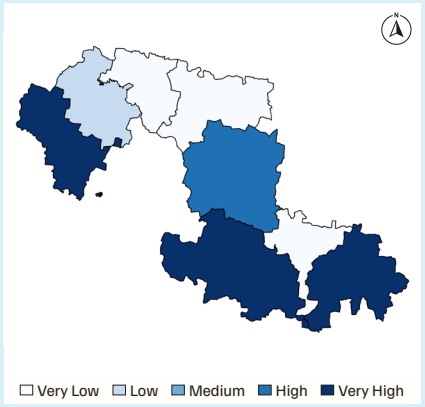
Dharashiv contributed an average of **0.9%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **50%,** industry sector **24%** and agriculture and allied activities contributed **26%** to Dharashiv's GDDP.

EXTREME SUMMER HEAT[3]



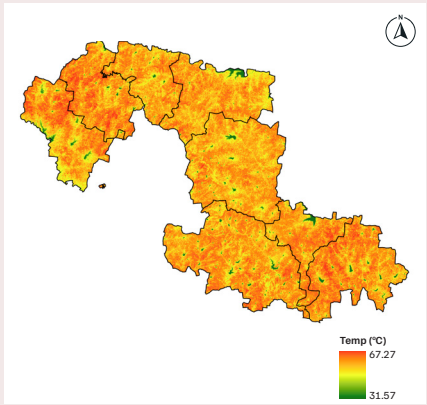
The tehsils of **Washi, Kalamb, Lohara, and Umarga** have the highest exposure to heat, expected to witness a **4.5-fold increase** in the number of warm nights and a **2.5-fold increase** in the number of hot days respectively in the future period (2030–2050) compared to the past (1981–2010).

EXTREME RAINFALL[3]



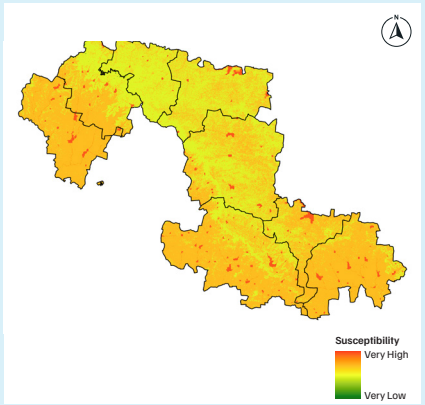
The tehsils of **Paranda, Tuljapur, and Umarga** have the highest exposure to rainfall, expected to witness a **2.5-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **31.57 to 67.27** °C. Overall the district has **medium to high surface temperature. Umarga, Bhum and Paranda** tehsils have some areas which observe high surface temperature primarily driven by vast open agricultural land.

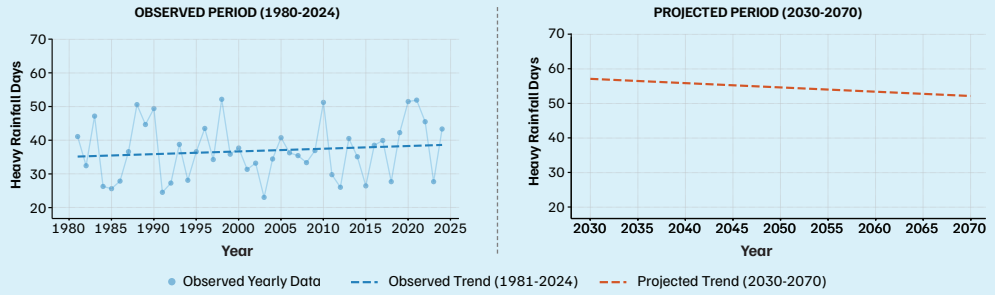
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility.** Tehsils such as **Lohara, Usmanabad, and Kalam** have a few areas with high flood susceptibility driven by their proximity to water bodies.

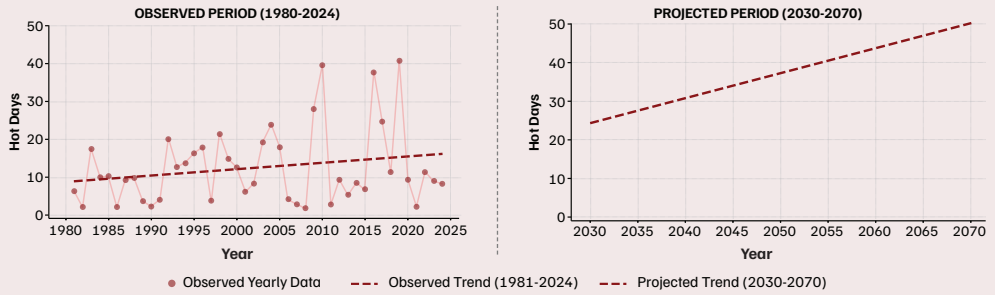
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



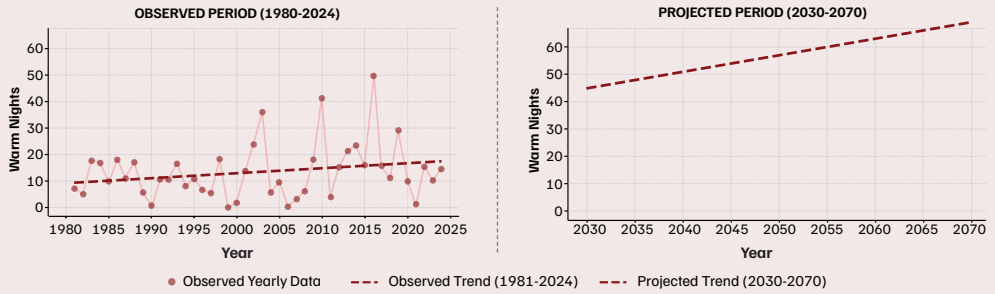
In **Dharashiv,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **56 days** in a year between **2030–2050** and **53 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Dharashiv,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **30 days** in a year between **2030–2050** and **44 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Dharashiv,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **17 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **51 days** in a year between **2030–2050** and **63 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

AGRICULTURAL RISK IN DHARASHIV

Agricultural risks from drought vulnerability

Dharashiv is one of Maharashtra's most vulnerable agricultural districts due to its talukas being highly prone to extreme drought events.

WATER RISK IN DHARASHIV

Rainfall extremes intensify water risk

Dharashiv faces severe water risk as it experiences a high frequency of both extreme rainfall deficits and damaging excess rainfall.

RECOMMENDATIONS[5]

1

RE-IMAGINING WATER SECURITY

Construct water harvesting structures like check dams to capture runoff in the Marathwada region. Increase surface water-based drinking water schemes in rural area to reduce groundwater dependence.

2

CLIMATE SMART AGRICULTURE AND CAPACITY BUILDING

Enhance Krishi Vigyan Kendras (KVKs) to showcase micro-irrigation success stories and build capacity. Educate farmers via KVKs on cropping calendar changes, improved seeds, and pest management under climate scenarios.

3

RESILIENT HEALTHCARE INFRASTRUCTURE

District health departments should conduct asset-level risk assessments to identify vulnerabilities and prioritise flood adaptation solutions for healthcare facilities.

4

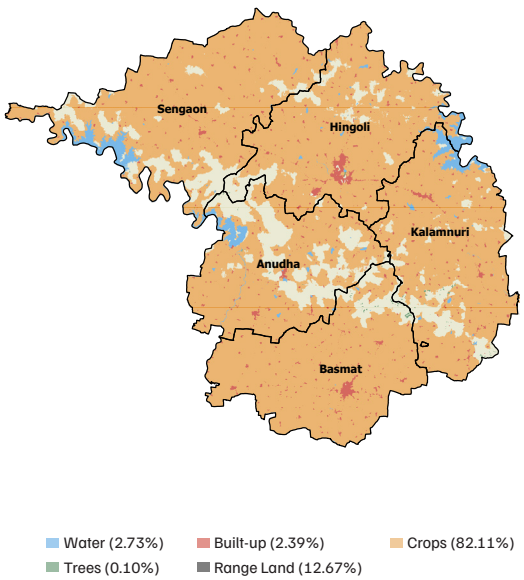
FLOOD-RESILIENT INFRASTRUCTURE

Retrofit existing healthcare buildings and install flood-resistant infrastructure, such as elevated water supply outlets and high-capacity pumps in low-lying areas.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

HINGOLI

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
4,526 sq km	260.13	2,28,868	67.16%	♂ 6,06,254 | 51.5% ♀ 5,71,091 | 48.5%



TURMERIC CULTIVATION AND PROCESSING UNITS

More than **8.9 lakh MT** of turmeric was produced in the district in 2023-24.

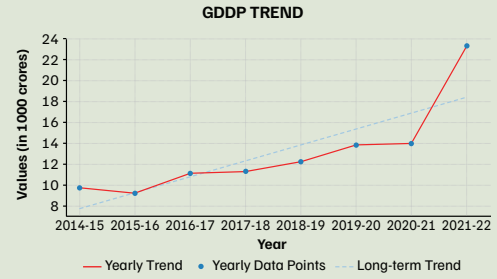
HON. BALASAHEB THACKERAY HARIDRA RESEARCH CENTRE

Located in a leading turmeric producing region of the global market, this centre will pioneer research to increase turmeric productivity in the nation.

LIGO-INDIA OBSERVATORY

The Laser Interferometer Gravitational-Wave Observatory (LIGO) in Hingoli district is a unique global mega-science project being established in India for advanced research on gravitational waves.

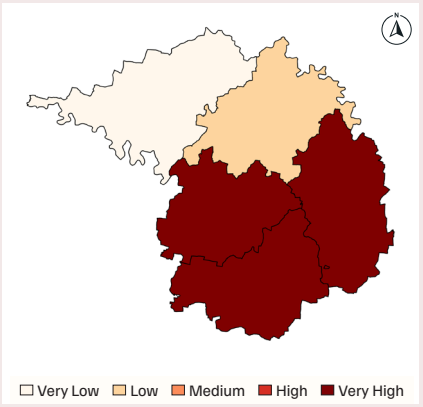
GDP GRAPH[2]



Hingoli's GDDP increased from **₹9,743 crore** in 2014–15 to **₹23,361 crore** in 2021–22, an overall growth of **140%** over 8 years.

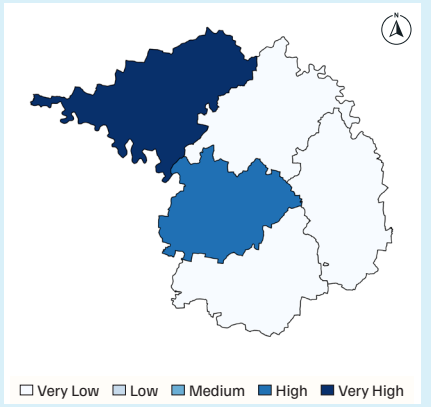
Hingoli contributed an average of **0.5%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **47%,** industry sector **23%** and agriculture and allied activities contributed **30%** to Hingoli's GDDP.

EXTREME SUMMER HEAT[3]



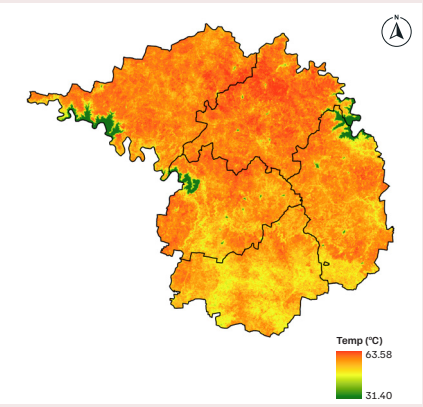
Anudha, Basmat, and Kalamnuri tehsils recorded the highest exposure to heat, expected to witness a **4.5-fold increase** in the number of warm nights and a **2.5-fold increase** in the number of hot days in the future period (2030–2050) compared to past (1981-2010).

EXTREME RAINFALL[3]



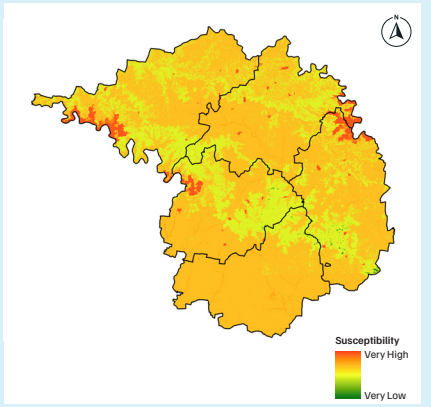
Sengaon tehsil recorded the highest exposure to rainfall, expected to witness a **1.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district observed surface temperature ranging from **31.40 to 63.58 °C.** High LST zones are concentrated in the **Hingoli and Basmat** tehsils, where there is rapid urbanisation and large expanses of exposed, dark soil that absorb intense solar radiation.

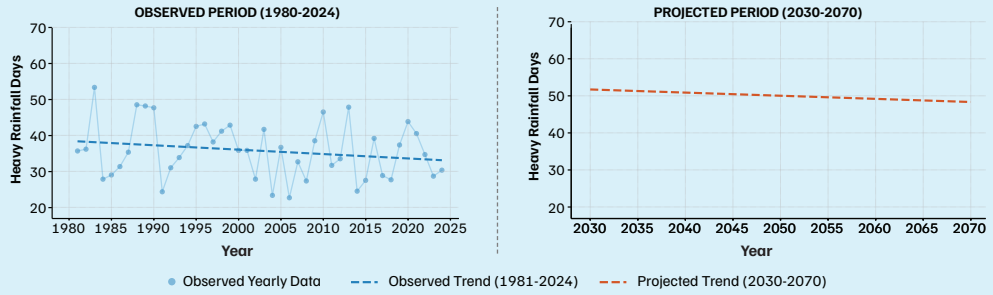
FLOOD SUSCEPTIBILITY[3]



The district observed **very low to medium flood susceptibility. Sengaon, Hingoli, and Kalamnuri** tehsils are highly susceptible because they occupy flat alluvial plains where poor natural drainage and riverbed siltation cause rapid inundation during heavy monsoon surges.

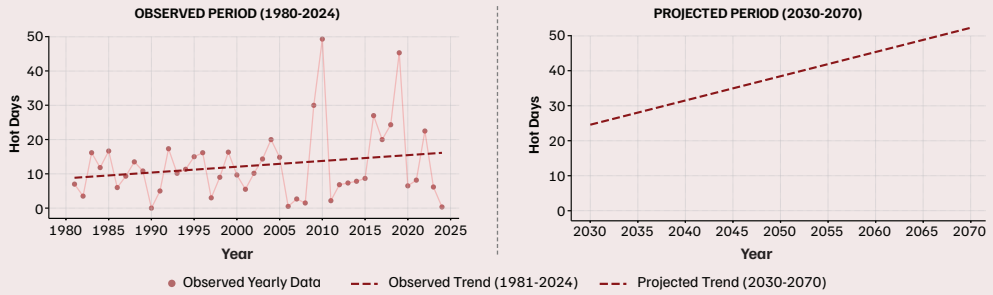
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



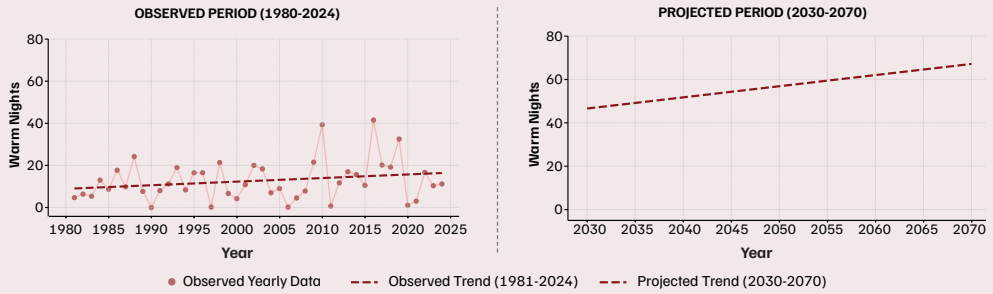
In **Hingoli,** the number of **heavy rainfall days** has **decreased** in recent decades from an average of **36 days** in a year between **1981–2010** to **34 days** in a year between **2011–2024.** Climate model projections show that this will **decrease** with an average of **51 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Hingoli,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **31 days** in a year between **2030–2050** and **46 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Hingoli,** the number of **warm nights** has **increased** in recent decades from an average of **11 days** in a year between **1981–2010** to **15 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **51 days** in a year between **2030–2050** and **63 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

DROUGHT RISK IN HINGOLI

Critical drought risk to agriculture

As a district with significant drought vulnerability, Hingoli stands as one of the most at-risk regions for agricultural instability.

EXTREME WEATHER RISK IN HINGOLI

Extreme rainfall volatility

Hingoli faces climate instability with rainfall fluctuating by over 25 percent and nearly half of the last five decades marked by extreme weather.

RECOMMENDATIONS[5]

1

WATER-SENSITIVE AGRICULTURE PRACTICES

Scale up micro-irrigation systems and water storage reservoirs for cash crops, like cotton which is extremely water-intensive.

2

CLIMATE-SMART AGRICULTURE

Subsidise short-duration, drought-tolerant seeds and promote soil-moisture conservation practices like mulching, ridge-furrow, farm ponds to farmers in order to protect crops during post-sowing dry spells.

3

RESILIENT INFRASTRUCTURE SYSTEM

Strengthen urban drainage, rural roads, drinking-water infrastructure, and early-warning services to reduce disruption from erratic monsoon rainfall, while integrating contingency planning for health services, schools, and local markets to ensure continuity during extreme wet or dry spells.

4

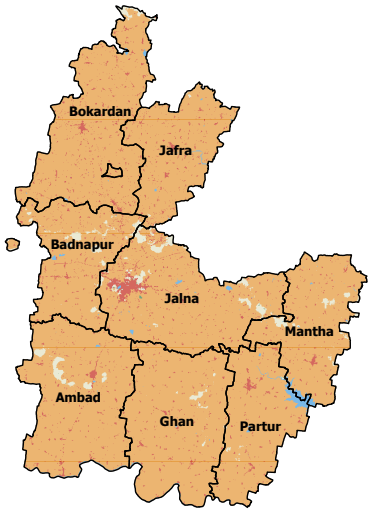
RESILIENT AGRICULTURAL PRACTICES AND SCHEMES

Strengthen soil-moisture conservation, decentralised water storage, and expand weather-based insurance to buffer farmers against erratic rainfall and dry spells.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

JALNA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
7,687 sq km	254.85	3,91,701	61.03%	♂ 10,11,382 | 51.6% ♀ 9,47,664 | 48.4%



Water (0.79%) Built-up (3.47%) Crops (93.5%)
Trees (0.02%) Range Land (2.21%)

JALNA SWEET ORANGE HUB

Jalna district contributes nearly **21%** of the state's orange production.

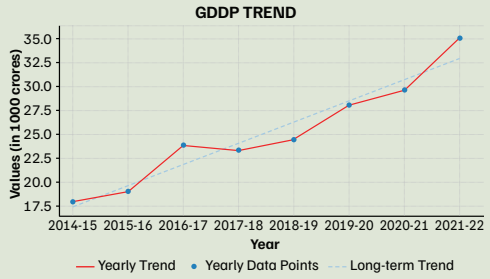
STEEL ROLLING MILLS

Jalna hosts a large number of steel rolling mills alongside specialised units manufacturing ball bearings and supporting metal processing.

HYBRID SEED INDUSTRIES

Important hybrid seed industries like Mahyco, Bejo-Shital etc. are located in the district.

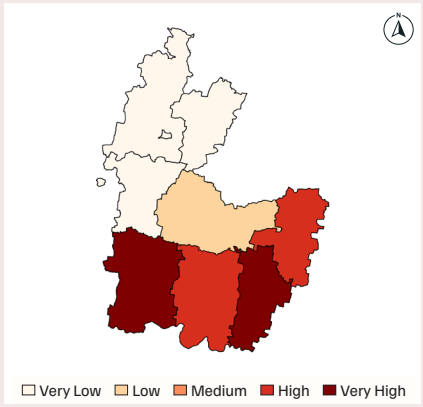
GDP GRAPH[2]



Jalna's GDDP increased from **₹17,807 crore** in 2014–15 to **₹35,037 crore** in 2021–22, an overall growth of **97%** over 8 years.

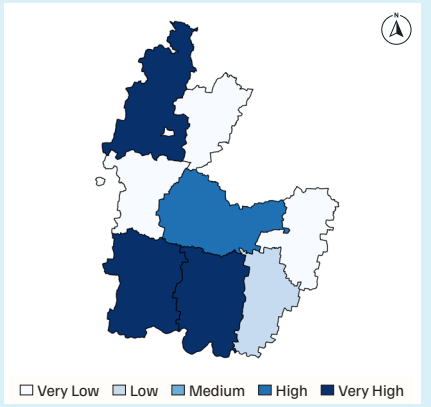
Jalna contributed an average of **1.0%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **49%,** industry sector **25%** and agriculture and allied activities contributed **26%** to Jalna's GDDP.

EXTREME SUMMER HEAT[3]



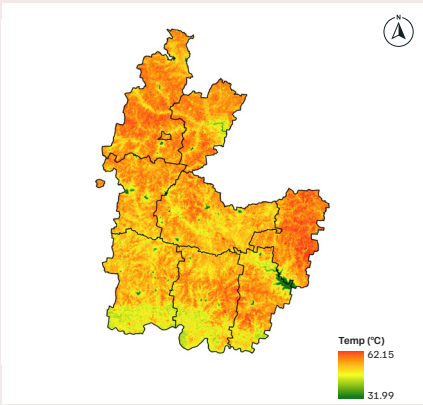
Partur and Ambad have the highest exposure to heat, expected to witness a **4-fold increase** in the number of warm nights and a **2.5 and 2.30-fold increase** respectively in the number of hot days in the future.

EXTREME RAINFALL[3]



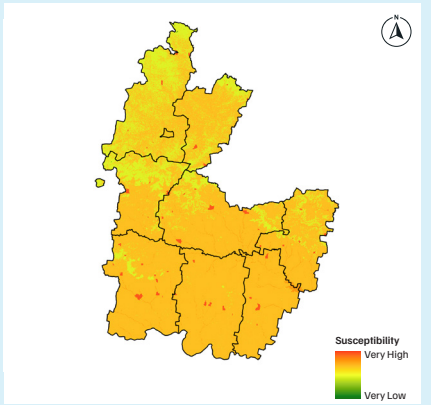
Ghan, Ambad, and Bokardan have the highest exposure to extreme rainfall, and are expected to witness **1.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past.

LAND SURFACE TEMPERATURE[3]



The district registers an LST range from **31.99 to 62.15 °C. Mantha** tehsil has the highest LST across all tehsils.

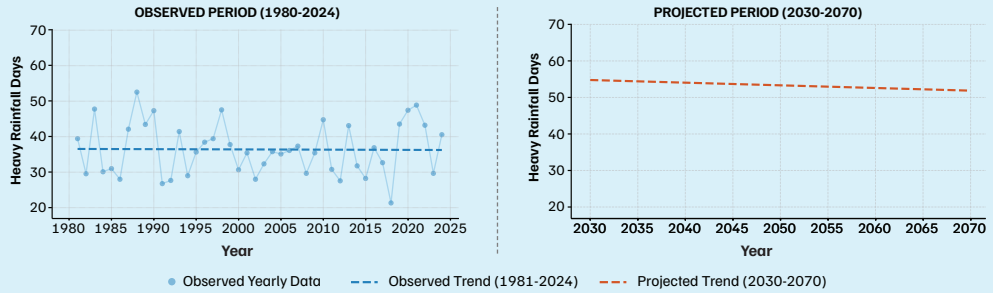
FLOOD SUSCEPTIBILITY[3]



Most of the tehsils have **very low to medium flood susceptibility.** However, a few areas near water bodies have high flood susceptibility.

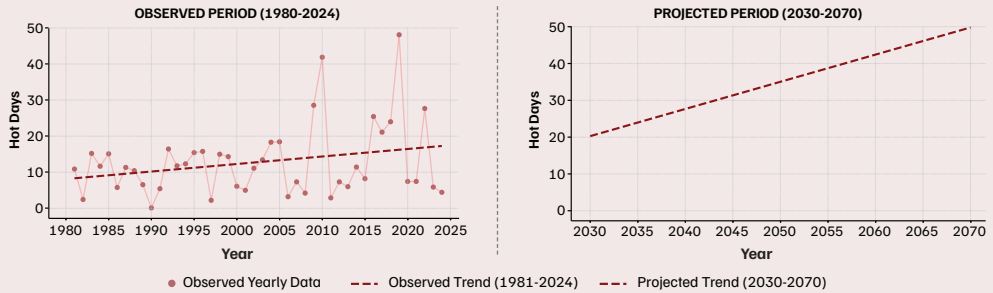
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



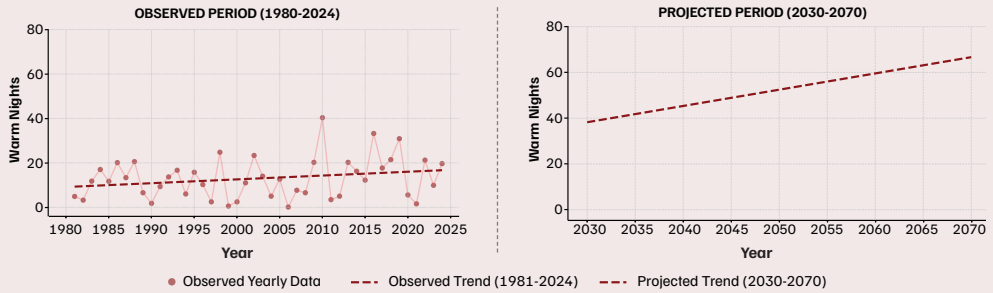
In **Jalna,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **36 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **54 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Jalna,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **15 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **27 days** in a year between **2030–2050** and **42 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Jalna,** the number of **warm nights** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **45 days** in a year between **2030–2050** and **60 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

WATER RISK IN JALNA

Critical water infrastructure deficit

Jalna faces extreme water vulnerability due to low reservoir storage and a lack of monitoring stations to buffer against drought.

AGRICULTURAL RISK IN JALNA

Agricultural risks from drought vulnerability

Jalna faces a moderate drought vulnerability that poses a persistent risk to the long-term stability of its agricultural sector.

RECOMMENDATIONS[5]

1

RESTORING WATER RESERVOIRS

Increase water storage capacity by undertaking silt removal from existing Ghanewadi reservoir, which had lost significant storage capacity due to 75 years of accumulated silt. New small-scale reservoirs or check dams should also be constructed.

2

INCENTIVISING EFFICIENCY & CONSERVATION

Promote water tariffs and flexible pricing systems to encourage efficient water use and incentivise conservation, drawing on Maharashtra's existing water resources regulatory authority.

3

RESILIENT SEEDS & REGENERATIVE SOIL PRACTICES

Utilise local and wild varieties of seeds that are drought-resistant, early maturing, and better suited to withstand monsoon unpredictability and dry conditions. Practice green manuring and mulching to improve soil fertility and moisture retention.

4

DE-RISKING FARMERS THROUGH INSURANCE & COOPERATIVE STRENGTHENING

Establish or strengthen insurance and market risk management mechanisms to mitigate financial losses for farmers. Promote the formation of cooperatives at the village level to enhance community resilience.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

LATUR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
7,157 sq km	342.91	4,81,572	67.26%	♂ 12,72,923 | 51.9% ♀ 11,81,273 | 48.1%



LEADING PULSE PRODUCER

With **3.73+ lakh MT** of pulses produced, Latur has **253** pulse processing industries which is the highest in the state.

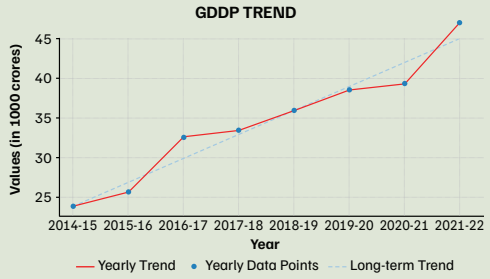
SOYA BEAN PRODUCTION

As Latur is one of the leading soybean-producers producing districts of the state, with a production of 9.75+ MT.

SUGAR PROCESSING

Latur is known as the 'Sugar belt' of Maharashtra, with several cooperative and private sugar factories that play a major role in the district's agri-based economy and employment.

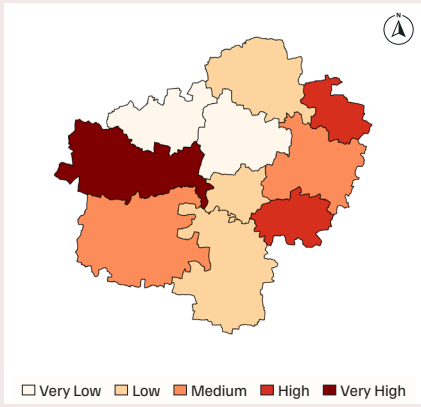
GDP GRAPH[2]



Latur's GDDP increased from **₹23,883 crore** in 2014–15 to **₹47,052 crore** in 2021–22, an overall growth of **97%** over 8 years.

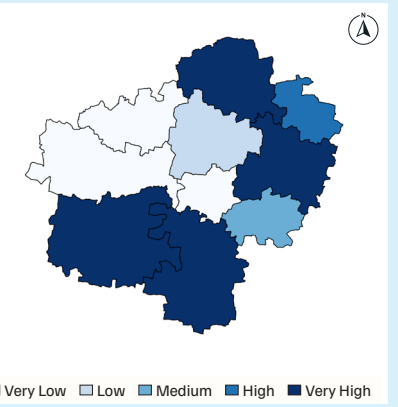
Latur contributed an average of **1.4%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, service sector contributed **53%,** industry sector **26%** and agriculture and allied activities contributed **22%** to Latur's GDDP.

EXTREME SUMMER HEAT[3]



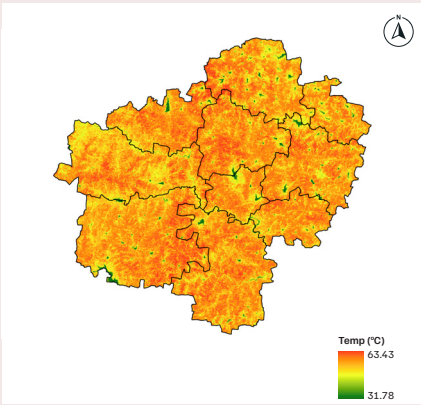
Latur tehsil observed the highest exposure to heat, and is expected to witness a **4.5-fold increase** in the number of warm nights and a **2.5-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981–2010).

EXTREME RAINFALL[3]



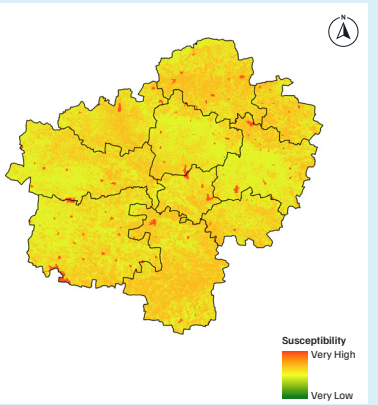
The tehsils of **Ahmadpur, Ausa, and Nilanga** observe the highest exposure to rainfall, and are expected to witness a **1.5-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past (1981–2010).

LAND SURFACE TEMPERATURE[3]



Latur exhibits a high thermal range from **31.78 to 63.43 °C.** Tehsils like **Latur, Chakur, and Udgir** face extreme surface heat due to intense urbanisation and vast agricultural expanses of dark basaltic soil that lack significant perennial green cover.

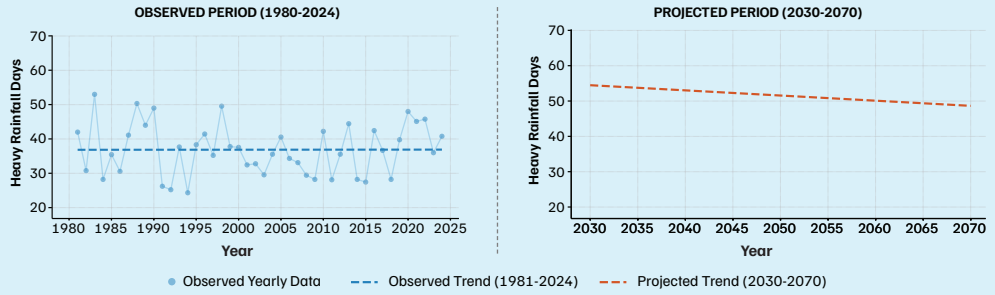
FLOOD SUSCEPTIBILITY[3]



Most of the tehsils have **very low to medium flood susceptibility.** However, a few areas near water bodies observed high flood susceptibility.

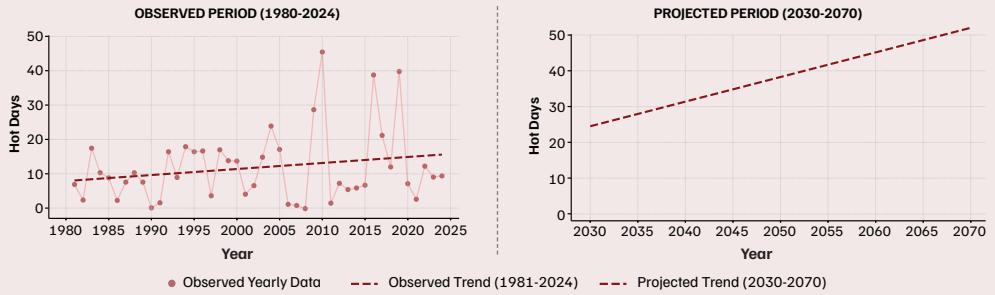
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



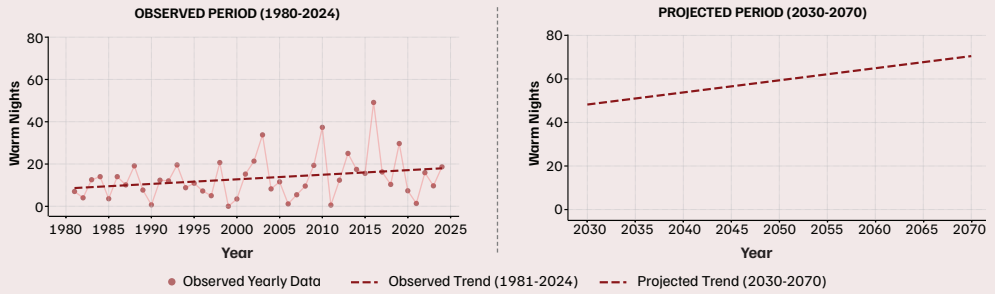
In **Latur,** the number of **heavy rainfall** days has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **53 days** in a year between **2030–2050** and **50 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Latur,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **31 days** in a year between **2030–2050** and **45 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Latur,** the number of **warm nights** has **increased** in recent decades from an average of **11 days** in a year between **1981–2010** to **16 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **53 days** in a year between **2030–2050** and **65 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

DROUGHT RISK IN LATUR

Heat stress threatens agriculture

Despite its moderate drought vulnerability, Latur's status as a heat-prone district creates an extreme risk for its agricultural stability.

HEAT RISK IN LATUR

Solar potential meets high heat risk

While Latur is a top-tier district for solar energy potential, its extreme heat levels pose a significant operational risk to energy infrastructure.

RECOMMENDATIONS[5]

1

CLIMATE-SMART SEEDS AND FARMING PRACTICES

Subsidise short-duration, drought-tolerant seeds and promote soil-moisture conservation practices like mulching, ridge–furrow, farm ponds to farmers in order protect crops during post-sowing dry spells.

2

SCALING MICRO-IRRIGATION SYSTEM

Introduce Group Micro Irrigation initiatives with smallholder farmers to expand coverage without compromising water security and set up demonstration plots at KVKs to showcase micro-irrigation success stories and build capacity.

3

RISK–INFORMED SOLAR INFRASTRUCTURE PLANNING

Mandate site-specific climate risk assessments for solar projects, incorporating future climate models, to inform adaptive design and protect investments against extreme heat and other weather events.

4

INNOVATION IN HEAT-RESILIENT SOLAR TECHNOLOGIES

Promote and incentivise the research, development, and deployment of heat-resilient solar panels and related technologies to maintain efficiency and protect installations from rising temperatures.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

NANDED

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
10,528 sq km	319.27	6,65,434	65.14%	♂ 17,29,950 | 51.5% ♀ 16,31,342 | 48.5%



TAKHT SACHKHAND SRI HAZUR SAHIB

The district hosts one of the most sacred and historic gurdwaras in the Sikh religion. The gurdwara is among one of the five supreme *Takhts of Sikhism.*

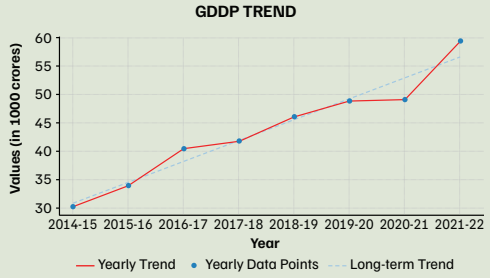
COTTON PRODUCTION AND RESEARCH STATION

Cotton is one of the a major agricultural produce in of the state. Research and development to increase their its yields has been a priority. This research station has pioneered the development of **21 cotton varieties** that offer higher yields and superior resistance to pests and diseases.

PHARMACEUTICAL INDUSTRY

An increasing number of small and medium-scale companies producing generic medicines, syrups and Ayurvedic products have emerged.

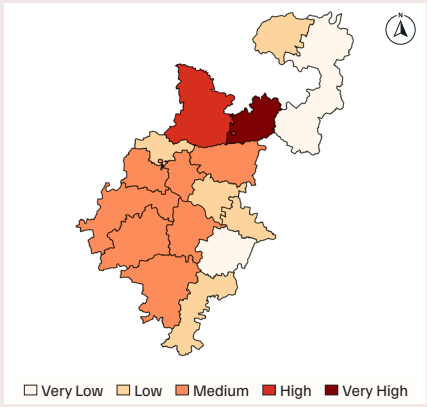
GDP GRAPH[2]



Nanded GDDP increased from **₹30,038 crore** in 2014–15 to **₹59,305 crore** in 2021–22, an overall growth of **97%** over 8 years.

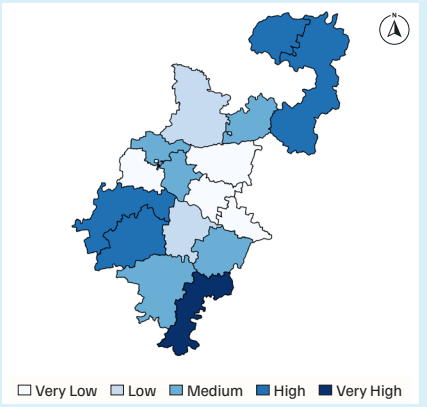
Nanded contributed an average of **1.8%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **57%,** industry sector **27%** and agriculture and allied activities contributed **16%** to Nanded's GDDP.

EXTREME SUMMER HEAT[3]



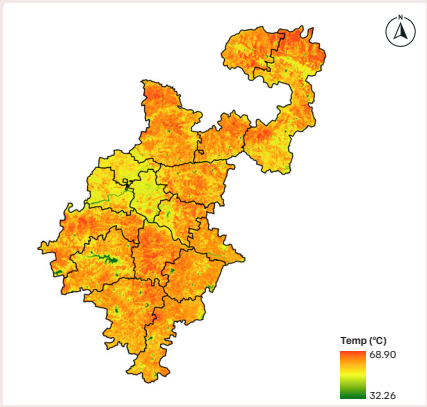
The district of **Nanded** overall is expected to witness a **4.5-fold increase** in the number of warm nights and a **2.5-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981–2010).

EXTREME RAINFALL[3]



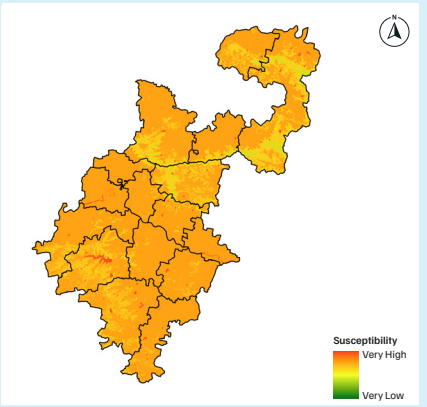
The tehsil of **Deglur** observes high exposure to extreme rainfall. It is expected to witness a **2-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **32.26 to 68.90 °C.** Due to the presence of vast rangelands and agricultural fields, areas in **Naigaon** and **Kinwat** tehsils have high surface temperature compared to others.

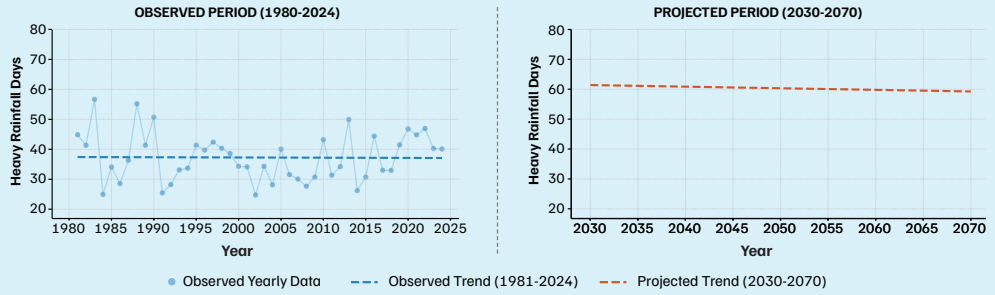
FLOOD SUSCEPTIBILITY[3]



It is observed that the southern part of the district is observed to be more susceptible to floods. Some areas in **Nanded and Kandhar** are more vulnerable to flooding due to their proximity to water bodies.

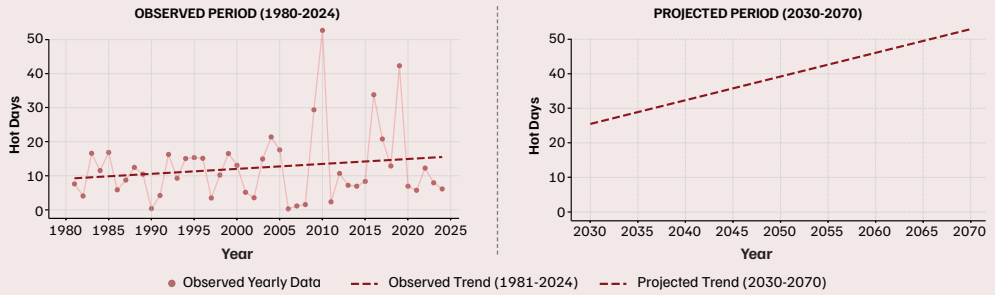
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



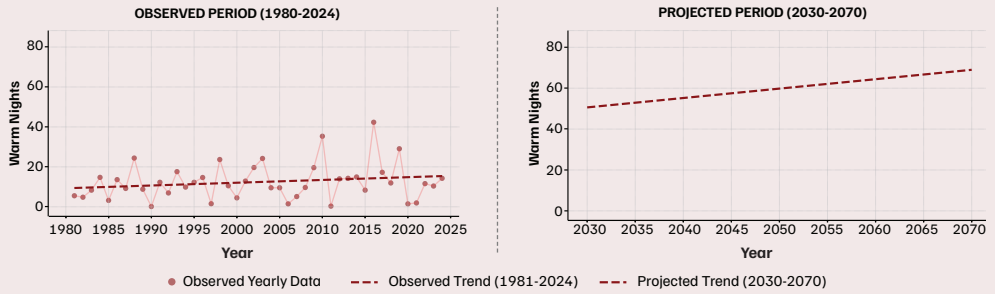
In **Nanded,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **39 days** in a year between **2011–2024.** Climate model projections show that this will **remain steady** to an average of **61 days** in a year between **2030–2050** and between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Nanded,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **32 days** in a year between **2030–2050** and **46 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Nanded,** the number of **warm nights** has **increased** in recent decades from an average of **11 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **55 days** in a year between **2030–2050** and **65 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

TOURISM AT RISK IN NANDED

Protecting tourism from extreme heat

Nanded has a dedicated heat action plan to protect its vulnerable tourism sector, which generates nearly 15% of the district's economy.

WATER RISK IN NANDED

Critical Water Infrastructure Deficit

Nanded lacks the reservoir storage and monitoring stations necessary to manage high water vulnerability during extreme climate events.

RECOMMENDATIONS[5]

1

CLIMATE-RESILIENT TOURISM

Climate-proof Sahastrakund waterfall's tourism infrastructure through riparian vegetation protection, water conservation, and heat-resilient facilities to sustain visitor safety and ecological health under rising temperatures.

2

RETHINKING TOURISM AT SAHASTRAKUND

Introduce heat-responsive tourism management at Sahastrakund waterfall—early warnings, shaded rest areas, drinking water points, and time-based entry restrictions during extreme heat days.

3

ENSURING WATER SECURITY

Strengthen Nanded's water storage reservoirs like Isapur dam through desiltation, catchment area treatment, and real-time storage monitoring to improve reliability under variable monsoon conditions.

4

INTEGRATED WATER USE & PARTICIPATORY MANAGEMENT

Reduce stress on reservoirs by regulating withdrawals, improving irrigation efficiency, and promoting conjunctive use of surface and groundwater through participatory water management.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

PARBHANI

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
6,250 sq km	293.77	3,61,130	63.06%	♂ 9,43,033 | 51.4% ♀ 8,93,053 | 48.6%



AGRICULTURAL RESEARCH HUB

Parbhani serves as a vital agricultural hub, home to Vasantrao Naik Marathwada Krishi Vidyapeeth, one of only four agricultural universities in Maharashtra and the birthplace of the famous 'Gaorani' cotton breed.

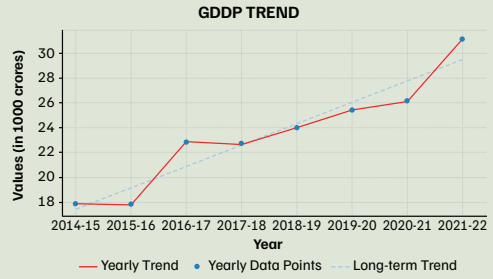
INDUSTRIAL GROWTH

Cotton and sugarcane is one of the important crops in the district and there are several sugar factories, spinning mills, ginning and pressing centers in the district.

MRITYUNJAYA PARDESHWAR TEMPLE (MERCURY SHIVLINGA)

The main shrine of Shivlinga is made of 250 kg of Mercury and one of the largest Shivlinga of the country.

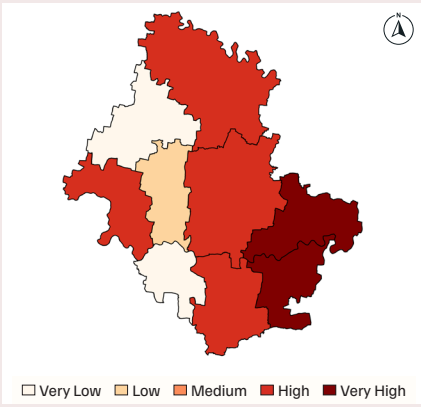
GDP GRAPH[2]



Parbhani's GDDP increased from **₹17,862 crore** in 2014–15 to **₹31,150 crore** in 2021–22, an overall growth of **74%** over 8 years, with slight dips observed in 2015–16 and 2017–18.

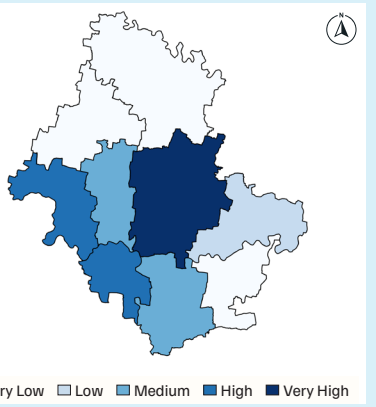
Parbhani contributed an average of **1.0%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **53%,** industry sector **26%** and agriculture and allied activities contributed **21%** to Parbhani's GDDP.

EXTREME SUMMER HEAT[3]



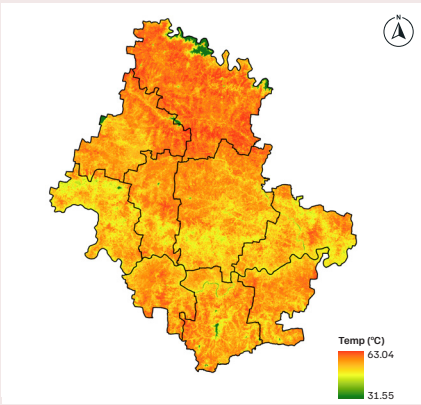
The tehsils of **Palam and Purna** observe high exposure to extreme heat. A **4.5-fold increase** is expected in the number of warm nights and a **2.5-fold increase** in the number of hot days respectively in the future period (2030–2050) compared to the past.

EXTREME RAINFALL[3]



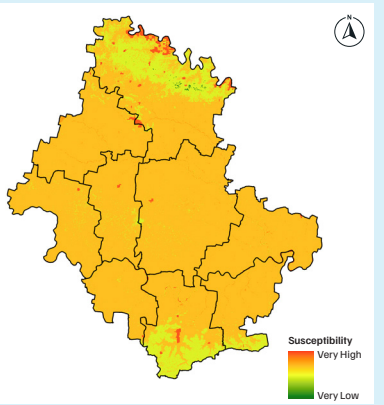
The tehsil of **Parbhani** observes high exposure to extreme rainfall. Climate models show a **1.6-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **31.55 to 63.04 °C. Jintur** tehsil observes high surface temperature compared to other tehsils. This is primarily driven due to presence of rangeland in the region.

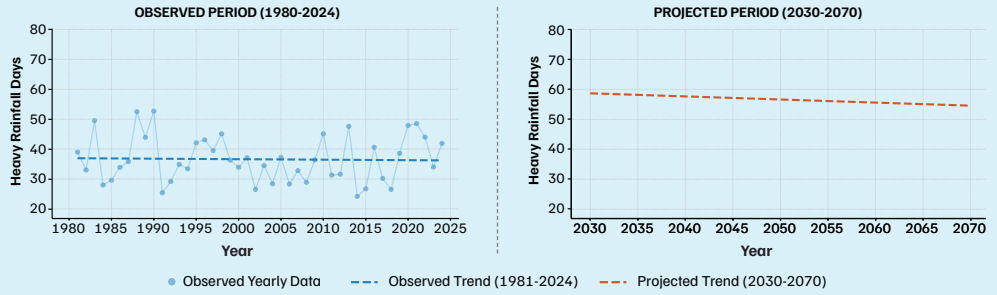
FLOOD SUSCEPTIBILITY[3]



The **northern and southern** parts of the district observe very low flood susceptibility. Overall, the district has medium susceptibility. A few areas in **Jintur** have very high susceptibility due to its proximity to a water body.

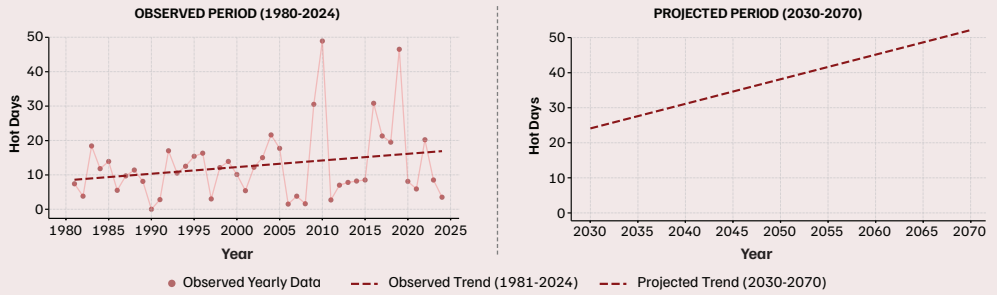
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



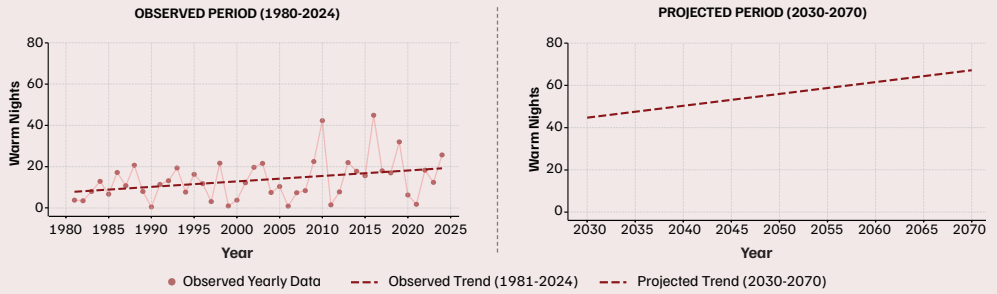
In **Parbhani,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **36 days** in a year between **1981–2010** to **37 days** in a year between **2011–2024.** Climate model projections show that this will **increase further and remain steady** to an average of **57 days** in a year between **2030-2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Parbhani,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **31 days** in a year between **2030–2050** and **45 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Parbhani,** the number of **warm nights** has **increased** in recent decades from an average of **11 days** in a year between **1981–2010** to **17 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **50 days** in a year between **2030–2050** and **63 days** in a year between **2050–2070.**

IMPACTS ON KEY SECTORS

AGRICULTURAL RISK IN PARBHANI

Agricultural risks from drought vulnerability

Parbhani is ranked among the most at-risk districts for agriculture as rising temperatures and prolonged droughts reduce productivity.

HEALTHCARE RISK IN PARBHANI

Severe water risk impacts healthcare

Parbhani faces severe healthcare and water challenges due to a high vulnerability to drought and a lack of critical water storage infrastructure.

RECOMMENDATIONS[5]

1

CLIMATE-RESILIENT CROPPING SYSTEMS

Implement mixed cropping or intercropping like maize and legumes, niger, sorghum, millet varieties) to provide a buffer against crop failure due to extreme weather. Utilise local and wild varieties of seeds that are drought-resistant, early maturing, and better suited to withstand monsoon unpredictability and dry conditions.

2

SCALING MICRO-IRRIGATION THROUGH COLLECTIVE ACTION

Introduce Group Micro Irrigation initiatives with smallholder farmers to expand coverage without compromising water security.

3

RISK-INFORMED RETROFITTING OF HEALTHCARE INFRASTRUCTURE

Utilise high-resolution susceptibility maps as a decision-making tool to identify optimal and unsuitable locations for the relocation of key critical equipment within healthcare facilities.

4

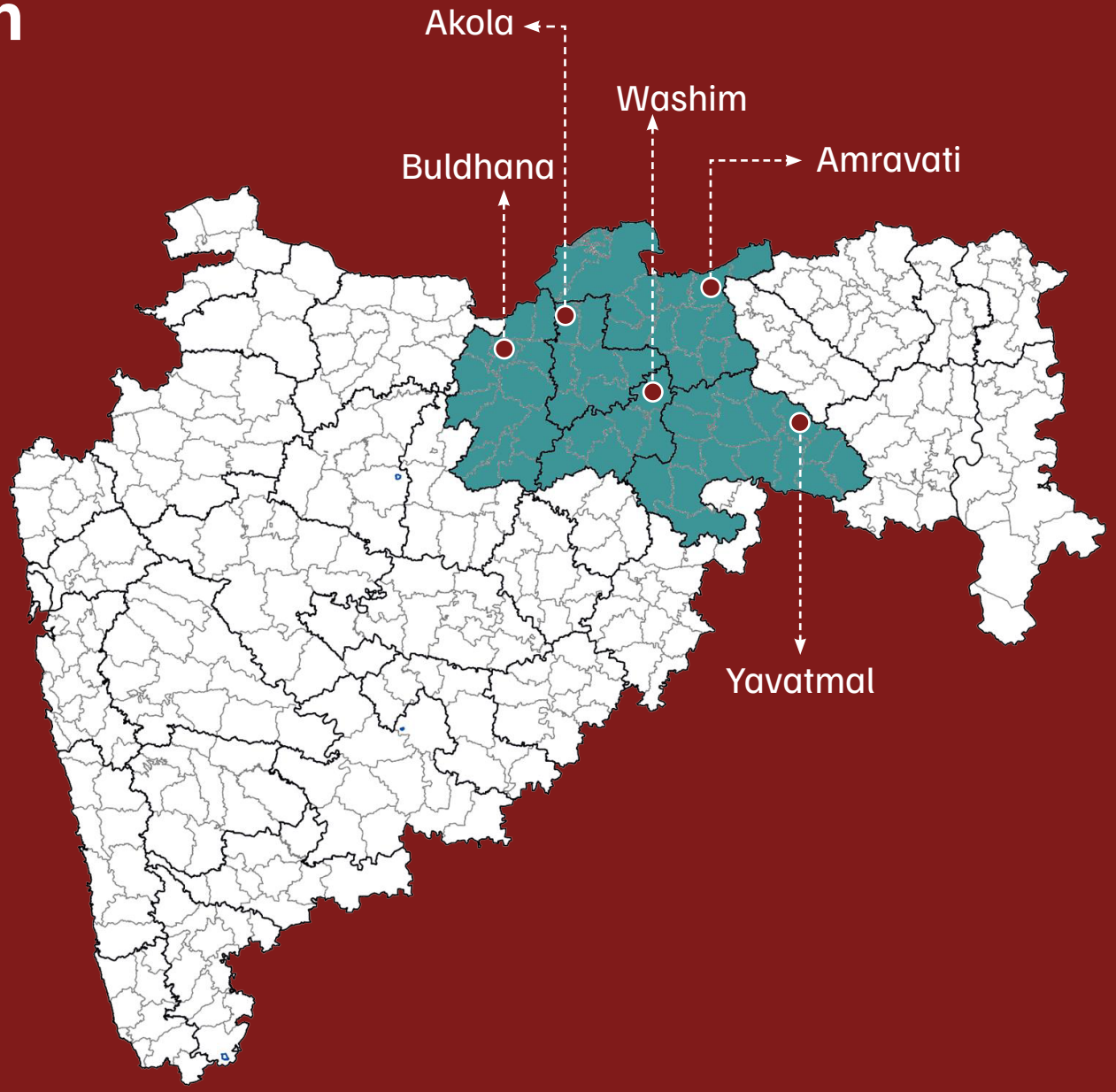
WATER-SECURE HEALTHCARE SYSTEMS FOR DROUGHT RESILIENCE

Implement water conservation and alternative water supply systems within healthcare facilities to ensure continuous water availability during droughts.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

VIDARBHA (WEST)

Amravati Division



Also known as

Cotton Belt of Maharashtra

Situated in the Varhad region, this area features the fertile Purna river basin and the forested highlands of the Melghat and Satpura ranges. The soil is exceptionally rich in minerals, making it some of the most productive cotton-growing land in the country.

HISTORIC IMPORTANCE

This division was a significant part of the ancient Vakataka Empire, whose rulers were great patrons of the arts. During the medieval period, it was a prosperous province under the Berar Sultanate, eventually becoming a centre for the Indian Independence movement and social justice crusades.

CUISINE

The cuisine is characterised by the use of besan (gram flour) and linseed, reflecting a climate that is intensely hot and dry. Spicy preparations like Zunka are staples, providing the high energy needed for the labor- intensive cotton harvests.



COMMUNITY AND OCCUPATION

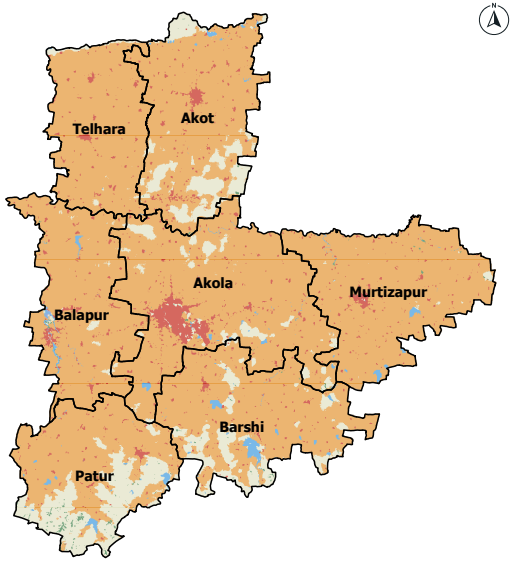
The region is home to a dedicated agrarian population and significant tribal groups in the northern belts. The economy is almost entirely dependent on the 'White Gold' (cotton) and soybean trade, supported by traditional pinning and weaving heritage.

CLOTHING

Reflecting its status as a textile hub, the clothing here is almost exclusively high-grade cotton—white gold. Men typically wear a white dhotar and a bandi (waistcoat), practical for the labor-intensive cotton harvests in the dry heat. Women often use a unique drape where the pallu is wrapped around the waist or head for extra protection during fieldwork.

AKOLA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
5,431 sq km	333.99	3,95,690	77.8%	♂ 9,32,120 | 51% ♀ 8,81,786 | 49%



COTTON PRODUCTION HUB

The district produces cotton on **1,03,362** hectares annually.

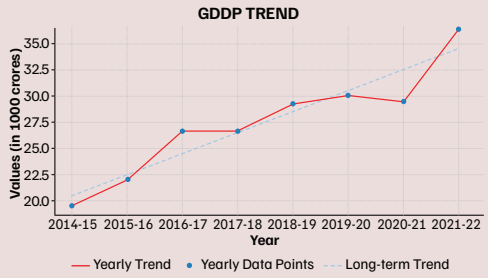
STRATEGIC AGRICULTURAL RESEARCH & SEED PRODUCTION HUB

Dr. Panjabrao Deshmukh Krishi Vidyapeeth has a pioneering modern tech research facility for drought-resistant crops and sustainable agricultural practices.

KATEPURNA SANCTUARY

Katepurna Sanctuary is a catchment of the Katepurna reservoir, spread over an area of **73.69 sq.km.** The sanctuary has over **115 species** of plants present.

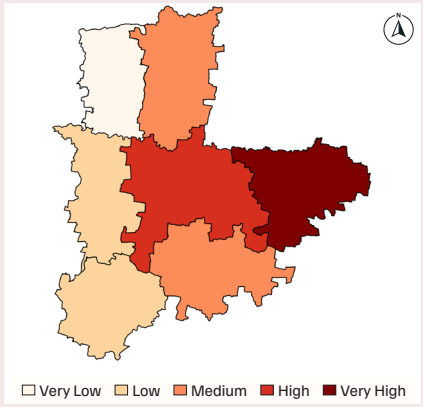
GDP GRAPH[2]



Akola's GDDP increased from **₹19,517 crore** in 2014–15 to **₹36,252 crore** in 2021–22 , an overall growth of **85.7%** over 8 years. The district contributed an average of **1.1%** to Maharashtra's GSDP between 2014–15 and 2021–22.

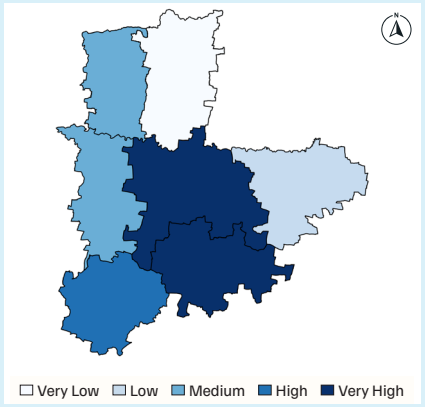
On average, the service sector contributed **57%**, the industry sector **27%** and agriculture and allied activities contributed **16%** to Akola's GDDP.

EXTREME SUMMER HEAT[3]



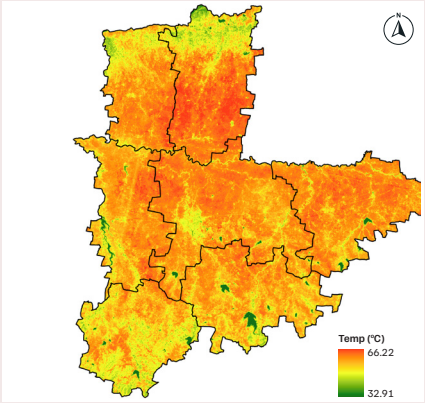
Murtizapur tehsil has the highest exposure to heat, expected to witness a **5-fold increase** in the number of warm nights and **2.5-fold increase** in the number of hot days in the near future (2030–2050) compared to past trends (1981–2010).

EXTREME RAINFALL[3]



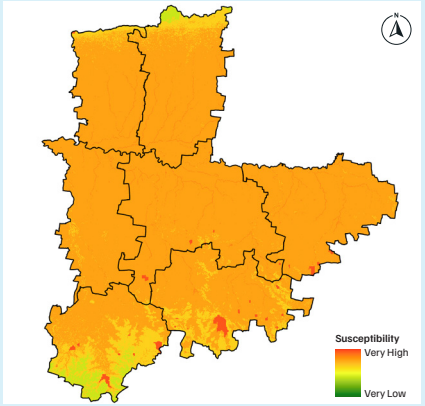
Akola and Barshi tehsils have the highest exposure to extreme rainfall. Climate model projections show that the number of heavy rainfall days may **increase 1.5-fold** in the near future (2030–2050) compared to the past trends (1981–2010)

LAND SURFACE TEMPERATURE[3]



The district observes an average surface temperature between **32.91 and 66.22 °C. Akola and Murtizapur** face extreme surface temperature due to high solar absorption by black cotton soils and dense urban built-up areas.

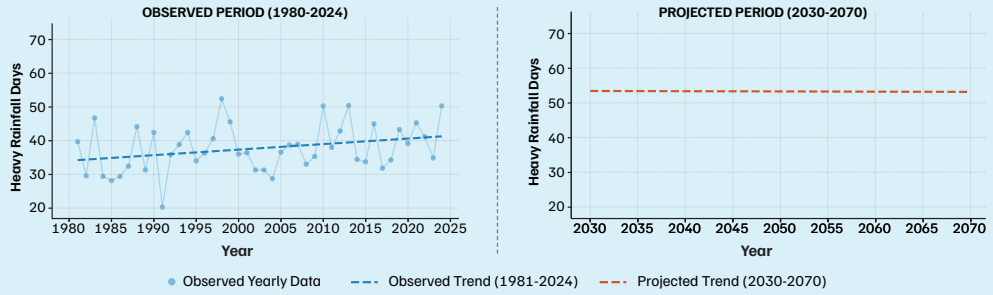
FLOOD SUSCEPTIBILITY[3]



Most of the tehsils are **highly susceptible to floods.** Tehsils such as **Akola and Balapur** observe the highest flood susceptibility. Some areas near the water bodies in Barshi tehsil are particularly susceptible to flooding.

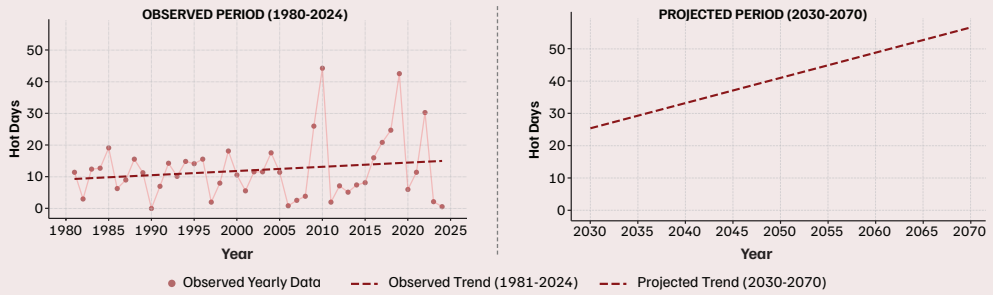
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



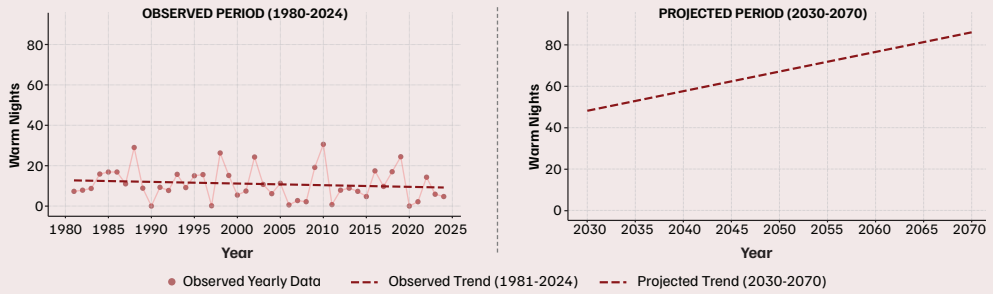
In **Akola,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **40 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **53 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Akola,** the number of **hot days** has **increased** in recent decades from an average of **11 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **33 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Akola,** the number of **warm nights** has **decreased** in recent decades from an average of **12 days** in a year between **1981–2010** to **9 days** in a year between **2011–2024.** Climate model projections show that this will **increase** to an average of **57 days** in a year between **2030–2050** and **77 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

DROUGHT RISK IN AKOLA

Rising heat and increasingly erratic rainfall are stressing Akola's cotton-dominated agriculture, depressing yields and leaving farmers' incomes highly exposed.

HEAT RISK IN AKOLA

Urban growth intensifying heat risk

Akola's high urbanisation rate of 39.67% intensifies its heat-prone climate, creating significant temperature risks for the growing city.

RECOMMENDATIONS[5]

1

NATURAL FARMING & SEED RESILIENCE

Promoting use of drought- and heat-tolerant seed varieties, and intercropping of cotton with pulses such as tur in cotton-growing tehsils, supported by assured procurement and crop insurance to reduce risk to agriculture.

2

URBAN WATER SECURITY

Protecting the Katepurna reservoir, reducing supply losses with drought-preparation plans along with promotion of rainwater harvesting and treated wastewater reuse as local buffers to strengthen Akola city's water security.

3

STRENGTHENING EWS

Building new and strengthening forecasting and ICT infrastructure for advance heat warning systems.

4

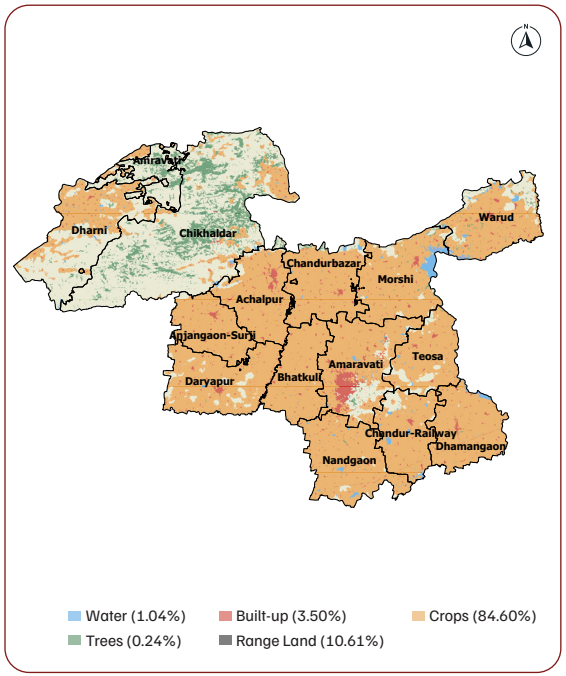
BLUE GREEN CORRIDOR

Implement blue-green corridors along major roads to mitigate the urban heat island effect along, with passive cooling solutions like cool roofing in town planning to reduce urban heat islands.

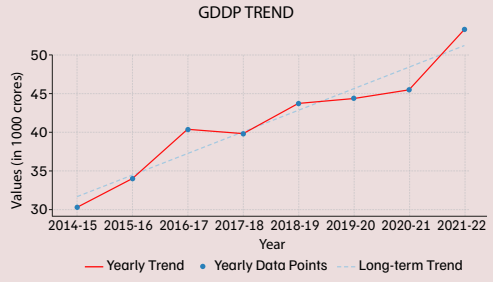
Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

AMRAVATI

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
12,235 sq km	236.08	6,47,451	77.96%	♂ 14,80,495 | 51% ♀ 14,07,950 | 49%



GDP GRAPH[2]



MANDARIN ORANGE HUB

The district is one of the largest orange hubs, covering an area of **90,496.36 hectares.**

MELGHAT TIGER RESERVE

The tiger reserve has one of the highest footfalls in the district receiving more than 1 lakh tourists every year. It is spread across an area of **1,677 sq. km** and the forest is covered with dry deciduous trees.

BAMBOO GARDEN

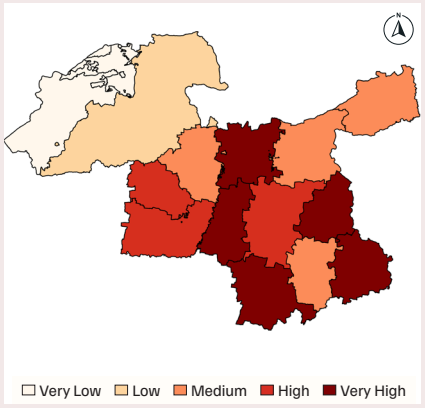
The district hosts Maharashtra's first bamboo garden, comprising **63** different species of bamboo, spread across **49 hectares**.

COTTON PRODUCTION & MILLS

Cotton is a major crop produced in the district and hence cotton mills provide significant employment. More than **1,000 hectares** of land is reserved for textile zones.

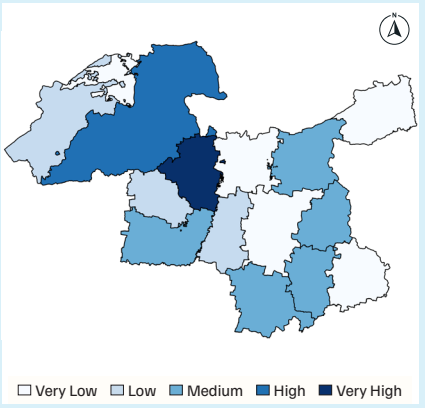
Amravati's GDDP increased from **₹30,282 crore** in 2014-15 to **₹53,285 crore** in 2021-22, an overall growth of **76%** over **8 years**. The district contributed an average of **1.7%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the services sector contributed **53%**, industry **26%** and agriculture **21%** to Amravati's GDDP.

EXTREME SUMMER HEAT[3]



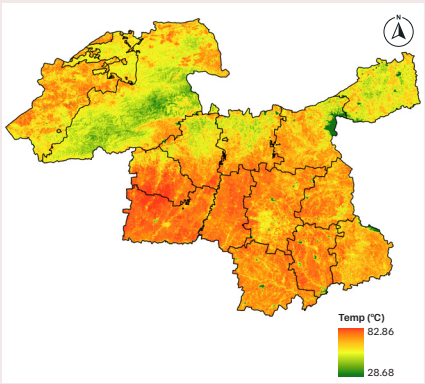
Dhamangaon, Nandgaon, Teosa, and Chandurbazar tehsils have the highest exposure to heat. These tehsils are expected to witness a **5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days, in the near future period (2030–2050) compared to the past trends (1981–2010).

EXTREME RAINFALL[3]



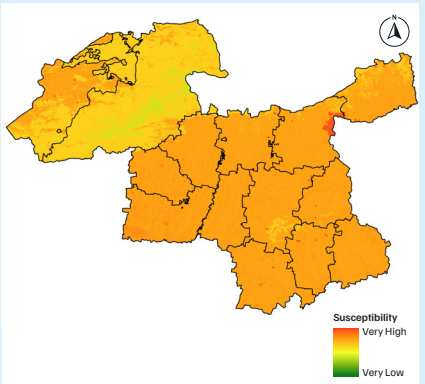
Achalpur tehsil has the highest rainfall exposure. According to the climate models, Achalpur tehsil is expected to witness a **1.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past trends (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district observes a surface temperature range from **28.68 to 82.86°C**. Tehsils such as **Daryapur** observe high land surface temperatures compared to other tehsils, primarily due to lower green cover and the presence of large agricultural fields and range lands.

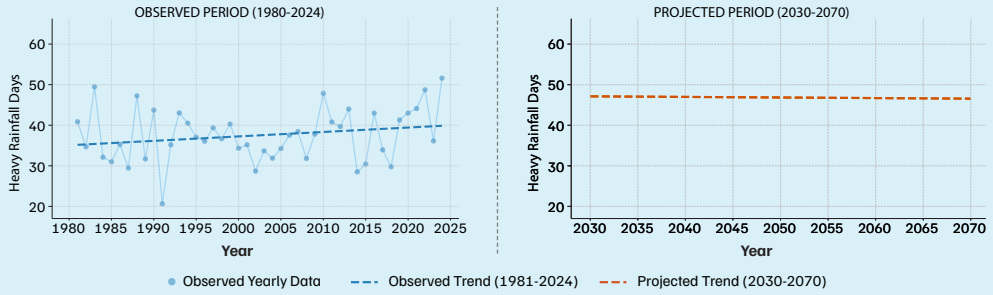
FLOOD SUSCEPTIBILITY[3]



The district shows widespread **high flood susceptibility, with critical 'Very High' zones** located along water bodies. **Morshi and Warud** tehsils are particularly vulnerable due to their proximity to the Upper Wardha Dam and the confluence of multiple tributaries, such as the Chundamani and Bel rivers, which drain steep hilly runoff into narrow plains.

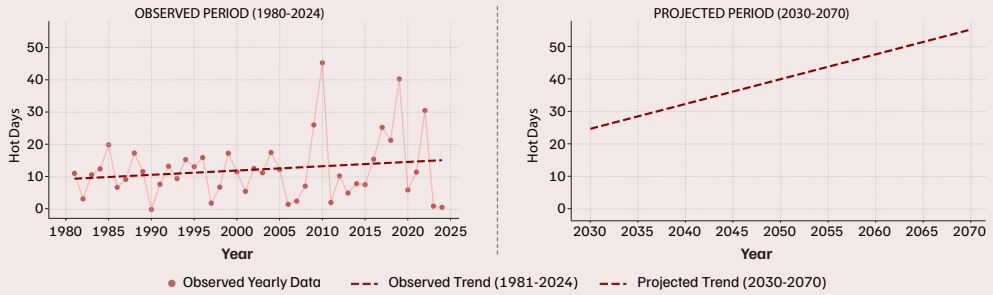
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



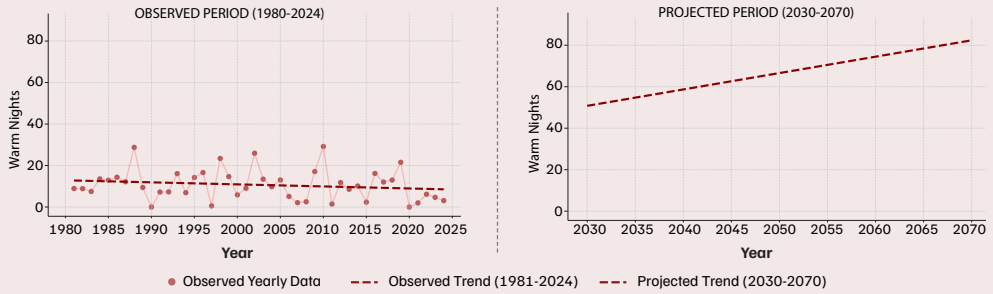
In **Amaravati,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **40 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **47 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Amaravati,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **32 days** in a year between **2030–2050** and **48 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Amaravati,** the number of **warm nights** has **decreased** in recent decades from an average of **12 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **58 days** in a year between **2030–2050** and **75 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT



AGRICULTURAL FLOOD RISK IN AMRAVATI

Flood occurrences for the first time since 2020

Amravati's agriculture is now facing a critical shift as its most productive talukas experience their first extreme flood events since 2020



WATER RISK IN AMRAVATI

Excessive groundwater use drives risk

Amravati faces increased risk exposure during climate disasters due to its critically high rates of groundwater extraction.

RECOMMENDATIONS[5]

1

FLOOD BASIN-ZONATION

Conduct basin-level flood zonation mapping to identify flood-prone areas and improve disaster preparedness.

2

STRENGTHENING STORMWATER DRAINAGE

Building stormwater drainage along the natural drainage channel connected to detention ponds in low-lying areas to collect excessive stormwater and reduce flooding.

3

WATER HARVESTING INFRASTRUCTURE

Construct water harvesting structures like check dams to capture runoff in the Vidarbha region.

Increase surface water-based drinking water schemes in rural areas to reduce groundwater dependence.

4

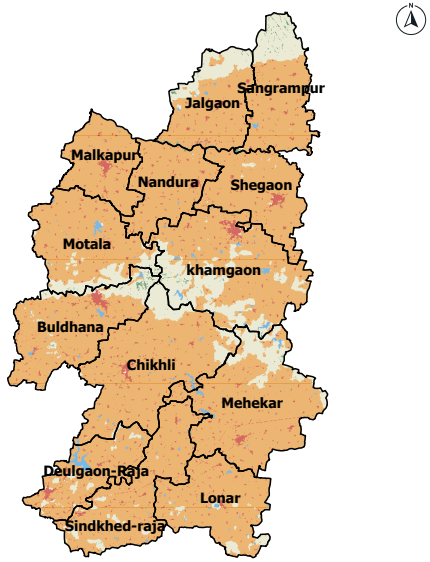
WASTE WATER REUSE PLAN

Develop a water reuse plan and promote the reuse of treated wastewater in thermal power plants, industries, and urban areas.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

BULDHANA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
9,680 sq km	267.18	5,61,504	72.69%	♂ 13,37,259 | 51.7% ♀ 12,48,999 | 48.3%



LONAR CRATER LAKE

Declared as a Wildlife Sanctuary, this over **52,000 year-old** marvel is the only crater in Basaltic rock formed by a meteorite impact in India ranking the **3rd** biggest in the world.

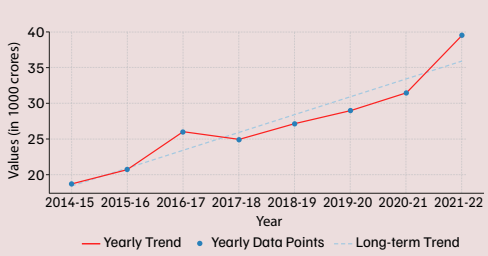
PULSES & OILSEED PRODUCTION

Pulses constitute **31.43%** of the total area under crop land while oilseed comprises **38.71%**.

DNYANGANGA WILDLIFE SANCTUARY

Home to rich flora and fauna with about **150 species** of birds.

GDP GRAPH[2]

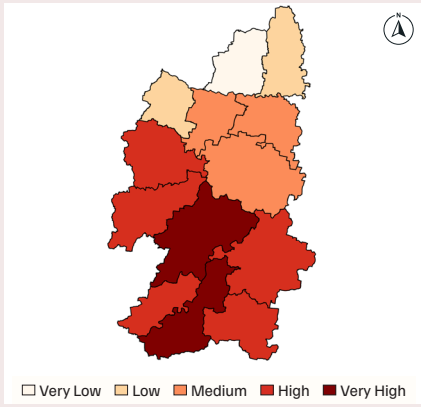


Buldhana's GDDP more than doubled between 2014-15 to 2021-22 with a slight dip in 2017-18 and peak growth in 2016-17 and 2021-22.

Buldhana contributed an average of **1.1%** to Maharashtra's GSDP between 2014–15 and 2021–22.

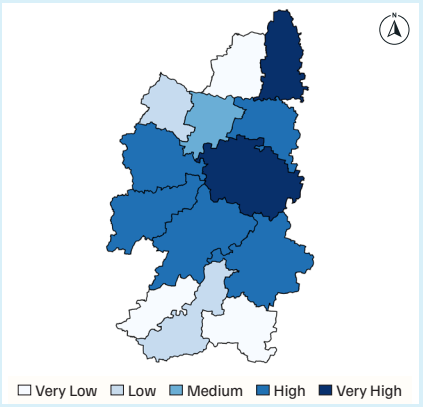
On average, service sector contributed **51%**, industry sector **26%** and agriculture and allied activities contributed **23%** to Buldhana's GDDP.

EXTREME SUMMER HEAT[3]



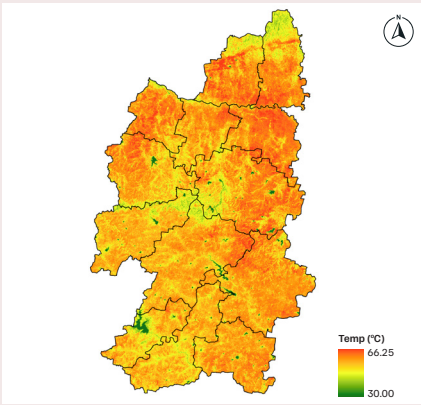
Sindkhed-Raja and Chikhli tehsils, with high exposure to heat are expected to witness a **4.5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days in the future period (2030–2050) compared to the past.

EXTREME RAINFALL[3]



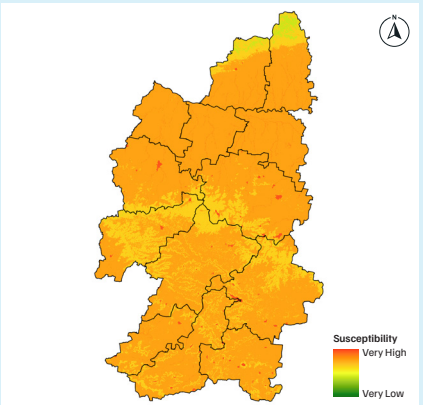
Mohadi and Pauni tehsils have the highest precipitation score, expected to witness a **1.05-fold increase** in the number of heavy rainfall days in the near future (2030–2050) compared to the past (1981–2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits the surface temperature in range of **30.00 to 66.25°C**. Tehsils such as **Khamgaon, Malkapur, and Shegaon** exhibit the highest surface temperature due to solar absorption in black soil.

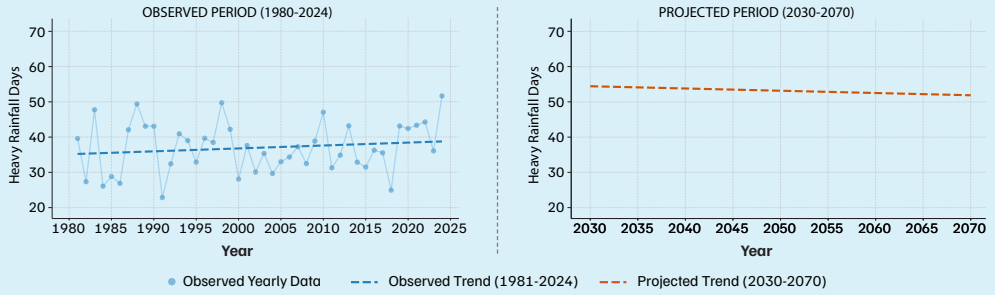
FLOOD SUSCEPTIBILITY[3]



Most of the district lies in high flood susceptible zones. Tehsils like **Sangrampur, Jalgaon Jamod, and Nandura** are most susceptible due to their low elevation in alluvial plains and rapid runoff from the Satpura ranges.

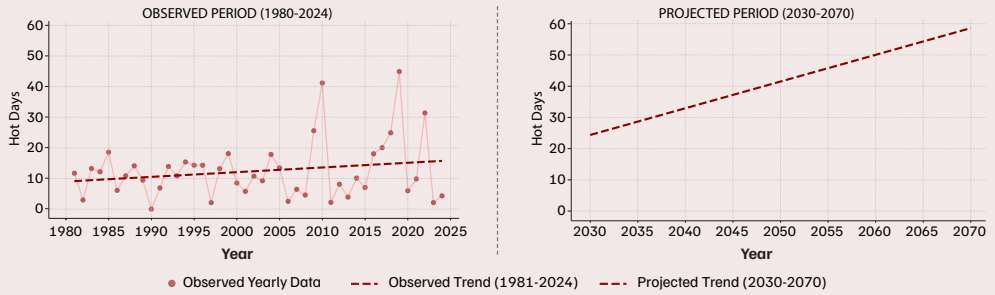
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



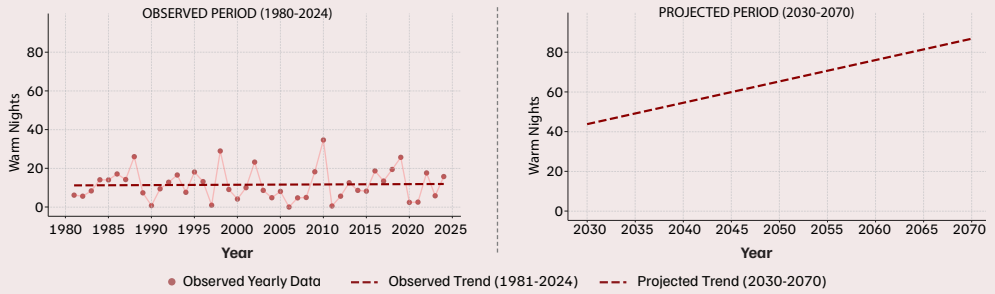
In **Buldhana,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **54 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Buldhana,** the number of **hot days** has **increased** in recent decades from an average of **12 days** in a year between **1981–2010** to **14 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **32 days** in a year between **2030–2050** and **51 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Buldhana,** the number of **warm nights** has **remained steady** in recent decades from an average of **11 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **54 days** in a year between **2030–2050** and **76 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

TOURISM RISK IN BULDHANA

Flooding threatens Lonar Lake heritage

Rising water levels at Lonar Lake threaten to submerge ancient heritage sites and disrupt the rare ecological balance.

AGRICULTURAL RISK IN BULDHANA

Groundwater depletion threatens agricultural stability

Buldhana's heavy reliance on groundwater extraction leaves its agricultural sector exposed to the impacts of both floods and droughts.

RECOMMENDATIONS[5]

1

FLOOD-RESILIENT TOURISM

Strengthen flood-resilient infrastructure around Lonar Lake through improved drainage, controlled access zones, and protection of embankments to reduce flood damage to tourism assets.

2

STRENGTHENING RAINFALL EWS

Implement real-time rainfall and flood early-warning systems with temporary closures and visitor advisories to safeguard tourists and local livelihoods during extreme rainfall events.

3

WATER SECURITY

Leverage Jalyukt Shivar Abhiyan, a Maharashtra's flagship water conservation programme to reduce drought, recharge groundwater, and improve irrigation water availability for farms. Farmers benefit from water retention structures, percolation tanks, and watershed works that improve water for crop and fodder production.

4

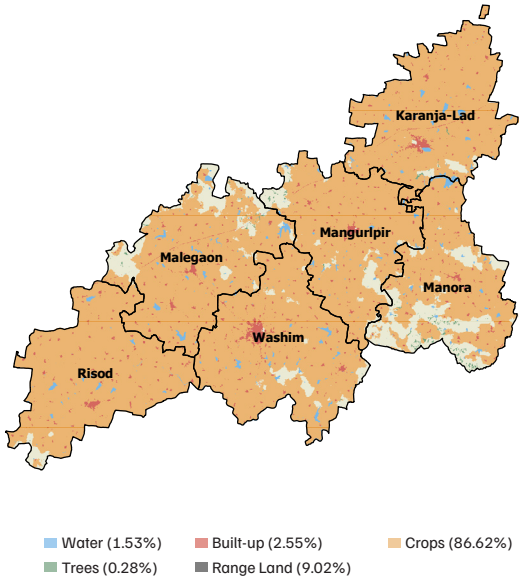
TREATED WATER REUSE

Promote the reuse of treated wastewater in thermal power plants, industries, and urban areas by uptake through pricing reforms, long-term supply contracts, and regulatory mandates will help scale adoption and improve water security.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

WASHIM

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
5,150 sq km	232.46	2,59,464	72.67%	♂ 6,20,290 | 51.8% ♀ 5,76,870 | 48.2%



SOYA BEAN PRODUCTS & WHEAT

Per hectare production of soybean is **1,918.95 kg** and that of wheat is **1,855.13 kg**.

COTTON PRODUCTION & TEXTILE

The district serves as a crucial centre for cotton production and the export of cotton- related products.

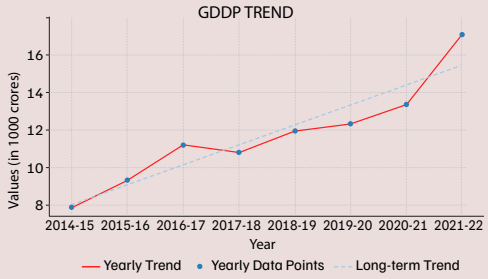
SHRI BALAJI TEMPLE

The temple dates back to **1779 AD**, constructed by Bhavani Kalu and is dedicated to Venkateshwara Balaji.

FOOD PROCESSING INDUSTRY

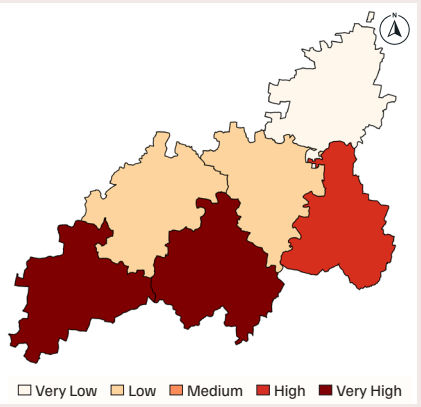
There are numerous dal and oil mills spread across the district.

GDP GRAPH[2]



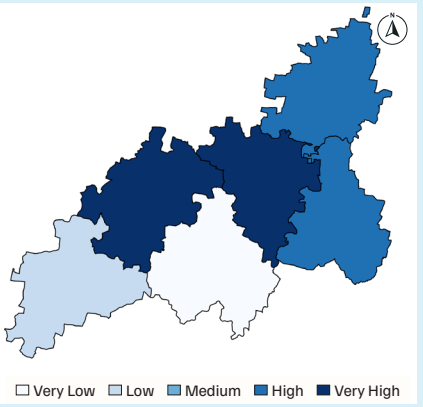
Washim's GDDP increased from **₹7,879 crore** in 2014–15 to **₹17,060 crore** in 2021–22, an overall growth of **117%** over 8 years. Washim contributed an average of **0.5%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **49%**, industry sector **23%** and agriculture and allied activities contributed **28%** to Washim's GDDP.

EXTREME SUMMER HEAT[3]



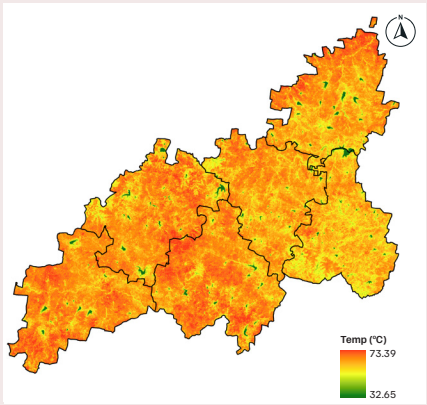
The tehsils of **Risod and Washim** observe the highest exposure to extreme heat. They are expected to witness a **4.5-fold increase** in the number of warm nights and a **1.5-fold increase** in the number of hot days respectively in the future period (2030–2050) compared to the past (1981-2010)

EXTREME RAINFALL[3]



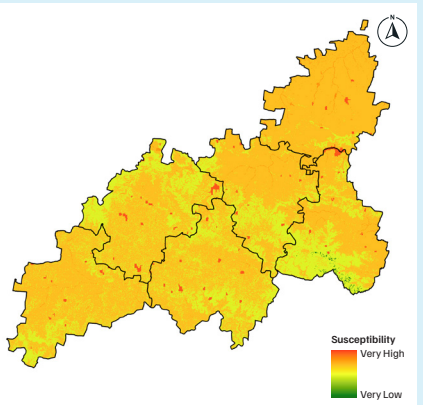
The tehsils of **Malegaon, and Mangurlpir** observe the highest exposure to extreme rainfall. Climate model projects a **1.5-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past (1981-2010)

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **31.57 to 67.27 °C.** Overall, the district has **medium to high surface temperature. Washim, Risod, and Malegaon** have recorded the peak surface temperature

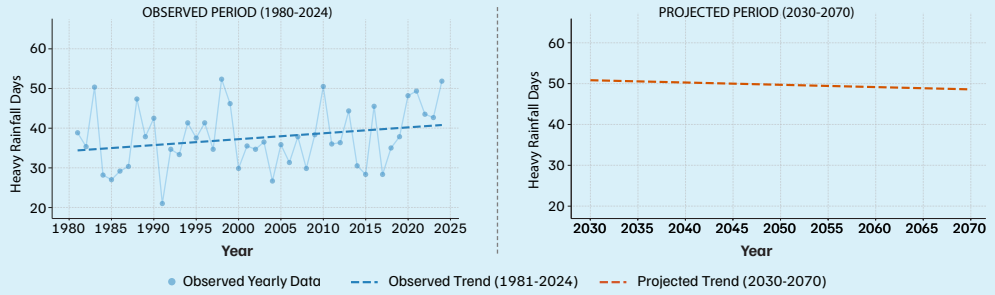
FLOOD SUSCEPTIBILITY[3]



The district has **very low to medium flood susceptibility overall.** Only a few scattered areas — largely along drainage lines and near water bodies — show high flood susceptibility.

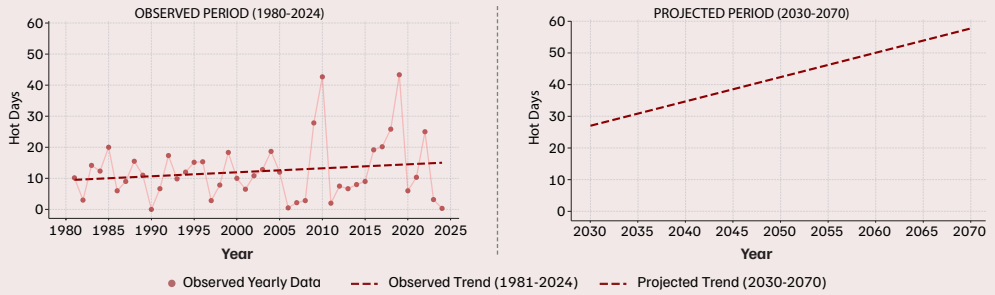
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



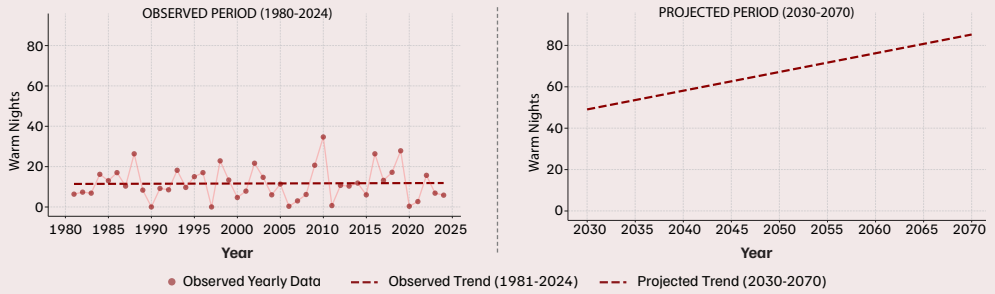
In **Washim,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **37 days** in a year between **1981–2010** to **40 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **50 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Washim,** the number of **hot days** has **increased** in recent decades from an average of **11 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **34 days** in a year between **2030–2050** and **51 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Washem,** the number of **warm nights** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **57 days** in a year between **2030–2050** and **77 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

HEALTHCARE RISK IN WASHIM

Healthcare vulnerability due to extreme weather

Washim's rising heat and humidity trends demand proactive planning to safeguard its healthcare industry.

AGRICULTURAL RISK IN WASHIM

Critical infrastructure gaps threaten agriculture

Washim's agricultural industry is vulnerable due to lack of reservoir storage and monitoring stations for drought and flood risks.

RECOMMENDATIONS[5]

1

RESILIENT HEALTHCARE INFRASTRUCTURE

Expand the Indian Public Health Standards (IPHS) to monitor healthcare facility resilience through an online portal for real-time data-driven management.

2

RISK-BASED FINANCING

Channel climate risk-based financing through the National Health Mission (NHM) to strengthen healthcare infrastructure resilience, prioritising regions identified by sub-district level risk assessments.

3

WATER HARVESTING

Construct water harvesting structures like check dams to capture runoff in the Vidarbha region. Increase surface water-based drinking water schemes in rural area to reduce groundwater dependence.

4

IMPROVE STORMWATER DRAINAGE

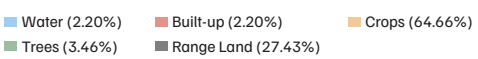
Build stormwater drainage along the natural drainage channel connected to detention ponds in low-lying areas to collect excessive stormwater and reduce flooding.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

YAVATMAL

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
13,582 sq km	204.12	6,46,886	72.96%	♂ 14,20,260 | 51.2% ♀ 13,52,088 | 48.7%





COTTON TEXTILE CAPITAL

There are a total of six cooperative spinning mills in the district whose share capital is **Rs. 120 crore.**

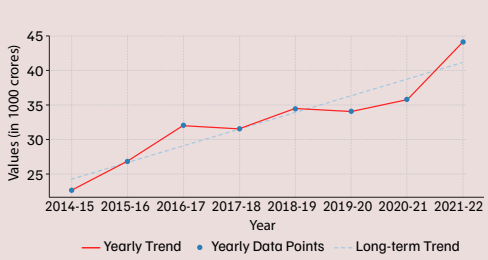
TIPESHWAR WILDLIFE SANCTUARY

Deriving its name from the nearby 'Goddess Tipai', the sanctuary is nestled in the Pandharkawada region, spanning across **148.63 sq km.**

DOLOMITE AND LIMESTONE MINES

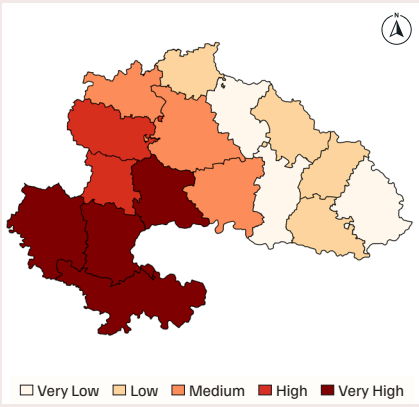
The annual production of Limestone and dolomite is around **1.5 Cr Tonnes.**

GDP GRAPH[2]



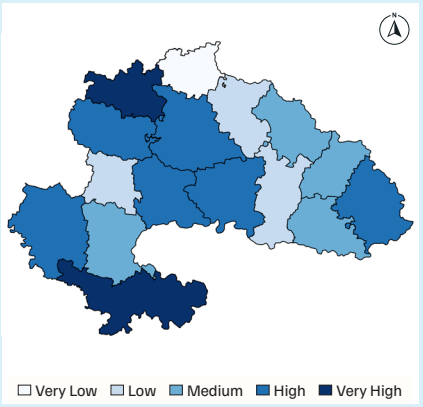
Yavatmal's GDDP increased from **₹22,649 crore** in 2014–15 to **₹44,097 crore** in 2021–22, an overall growth of **95%** over 8 years. Yavatmal contributed an average of **1.4%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **49%**, industry sector **28%** and agriculture and allied activities contributed **23%** to Yavatmal's GDDP.

EXTREME SUMMER HEAT[3]



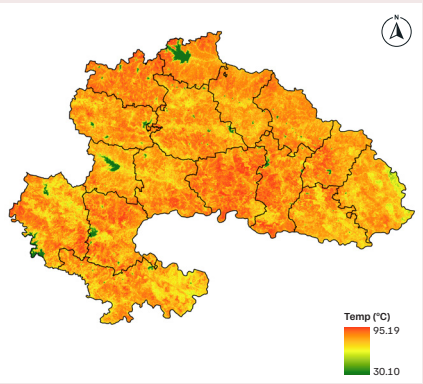
The tehsils of **Umerkhed, Mahagaon, Arni and Pusad** observe the highest exposure to extreme heat. Climate model projects a **4.5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days respectively in the future period (2030–2050) compared to the past (1981-2010)

EXTREME RAINFALL[3]



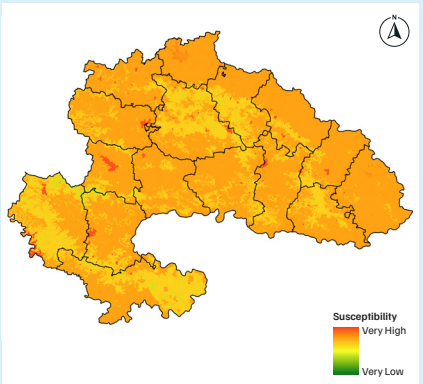
The tehsils of **Umerkhed and Ner** have the highest exposure to extreme rainfall and are projected to witness a **1.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010)

LAND SURFACE TEMPERATURE[3]



The district exhibits the highest surface temperature across the state with temperature ranging from **30.10** to **95.19 °C**. Tehsils such as **Ghatanji, Kelapur, Pusad and Darwha** show high to very high surface temperatures as compared to other tehsils.

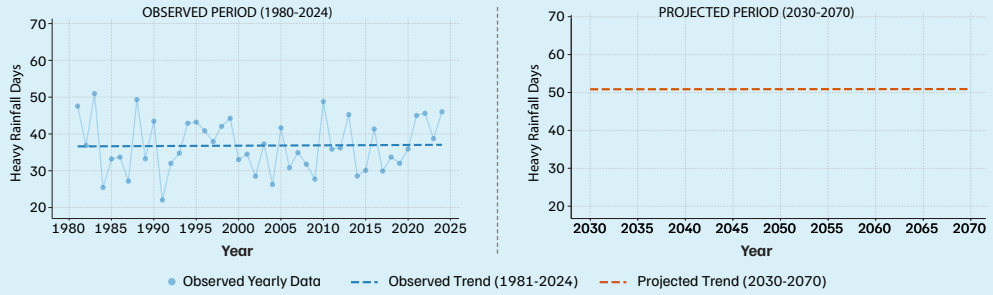
FLOOD SUSCEPTIBILITY[3]



The district has **medium to high flood susceptibility**. Most of the tehsils in the eastern part of the district observed high flood susceptibility with low to medium susceptibility along the western borders. Some areas in **Digras, Mahagaon, and Yavatmal** have very high flood susceptibility due to their low elevation and presence of water bodies.

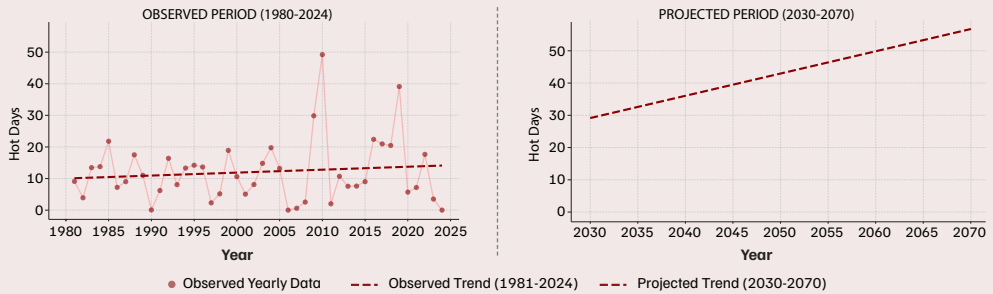
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



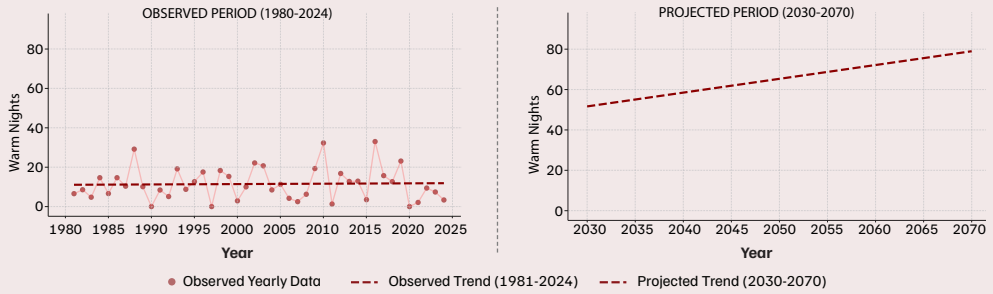
In **Yavatmal,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **50 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Yavatmal,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **35 days** in a year between **2030–2050** and **50 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Yavatmal,** the number of **warm nights** has **remained steady** in recent decades from an average of **11 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **58 days** in a year between **2030–2050** and **73 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

AGRICULTURAL RISK IN YAVATMAL

Erratic monsoons disrupt crop growth

Yavatmal's farmers face severe crop failures as irregular monsoons and late-season dry spells disrupt growth right after sowing.

HEAT RISK IN YAVATMAL

Rising heat increases population vulnerability

Yavatmal's population faces high heat risks as the district is projected to become one of Maharashtra's five warmest regions.

RECOMMENDATIONS[5]

1

PARAMETRIC INSURANCE

Expand parametric insurance with early-season dry-spell triggers, to provide automatic payouts when rainfall fails immediately after sowing.

2

HEAT-RESILIENT AGRICULTURE

Subsidise short-duration, drought-tolerant seeds and promote soil-moisture conservation practices like mulching, ridge-furrow, farm ponds to farmers in order to protect crops during post-sowing dry spells.

3

HEAT PREPAREDNESS CAPACITY BUILDING

Awareness campaign for heat protection for people like avoid heat exposure, keep cool, and prevent dehydration; wear lightweight, light-coloured, loose, cotton clothes, and during heat events take extreme care for vulnerable individuals such as infants, the elderly, and people with chronic diseases.

4

BLUE-GREEN INFRASTRUCTURE

Implement blue-green corridors along major roads to mitigate the urban heat island effect, along with implementing adaptation strategies like cooling shelters, cool roofing, among others to combat heatwaves.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

VIDARBHA (EAST)

Nagpur Division



Also known as

Dandakaranya Fringe

Unlike the rest of the state, this easternmost division is rich in tropical moist deciduous forests and massive mineral deposits. It is a land of many lakes and rivers, including the Wainganga and Wardha, which keep the landscape greener than the western plateaus

HISTORIC IMPORTANCE

The region flourished as the capital of the Gond kings and later became the seat of the Bhonsle Marathas, who expanded their influence deep into Central India from Nagpur. In the modern era, it gained importance as the 'Second Capital' of Maharashtra, serving as a bridge between the state and central India.



CUISINE

The local Varhadi or Saoji cuisine is famous for being among the spiciest in India, utilising black pepper and dried chilies to stimulate the palate in the humid, tropical heat. Oranges and forest produce like Mahua and Tendu also play a significant role in the local economy and diet.

COMMUNITY AND OCCUPATION

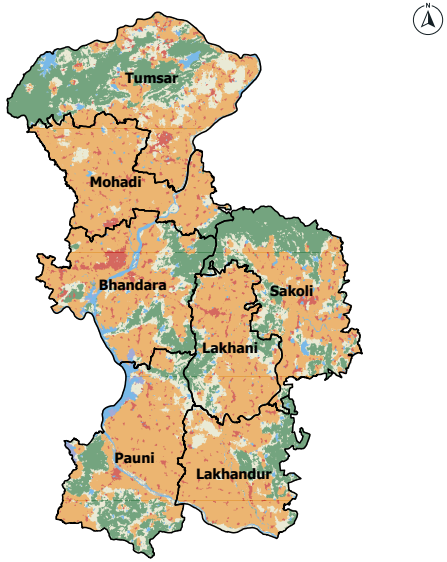
The population includes a blend of forest-dwelling tribes, miners, and citrus cultivators. Occupationally, the region is a leader in coal mining, manganese extraction, and the world-renowned production of Nagpur oranges.

CLOTHING

Eastern Vidarbha's attire is influenced by both the dense forest environment and its proximity to Central India. Tribal communities like the Gonds have distinct dressing styles involving shorter drapes and vibrant body art (tattoos) that signify social status and protection. In urban Nagpur, the men often opt for the Patka and women wear cotton sarees with broad, colourful borders suited for the humid, forest-fringe climate.

BHANDARA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
3,717 sq km	322.93	2,78,076	74.97 %	♂ 6,05,618 | 50.5% ♀ 5,94,716 | 49.5%



Water (3.88%) Built-up (5.14%) Crops (53.44%)
Trees (21.62%) Range Land (15.25%)

MAHARASHTRA'S RICE BOWL

Bhandara district is home to a historic rice mill cluster that has been operational for over five decades and currently includes more than 240 mills.

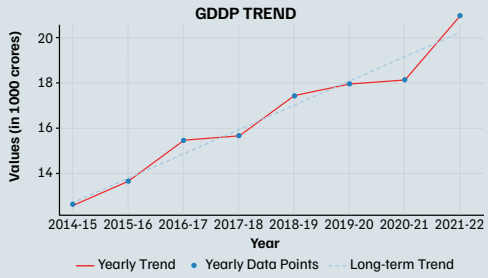
THE BRASS CITY

Bhandara is famously known as the 'Brass City', a title earned through its centuries-old tradition and significant industry in manufacturing high-quality brass products.

AMBAGAR FORT

The fort features a unique Gomukhi-style entrance, carved with images of peepal leaves and lotuses, tucked between two massive bastions, with 14 bastions total surrounding the 4-acre area.

GDP GRAPH[2]

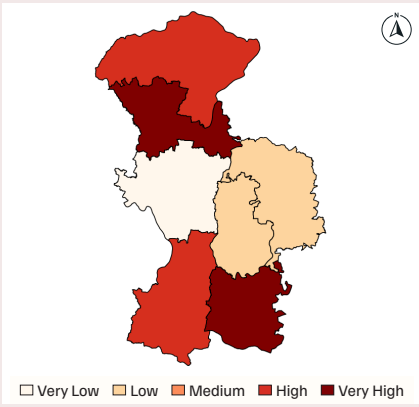


Bhandara's GDDP increased from **₹12,548 crore** in 2014-15 to **₹20,928** crore in 2021-22, an overall growth of **67%** over 8 years.

Bhandara contributed an average of **0.7%** to Maharashtra's GSDP between 2014–15 and 2021–22.

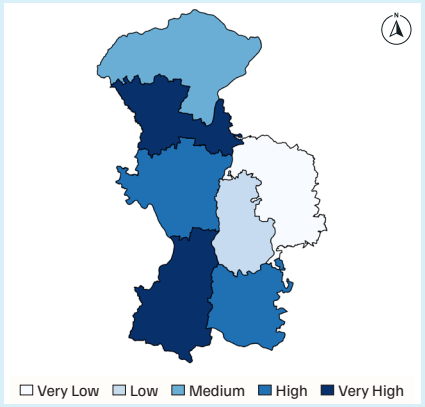
On average, the service sector contributed **49%**, industry sector **30%** and agriculture and allied activities contributed **21%** to Bhandara's GDDP.

EXTREME SUMMER HEAT[3]



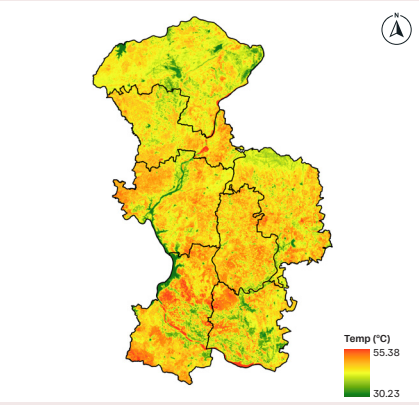
Mohadi and Lakhandur tehsils have the highest heat exposure, expected to witness a **4.5 -fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days in the near future (2030-2050).

EXTREME RAINFALL[3]



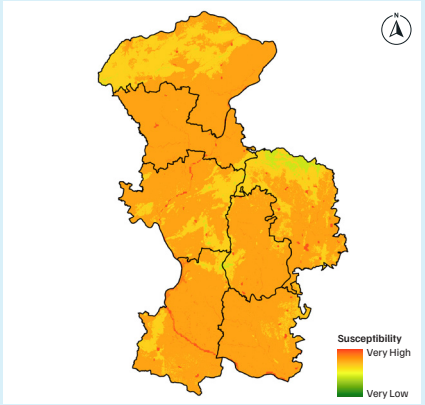
Mohadi and Pauni tehsils have the highest exposure to extreme rainfall, expected to witness a **1-fold increase** in the number of heavy rainfall days in the near future (2030-2050)

LAND SURFACE TEMPERATURE[3]



The district observes a surface temperature range from **30.23 to 55.38 °C. Pauni and Lakhandur** tehsils observe higher surface temperatures compared to other tehsils in the district.

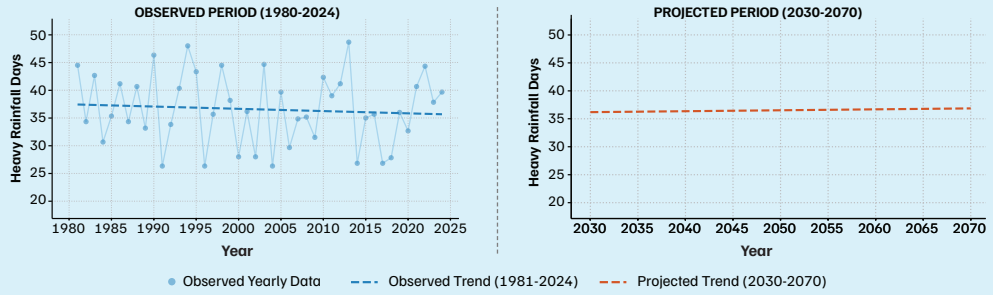
FLOOD SUSCEPTIBILITY[3]



The district observes **medium to high flood susceptibility.** Some areas along the river plains in **Pauni and Bhandara** observe high flood susceptibility due to low elevation compared to other tehsils in the district.

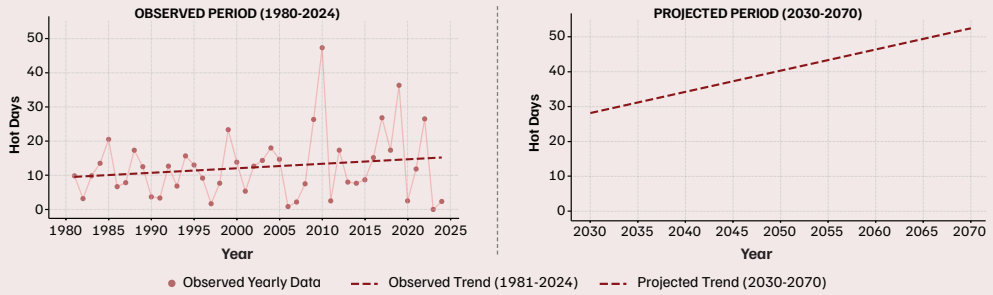
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



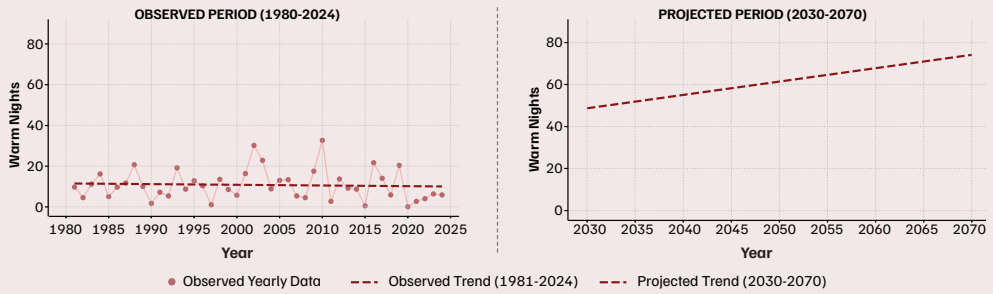
In **Bhandara,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981–2024.** Climate model projections show that this will remain steady further to an average of **37 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Bhandara,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **34 days** in a year between **2030–2050** and **46 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Bhandara,** the number of **warm nights** has **decreased** in recent decades from an average of **12 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **55 days** in a year between **2030–2050** and **68 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

WATER RISK IN BHANDARA

High irrigation drives water risk

Bhandara's high dependence on irrigation for croplands creates exposure to persistents water stress

HEALTHCARE RISK IN BHANDARA

Healthcare infrastructure faces climate risk

Bhandara's healthcare faces climate exposure because of its high density of facilities concentrated in areas vulnerable to natural hazards.

RECOMMENDATIONS[5]

1

PROMOTING MICRO-IRRIGATION SUCCESS

Set up demonstration plots at Krishi Vigyan Kendras to showcase micro-irrigation success stories and build capacity.

2

COLLECTIVE MICRO-IRRIGATION FOR SMALLHOLDERS

Introduce Group Micro Irrigation initiatives with smallholder farmers to expand coverage without compromising water security.

3

DISASTER READY AND RESILIENT HEALTH SYSTEMS

Integrate structural audits, disaster preparedness plans, and resilient water/power systems under the National Programme on Climate Change and Human Health to ensure uninterrupted services during extreme hydro-meteorological events.

4

PHCS TO AYUSHMAN AROGYA MANDIRS

Upgrade primary health centres into comprehensive 'Ayushman Arogya Mandirs' with last-mile access and digital integration for a primary healthcare transformation.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

CHANDRAPUR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
11,443 sq km	192.63	5,36,686	71.62 %	♂ 11,24,073 | 51% ♀ 10,80,234 | 49%



ENERGY & MINING HUB

Chandrapur serves as a major energy hub, with large-scale coal mining projects and thermal power operations that drive the district's economy.

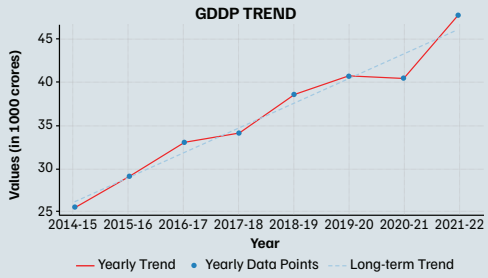
WILDLIFE CONSERVATION

The district is home to the Tadoba-Andhari Tiger Reserve, a government-notified area dedicated to biodiversity conservation and eco-tourism.

PAPER INDUSTRY

Home to Ballapur Industries (BILT), one of the world's top 100 and India's largest paper manufacturers. The local paper mills use raw materials like bamboo, wood, sabia grass, rags, and yarn waste.

GDP GRAPH[2]

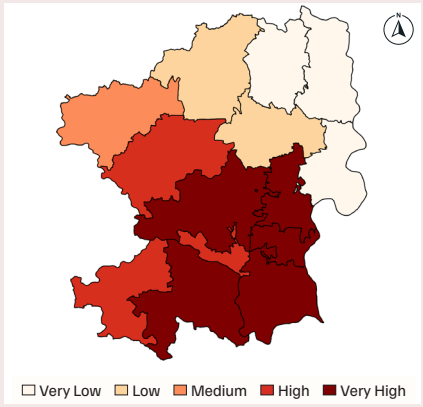


Chandrapur's GDDP increased from **₹26,019 crore** in 2014–15 to **₹48,096** crore in 2021–22, an overall growth of **85%** over 8 years.

Chandrapur contributed an average of **1.5%** to Maharashtra's GSDP between 2014–15 and 2021–22.

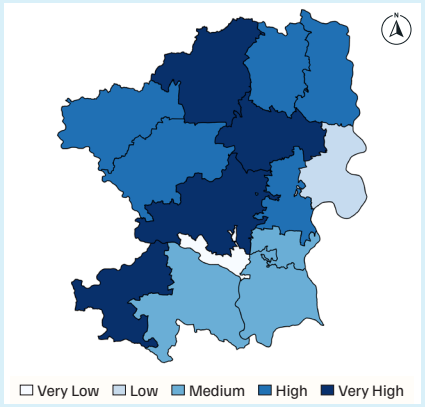
On average, the service sector contributed **51%**, industry sector **34%**, and agriculture and allied activities contributed **15%** to Chandrapur's GDDP.

EXTREME SUMMER HEAT[3]



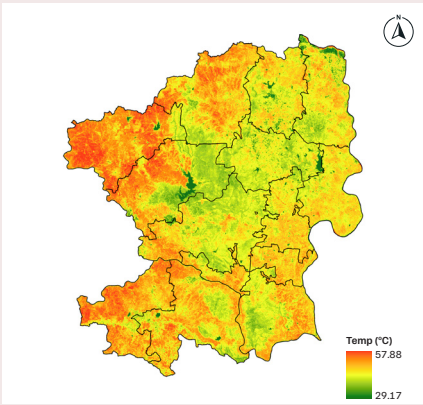
Mul, Gondpipri, Chandrapur, and Rajura observe high heat exposure, expected to witness a **5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



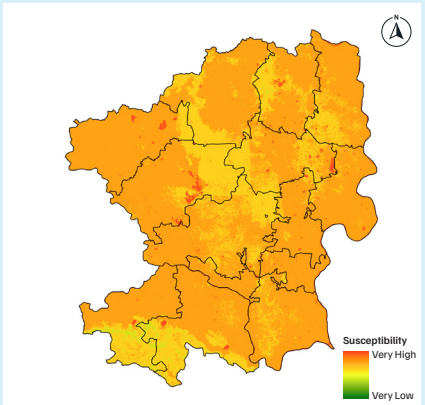
Sindewahi, Chimur, Korapana, and Chandrapur have high exposure to rainfall, expected to witness a **1.5-fold increase** in the number of heavy rainfall days respectively in the near future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district observes LST range from **29.17 to 57.88 °C. Warora** and areas of **Bhadravati** tehsils observe the highest LST due to intense open-cast coal mining and the operations of the **thermal power.**

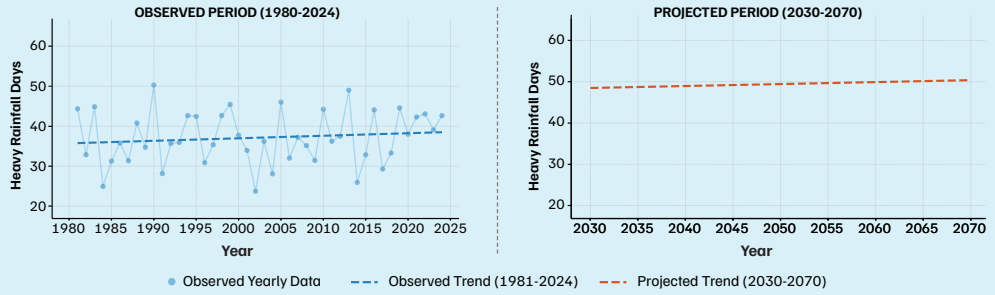
FLOOD SUSCEPTIBILITY[3]



The district faces significant flood risks. Some areas in **Bhadravati and Warora** are vulnerable to the events of flooding primarily driven by their close proximity to existing waterbodies in the tehsil.

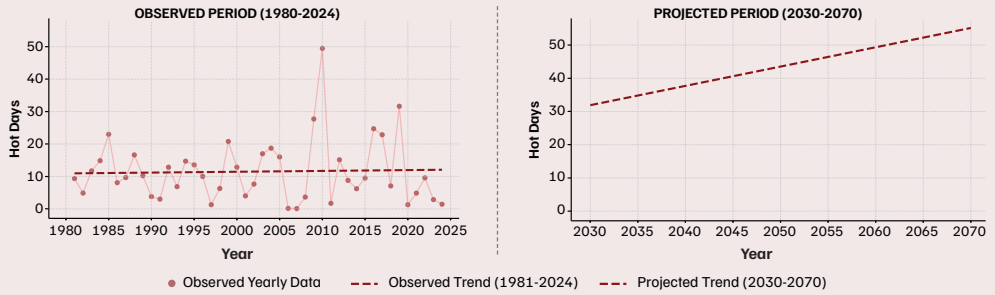
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



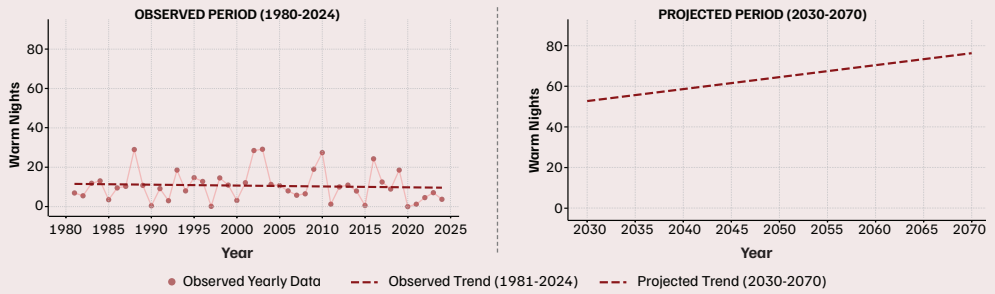
In **Chandrapur,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **48 days** in a year between **2030–2050** and **50 days** in a year between **2050–2070**.

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Chandrapur,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **11 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **38 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Chandrapur,** the number of **warm nights** has **decreased** in recent decades from an average of **11 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **58 days** in a year between **2030–2050** and **71 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

MINING AT RISK IN CHANDRAPUR

Extreme Heat Impacts Mining Operations

Projected as one of the warmest districts by the 2030s, Chandrapur faces severe climate risks to its leading mining sector.

HEALTHCARE RISK IN CHANDRAPUR

Critical healthcare vulnerability to extreme weather

Chandrapur faces critical risk for healthcare, as its medical infrastructure faces exposure from floods and cyclones.

RECOMMENDATIONS[5]

1

HEAT-RESILIENT MINING INFRASTRUCTURE

Introduce heat-resilient mining infrastructure— shaded conveyor belts, cool roofs for facilities, water-efficient dust suppression and climate-proof power systems- to ensure safe operations under rising temperatures.

2

HEAT-SAFE MINING OPERATIONS

Mandate heat-action protocols for mines in Chandrapur—shift timings, compulsory rest, cooling breaks, hydration points and heat-stress monitoring for workers during extreme heat days.

3

RESILIENT INFRASTRUCTURE FOR SERVICE CONTINUITY

Strengthen power, water, transport and telecom infrastructure with elevated, wind-resistant, and heat-tolerant materials to ensure service continuity.

4

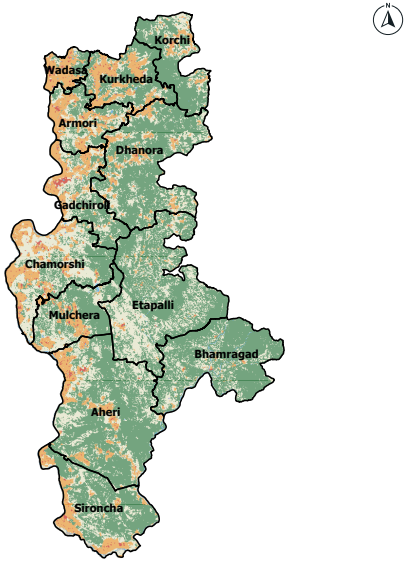
RISK-INFORMED RELOCATION OF CRITICAL HEALTHCARE ASSETS

Utilise high-resolution susceptibility maps as a decision-making tool to identify optimal and unsuitable locations for the relocation of key critical equipment within healthcare facilities.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

GADCHIROLI

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
14,412 sq km	74.45	2,50,435	66.02%	♂ 5,41,343 | 50.5% ♀ 5,31,599 | 49.5%



Water (1.00%) Built-up (1.14%) Crops (14.53%)
Trees (55.96%) Range Land (27.06%)

FOREST RESOURCES

Gadchiroli is a major resource hub, where vast government-managed forest lands support livelihoods, centered on bamboo and minor forest produce.

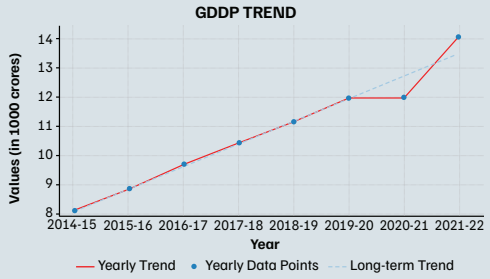
MINERAL RESERVES

The district also serves as a significant mineral zone, featuring iron ore mining operations that are strictly regulated by the government's Directorate of Geology and Mining.

GREEN GOLD OF GADCHIROLI

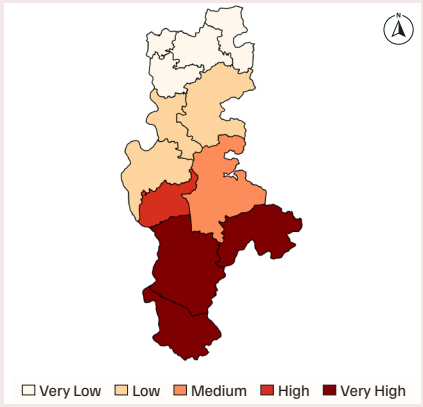
Tendu leaf trade in Gadchiroli generates over **₹114** crore annually, with millions of households depending on it for seasonal employment.

GDP GRAPH[2]



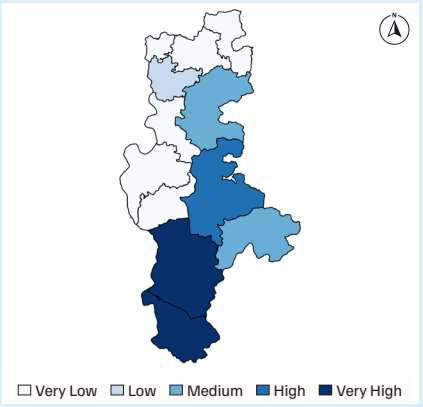
Among all the districts, Gadchiroli has the **lowest GDDP** at **₹14,119 crores** in 2021-22. Gadchiroli contributed an average of **0.5%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **52%**, industry sector **26%** and agriculture and allied activities contributed **22%** to Gadchiroli's GDDP.

EXTREME SUMMER HEAT[3]



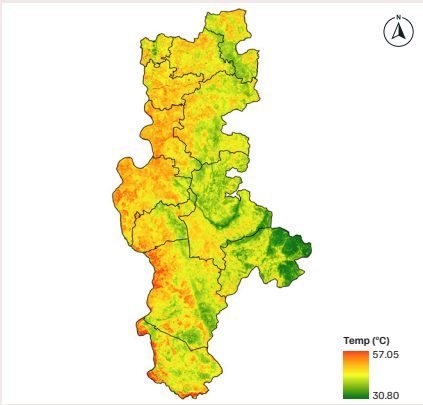
Sironcha, Aheri, and Bhamragad have the highest exposure to heat, expected to witness a **5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days in the future period (2030–2050) compared to the past.

EXTREME RAINFALL[3]



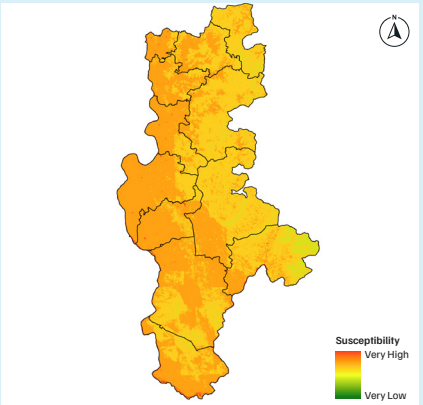
Sironcha and Aheri have the highest exposure to precipitation, expected to witness a **1.5-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past three decades.

LAND SURFACE TEMPERATURE[3]



The district observes the surface temperature range from **30.80 to 57.05 °C. Gadchiroli and Wadasa** tehsils have high surface temperature due to concentrated urbanisation.

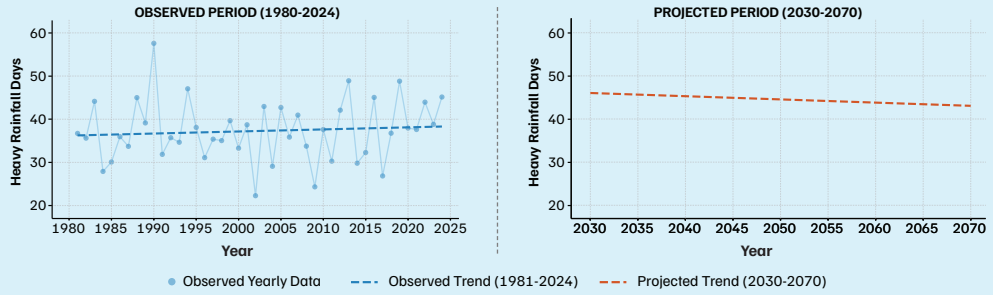
FLOOD SUSCEPTIBILITY[3]



The **western part** of the district has high flood susceptibility, which may be driven by lower retention and percolation capacity of the agricultural soil in the area.

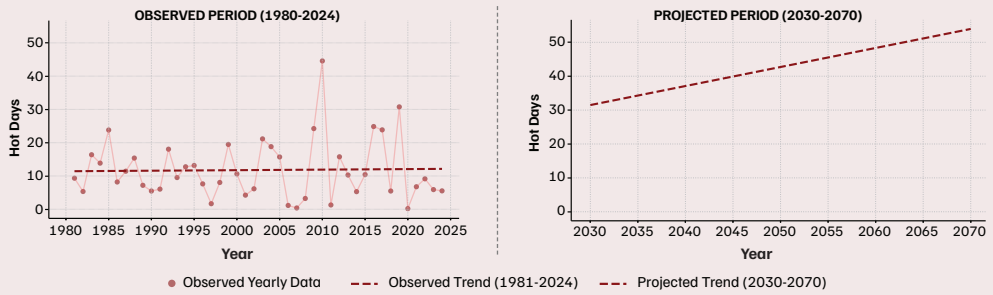
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



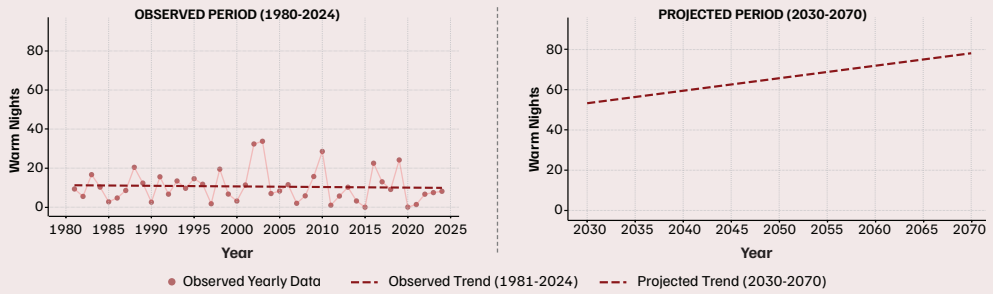
In **Gadchiroli,** the number of **heavy rainfall days** has **increased** in recent decades from an average of **36 days** in a year between **1981–2010** to **39 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **45 days** in a year between **2030–2050.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Gadchiroli,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **11 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **37 days** in a year between **2030–2050** and **48 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Gadchiroli,** the number of **warm nights** has **decreased** in recent decades from an average of **11 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **59 days** in a year between **2030–2050** and **72 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

ESCALATING HEAT RISK IN GADCHIROLI

Rising temperatures threaten forest economy

Projected as one of the warmest districts by the 2030s, Gadchiroli faces severe climate stress on its vital forest industry.

HEAT RISK IN GADCHIROLI

Rising temperatures threaten vulnerable communities

Gadchiroli's significant vulnerable population is facing heat risk as the district is projected to be one of Maharashtra's warmest region by the 2030s.

RECOMMENDATIONS[5]

1

HEAT RESILIENCE FOR FOREST-BASED LIVELIHOODS

Introduce heat-action protocols and seasonal income support for forest-dependent communities in Gadchiroli, including adjusted collection timings, hydration support, and heat advisories for NTFP gatherers.

2

ENHANCING NTFP SECURITY

Invest in heat-resilient forest management—water conservation in forest landscapes, fire-risk reduction, and climate-resilient regeneration of native species to safeguard NTFP productivity under rising temperatures.

3

ECOSYSTEM-BASED HEAT BUFFERING IN GADCHIROLI

Protect and expand forest and wetland ecosystems in Gadchiroli to act as natural heat buffers through landscape water conservation, fire prevention, and climate-resilient restoration.

4

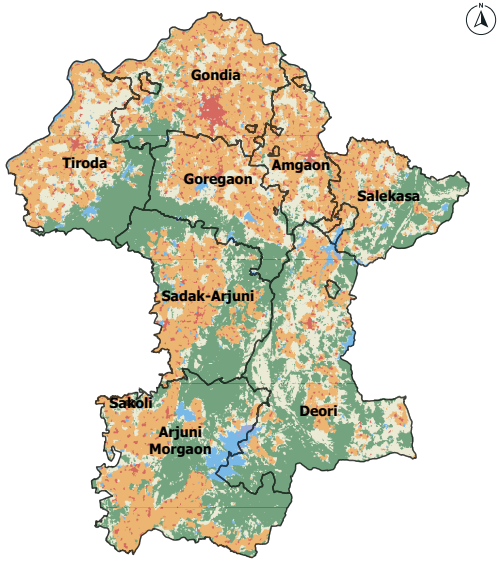
OPERATIONALISING DISTRICT HEAT ACTION PLAN

Operationalise a district Heat Action Plan with early warnings, heat-safe work protocols, resilient housing, and reliable water and power access to reduce heat stress impacts.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

GONDIA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
5,234 sq km	252.68	2,92,369	75.93%	♂ 6,61,584 | 50% ♀ 6,60,923 | 50%



RICE PRODUCTION

Paddy is the main agricultural crop and the district has a large number of **rice mills** supporting farmer livelihoods.

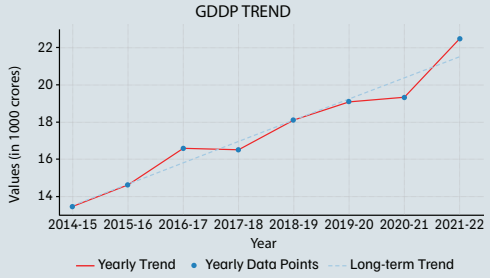
KACHARGADH CAVES

Kachargadh caves are ancient natural caves, serving as a sacred site for the **Gond tribal** community.

WAINGANGA RIVER

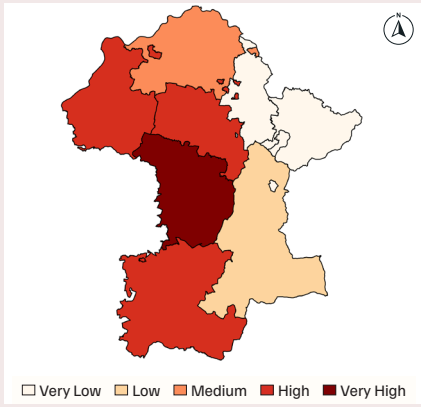
The **Wainganga River,** the main river in the district supports irrigation, fisheries and paddy cultivation in the region.

GDP GRAPH[2]



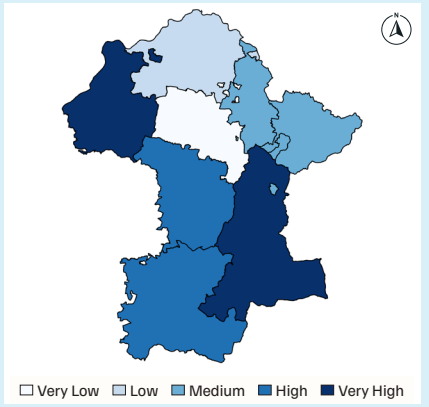
Gondia's GDDP increased from **₹13,450** crore in 2014–15 to **₹22,488** crore in 2021–22, an overall growth of **67%** over 8 years, with a marginal dip observed in 2017–18. Gondia contributed an average of **0.7%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **55%**, industry sector **30%** and agriculture and allied activities contributed **15%** to Gondia's GDDP.

EXTREME SUMMER HEAT[3]



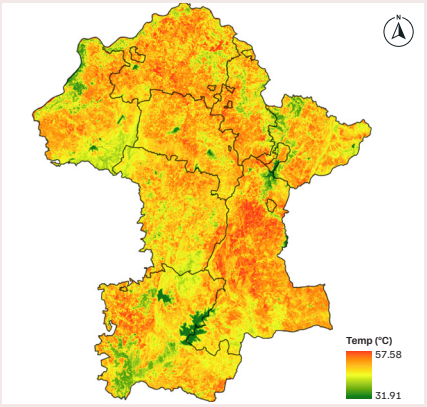
Arjuni Morgaon tehsil observes the highest heat exposure. Projections show a **5-fold increase** in the number of warm nights and a **6-fold increase** in the number of hot days in the future period (2030–2050) compared to past (1981-2010).

EXTREME RAINFALL[3]



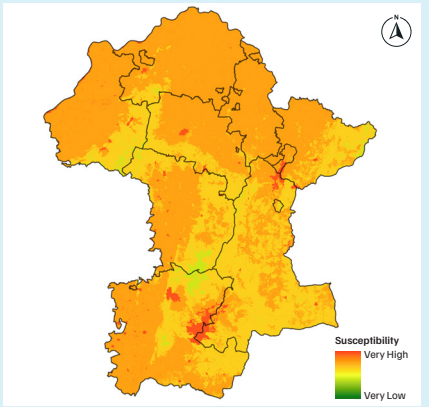
Tiroda and Deori tehsils have the highest precipitation score, and can expect a **1-fold** change in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past (1981-2010)

LAND SURFACE TEMPERATURE[3]



The district observes LST range from **31.91 to 57.58 °C. Deori** tehsil observes the highest surface temperature across all tehsils due to large area of range land

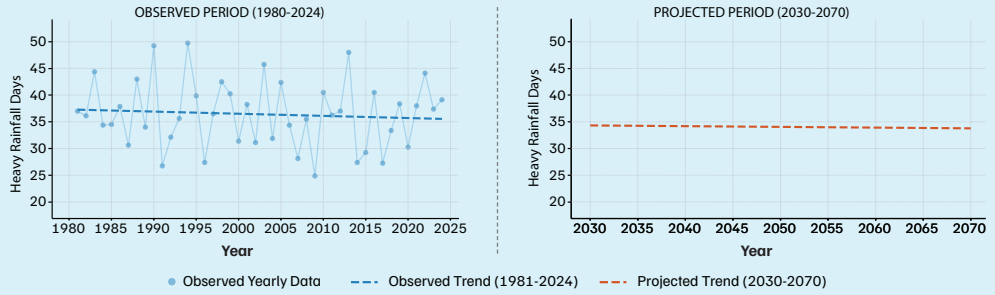
FLOOD SUSCEPTIBILITY[3]



Most of the tehsils have **medium to high flood susceptibility. Arjuni Morgaon** has a few areas with high susceptibility due to water body

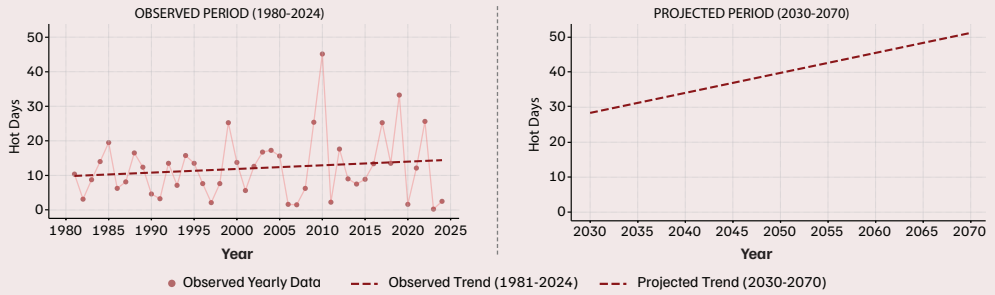
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



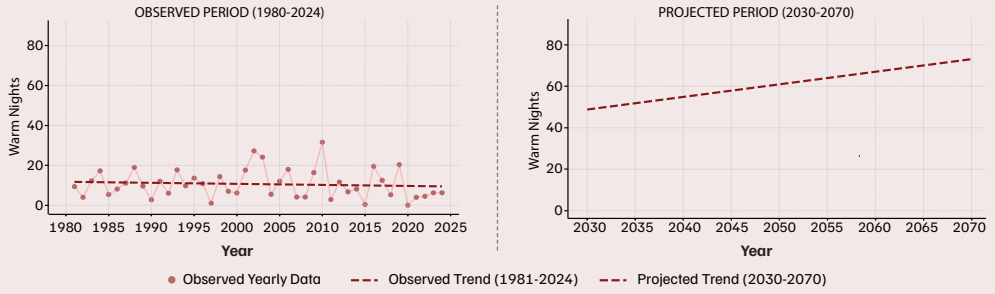
In **Gondia,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981–2024.** Climate model projections show that this will **decrease** further to an average of **34 days** in a year between **2030–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Gondia,** the number of **hot days** has **remained steady** in recent decades with an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **34 days** in a year between **2030–2050** and **45 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Gondia,** the number of **warm nights** has **decreased** in recent decades from an average of **12 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **55 days** in a year between **2030–2050** and **67 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

WATER RISK IN GONDA

Critical water infrastructure deficit

Gonda faces extreme water vulnerability due to low reservoir storage and a lack of monitoring stations to buffer against drought.

FORESTRY RISK IN GONDIA

Warming climate threatens forest ecosystems

Gondia's extensive forest cover faces a severe long-term threat as the district is projected to become one of the state's warmest regions by the 2030s.

RECOMMENDATIONS[5]

1

CLIMATE-RESILIENT WATER INFRASTRUCTURE

Restore and climate-proof Gondia's tanks, reservoirs, and canals through desiltation, catchment treatment, and groundwater recharge to stabilise water availability.

2

GROUNDWATER REGULATION AND SUSTAINABLE USE POLICY

Formulate and enforce policies to restrict the overexploitation of groundwater resources, with support from the Central Ground Water Board (CGWB). Reduce pressure on depleting reservoirs by promoting water-efficient irrigation, crop diversification, and regulated withdrawals through participatory water governance.

3

HEAT-RESILIENT FOREST MANAGEMENT

Strengthen heat-resilient forest management in Gondia by conserving water in forest landscapes, preventing forest fires, and restoring native, climate-tolerant species to buffer extreme heat.

4

SAFEGUARDING NTFPS THROUGH RESILIENT FOREST MANAGEMENT

Invest in heat-resilient forest management—water conservation in forest landscapes, fire-risk reduction, and climate-resilient regeneration of native species– to safeguard NTFP productivity under rising temperatures.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

NAGPUR

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
9,892 sq km	470.44	10,41,544	78.95%	♂ 23,85,223 | 51.3% ♀ 22,68,347 | 48.7%



LAND OF ORANGES

Nagpur district is renowned for the **GI-tagged Nagpur Mandarin orange.** Approximately **20,000 hectares** are under orange cultivation, making it one of India's major citrus belts and a significant source of farmer income.

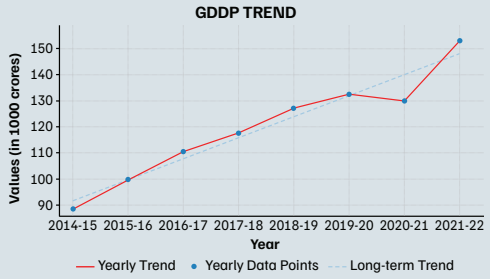
DEEKSHABHOOMI

Deekshabhoomi is one of the most important **Buddhist pilgrimage** sites in India. It attracts thousands of visitors and pilgrims every year and is a major cultural landmark of the region.

ZERO MILE CENTRE

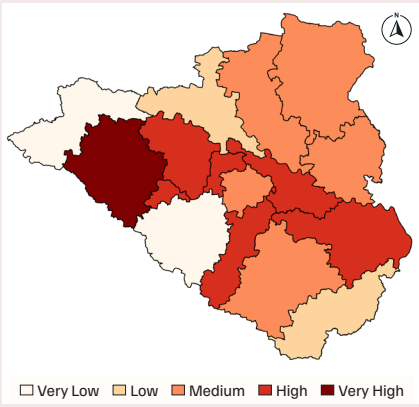
Nagpur is the geographical centre point of undivided India. The British established this location in 1907 during the Great Trigonometrical Survey of India.

GDP GRAPH[2]



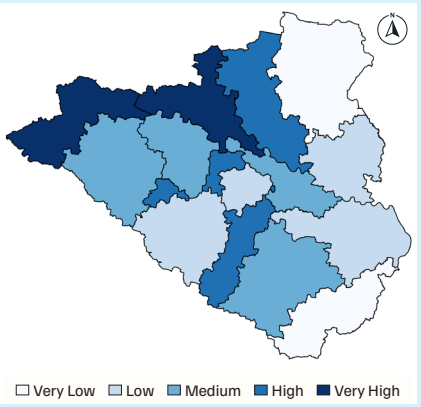
Nagpur's GDDP increased from **₹88,542 crore** in 2014–15 to **₹1,53,027 crore** in 2021–22, an overall growth of **73%** over 8 years. Nagpur contributed an average of **5%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **63%**, industry sector **30%**, and agriculture and allied activities contributed only **6%** to Nagpur's GDDP.

EXTREME SUMMER HEAT[3]



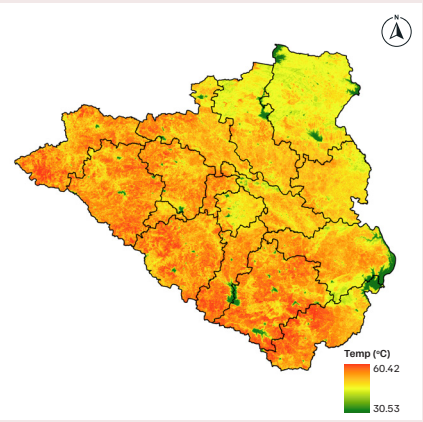
The tehsil of **Katol** observes the highest exposure to heat, and is expected to witness a **5-fold increase** in the number of warm nights and a **3-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010)

EXTREME RAINFALL[3]



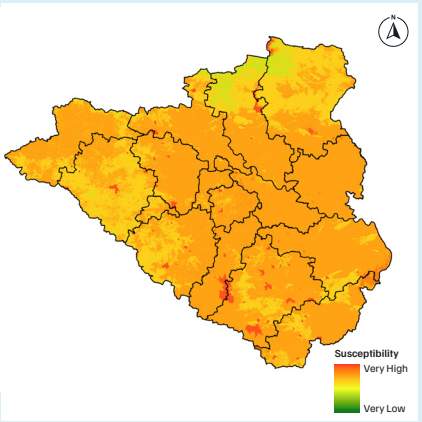
The tehsil of **Narkhed and Saoner** observes the highest exposure to extreme rainfall, and are expected to witness a **1-fold increase** in the number of heavy rainfall days respectively in the future period (2030–2050) compared to the past three decades.

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **30.53 to 60.42 °C**. High surface temperature zones are concentrated on the east and south of the district, primarily due to presence of rangeland in the region

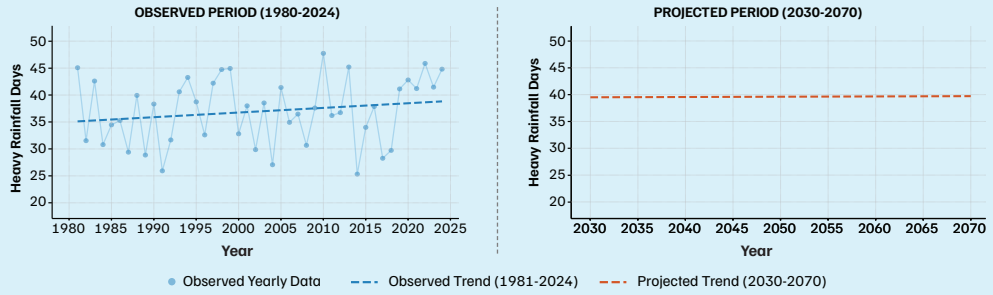
FLOOD SUSCEPTIBILITY[3]



Mauda and **Nagpur** tehsils observe high flood susceptibility due to their location in a low-elevation plain. Nagpur, being urbanised has less permeable areas making it more susceptible to floods

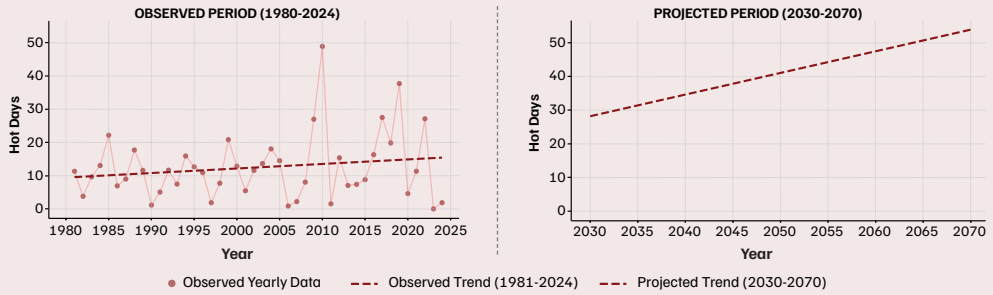
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



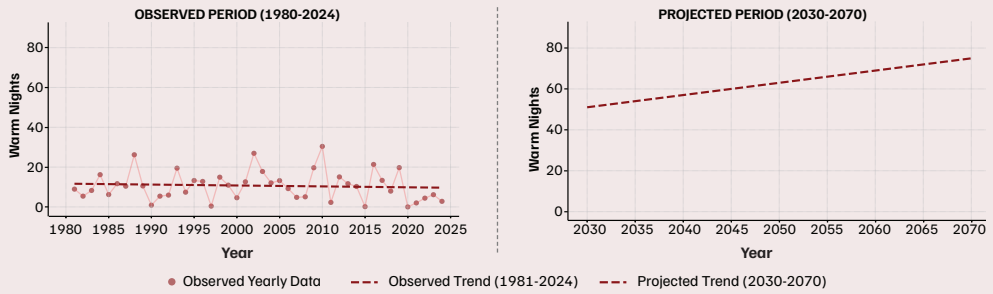
In **Nagpur,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will remain steady further to an average of **39 days** in a year between **2030–2050** and **40 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Nagpur,** the number of **hot days** has **remained steady** in recent decades from an average of **12 days** in a year between **1981–2010** to **13 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **35 days** in a year between **2030–2050** and **48 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Nagpur,** the number of **warm nights** has **decreased** in recent decades from an average of **11 days** in a year between **1981–2010** to **8 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **57 days** in a year between **2030–2050** and **69 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

TOURISM RISK IN NAGPUR

Climate hazards threaten tourism revenue

As a high-heat and drought-prone district, Nagpur's tourism sector that contributes nearly 15% to its local economy is threatened.

HEAT RISK IN NAGPUR

Urban heat resilience through action planning

Nagpur is addressing its high heat-prone status by implementing a city-level heat action plan to protect its dense urban population.

RECOMMENDATIONS[5]

1

COMMUNITY-LED ECO-TOURISM

Engage local communities and stakeholders throughout the tourism vulnerability assessment process. Promote climate-friendly ecotourism by training youth volunteers in biodiversity conservation.

2

ECOSYSTEM PROTECTION FOR ECO-TOURISM SITES

Protect forests and wetlands around eco-tourism sites through water conservation, fire-risk reduction, and native-species restoration to maintain natural cooling under extreme heat.

3

STRENGTHENING HEAT EARLY WARNING SYSTEMS

Develop and disseminate robust early warning systems with last-mile connectivity, incorporating relative humidity and percentile-based temperature forecasts to prevent heat-related illnesses.

4

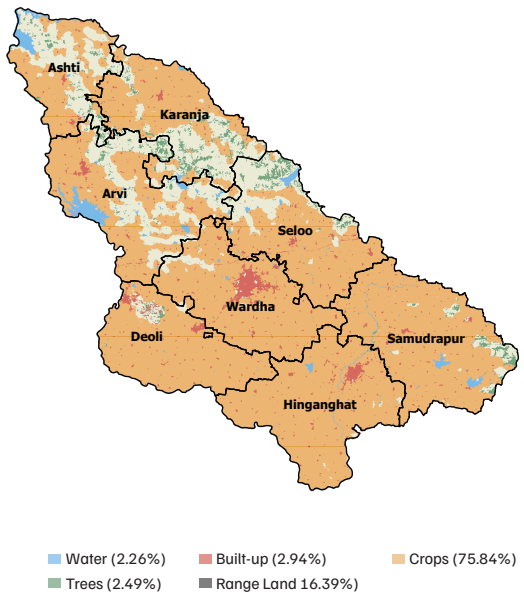
UNLOCKING FUNDS FOR HEATWAVE RESPONSE

Since heatwave is now a notified disaster, unlock funds for ex-gratia payments for fatalities and capacity building for frontline health workers.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

WARDHA

Area[1]	Population Density[1]	Households[1]	Literacy rate[1]	Demographics[1]
6,310 sq km	206.14	3,09,846	78.37%	♂ 6,68,435 | 51.4% ♀ 6,32,339 | 48.6%



PANCHDHARA WATERFALL

The Panchdhara Waterfall is a scenic hidden natural spot surrounded by greenery and rocky terrain. It is best to visit during the monsoon, when the water flow is strongest.

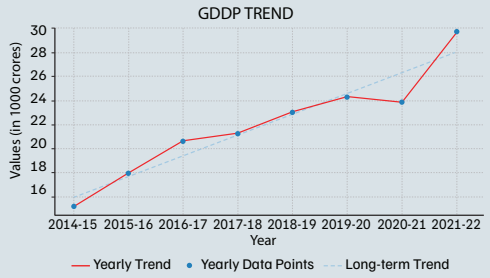
LAXMINARAYAN TEMPLE

The Laxminarayan Temple is a prominent place of worship dedicated to Lord Vishnu and Goddess Lakshmi, known for its traditional architecture and serene surroundings that attract devotees and visitors.

BOR WILDLIFE SANCTUARY

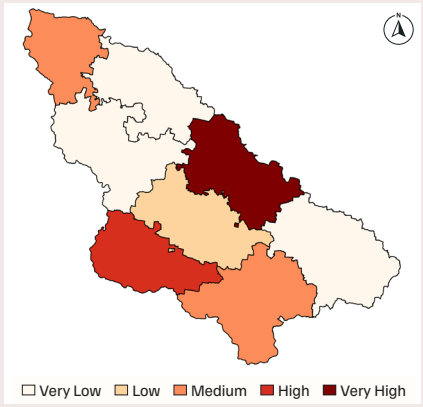
Bor Wildlife Sanctuary covers about **121 sq. km.** and supports diverse flora and fauna, including tiger, leopard, gaur, deer and many bird species, making it a popular destination for wildlife safaris and birdwatching.

GDP GRAPH[2]



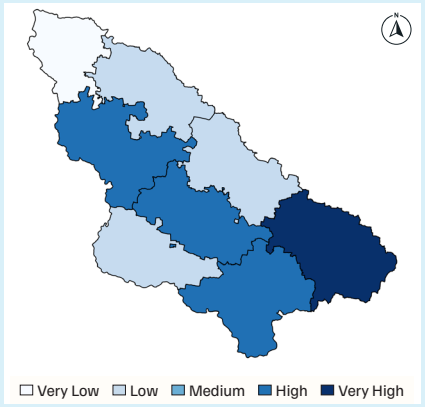
Wardha's GDDP increased from **₹15,155** crore in 2014–15 to **₹29,692** crore in 2021–22, an overall growth of **96%** over **8 years.** Wardha contributed an average of **0.9%** to Maharashtra's GSDP between 2014–15 and 2021–22. On average, the service sector contributed **53%**, industry sector **25%** and agriculture and allied activities contributed **22%** to Wardha's GDDP.

EXTREME SUMMER HEAT[3]



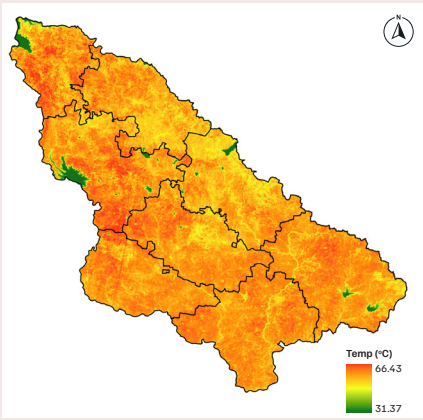
The tehsil of **Seloo** observes the highest exposure to extreme heat. Climate projections show a **4.5-fold increase** in the number of warm nights and a **2.5-fold increase** in the number of hot days in the future period (2030–2050) compared to the past (1981-2010).

EXTREME RAINFALL[3]



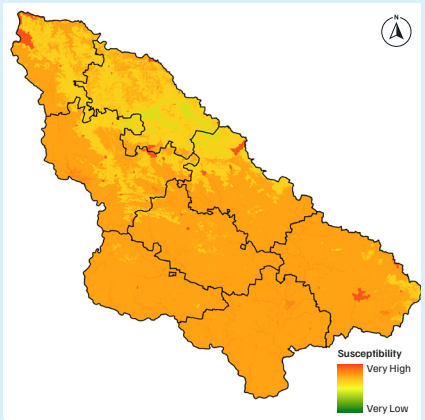
The tehsil of **Samudrapur** observes the highest exposure to extreme rainfall. Climate models project a **1.5-fold increase** in the number of heavy rainfall days in the future period (2030–2050) compared to the past (1981-2010).

LAND SURFACE TEMPERATURE[3]



The district exhibits thermal range from **31.37 to 66.43 °C**– which means an overall high surface temperature. **Deoli, Wardha, Hinganghat and Karanja** have areas with high surface temperature compared to other tehsils.

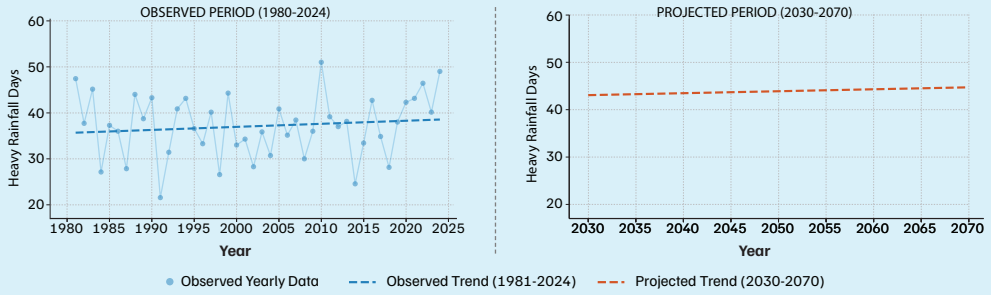
FLOOD SUSCEPTIBILITY[3]



The district has **medium to high flood susceptibility.** Tehsils such as **Ashti, Karanja and Samudrapur** have a few areas with high flood susceptibility due to their proximity to water bodies.

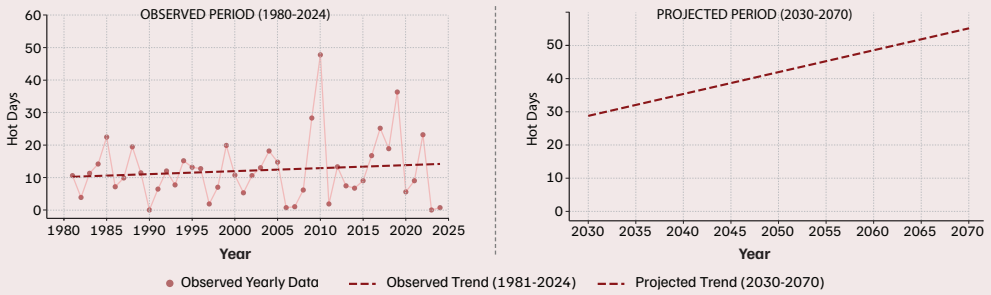
Source: [1]Census of India, 2011, [2]Authors' analysis and District Strategic Plan, Government of Maharashtra, [3]Authors' analysis based on India Meteorological Department and CORDEX CMIP5 at 25km resolution; Landsat 8 satelite data at 30m resolution derived from Google Earth Engine.

OBSERVED AND PROJECTED TRENDS OF HEAVY RAINFALL DAYS[4]



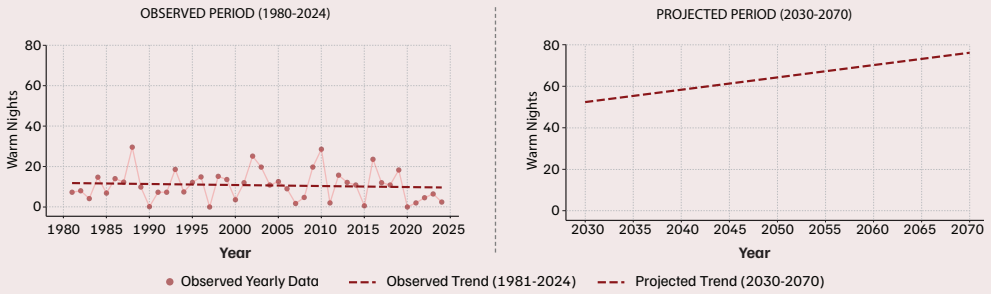
In **Wardha,** the number of **heavy rainfall days** has **remained steady** in recent decades from an average of **37 days** in a year between **1981–2010** to **38 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **43 days** in a year between **2030–2050** and **45 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF HOT DAYS[4]



In **Wardha,** the number of **hot days** has **remained steady** in recent decades with an average of **12 days** in a year between **1981–2024.** Climate model projections show that this will **increase** further to an average of **35 days** in a year between **2030–2050** and **49 days** in a year between **2050–2070.**

OBSERVED AND PROJECTED TRENDS OF WARM NIGHTS[4]



In **Wardha,** the number of **warm nights** has **decreased** in recent decades from an average of **11 days** in a year between **1981–2010** to **9 days** in a year between **2011–2024.** Climate model projections show that this will **increase** further to an average of **58 days** in a year between **2030–2050** and **70 days** in a year between **2050–2070.**

EXTREME SUMMER HEAT

AGRICULTURAL RISK IN WARDHA

Heat action plan protects agriculture

Wardha's agricultural industry faces severe risks as a designated heat-prone district, necessitating the implementation of a dedicated heat action plan.

HEALTHCARE RISK IN WARDHA

Healthcare sensitivity to extreme weather

Wardha's healthcare system shows notable sensitivity to climate disasters, especially floods and cyclones.

RECOMMENDATIONS[5]

1

HEAT ACTION PLAN FOR AGRICULTURE

Integrate agriculture-specific Heat Action Plans by issuing crop-stage-wise heat advisories, adjusting farm operations, and protecting agricultural labour during extreme heat events.

2

CLIMATE-INFORMED DYNAMIC CROPPING CALENDARS

Dynamically revise state cropping calendars using climate forecasts to promote heat-tolerant crops, flexible sowing windows, and reduced exposure to peak heat periods.

3

CLIMATE RISK-BASED FINANCING FOR HEALTH INFRASTRUCTURE

Channel climate risk-based financing through the National Health Mission (NHM) to strengthen healthcare infrastructure resilience against floods, prioritising regions identified by sub-district level risk assessments.

4

FLOOD-RESILIENT HEALTHCARE FACILITIES

District health departments should conduct asset-level risk assessments to identify vulnerabilities and prioritise flood adaptation solutions for healthcare facilities.

Source: [4]Authors' visualisation and analysis based on the India Meteorological Department and CORDEX CMIP5 at 25km resolution, [5]Authors' compilation based on Maharashtra SAPCC, Viksit Maharashtra 2047 and CEEW analysis.

METHODOLOGY

The exposure to EXTREME HEAT and EXTREME PRECIPITATION are computed using a set of indicators. Each indicator is weighted equally and normalised using the 'MAX-MIN' normalisation. The normalised score of the event is averaged to get the comprehensive score for the category, providing the final risk score.

EXTREME SUMMER HEAT

The Extreme Heat map provides a forward-looking climate projection detailing the systemic, macro-climatic shifts accelerating across the district. By forecasting a severe, multi-fold increase in both warm nights and hot days, the map highlights the compounding risks that tehsils will face in the near future.

The colour-coded risk gradients serve as a strategic framework to enable a tiered approach to planning and resource allocation. Areas designated as 'High' or 'Very High' risk require urgent, systemic interventions, whereas lower-risk zones can be managed through ongoing monitoring and baseline adaptive measures. By aligning these risk levels with structural timelines, interventions can be effectively categorised into short-term emergency responses, medium-term community adaptations, and long-term infrastructure resilience.

H **Indicators for estimating heat hazard** **6**

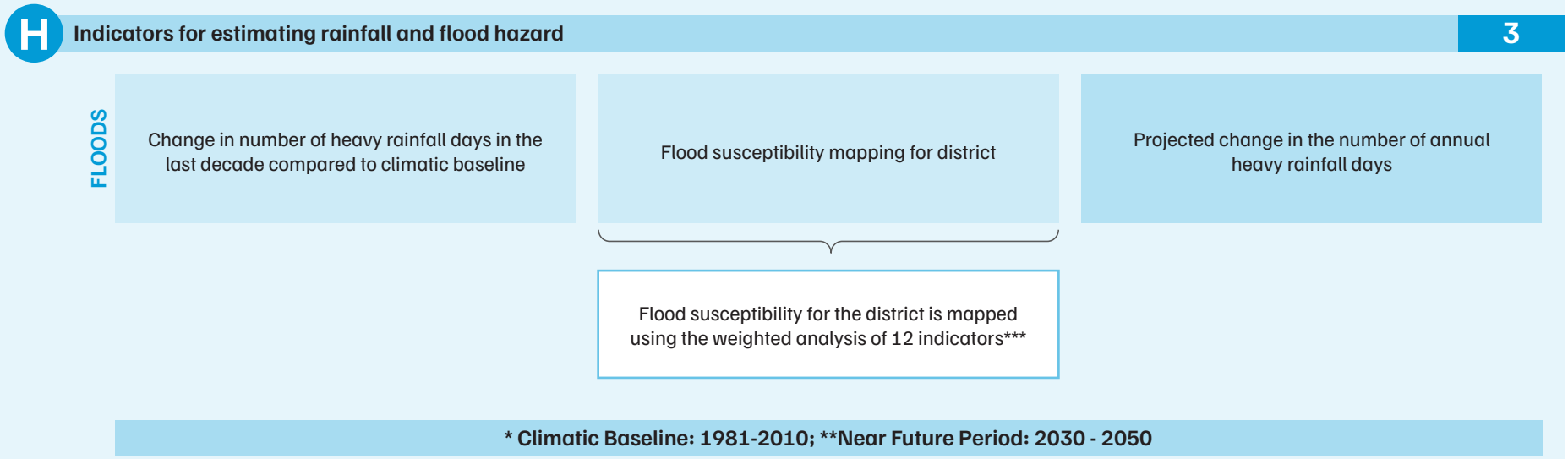
HEAT	Change in number of hot days in the last decade compared to the climatic baseline*	Change in number of warm nights in the last decade compared to the climatic baseline*	Change in heat index (estimated at the ward level) in the last decade compared to the climatic baseline*	Maximum recorded Land Surface Temperature (LST) in the ward	Projected change in number of hot days in the near future period** compared to the climatic baseline*.	Projected change in number of warm nights in the near future period** compared to the climatic baseline*.

*** Climatic Baseline: 1981-2010; **Near Future Period: 2030 - 2050**

EXTREME RAINFALL

The Extreme Rainfall map serves as a predictive meteorological guide, highlighting the geographical zones where climate change is accelerating both the frequency and intensity of precipitation. By forecasting a marked increase in heavy rainfall days, this map signals a compounding risk that specific areas will face in the near future.

The colour-coded risk gradients serve as a strategic framework to enable a tiered approach to planning and resource allocation. Areas designated as 'High' or 'Very High' risk require urgent, systemic interventions, whereas lower-risk zones can be managed through ongoing monitoring and baseline adaptive measures. By aligning these risk levels with structural timelines, interventions can be effectively categorised into short-term emergency responses, medium-term community adaptations, and long-term infrastructure resilience.



H Indicators for estimating surface temperature

The Land Surface Temperature (LST) map captures the actual radiant heat emitted by the Earth's surface rather than general atmospheric air temperature. Strongly influenced by land cover, this map vividly highlights the Urban Heat Island (UHI) effect—where concrete, asphalt, and dense infrastructure trap solar radiation—as well as the elevated temperatures found in degraded, barren, or deforested rural terrains.

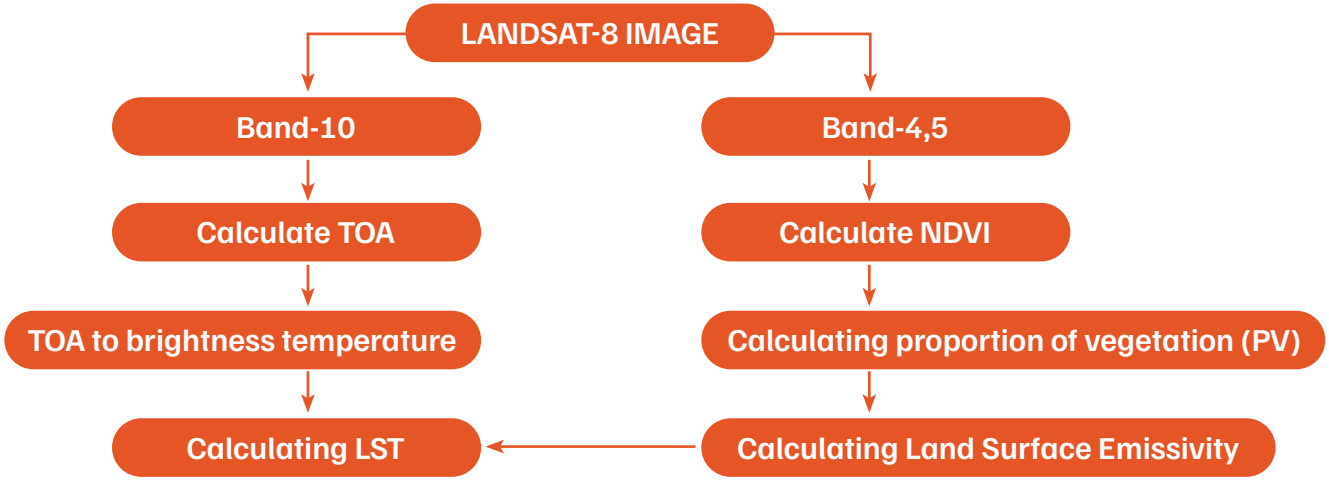
On this map, high thermal readings (indicated by darker shading) pinpoint localized areas experiencing severe thermal stress. By identifying these specific neighborhoods, industrial zones, or barren landscapes, the map highlights exactly where targeted interventions—such as urban greening or cool roofing—are needed to lower surface temperatures and mitigate the broader heat island effect.

For mapping the urban heat islands and various other landscape indicators, a combination of satellite-based data obtained from the Landsat-8 and Sentinel-2 has been used. Landsat-8 data is particularly useful for calculating various indices, such as the Normalised Difference Vegetation Index (NDVI), etc. These indices utilise the spectral information captured by Landsat-8 to derive meaningful insights about land cover, vegetation health, etc.

Normalised Difference Vegetation Index (NDVI): The NDVI is a widely used vegetation index calculated from remotely sensed data, in this case, Landsat-8 data. It quantifies the presence and health of vegetation by measuring the difference between near-infrared (NIR) and red bands of the electromagnetic spectrum (Sha Huang 2020). The formula for NDVI is:

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

Land Surface Temperature (LST) refers to the temperature of the Earth's surface as measured from a satellite or other remote-sensing platform. It is a crucial parameter which provides insights into surface energy fluxes, urban heat island effects, and land-atmosphere interactions. Landsat-8 is equipped with the Thermal Infrared Sensor (TIRS), which enables the estimation of land surface temperature (Ridho 2023, Anandababu D. 2018).



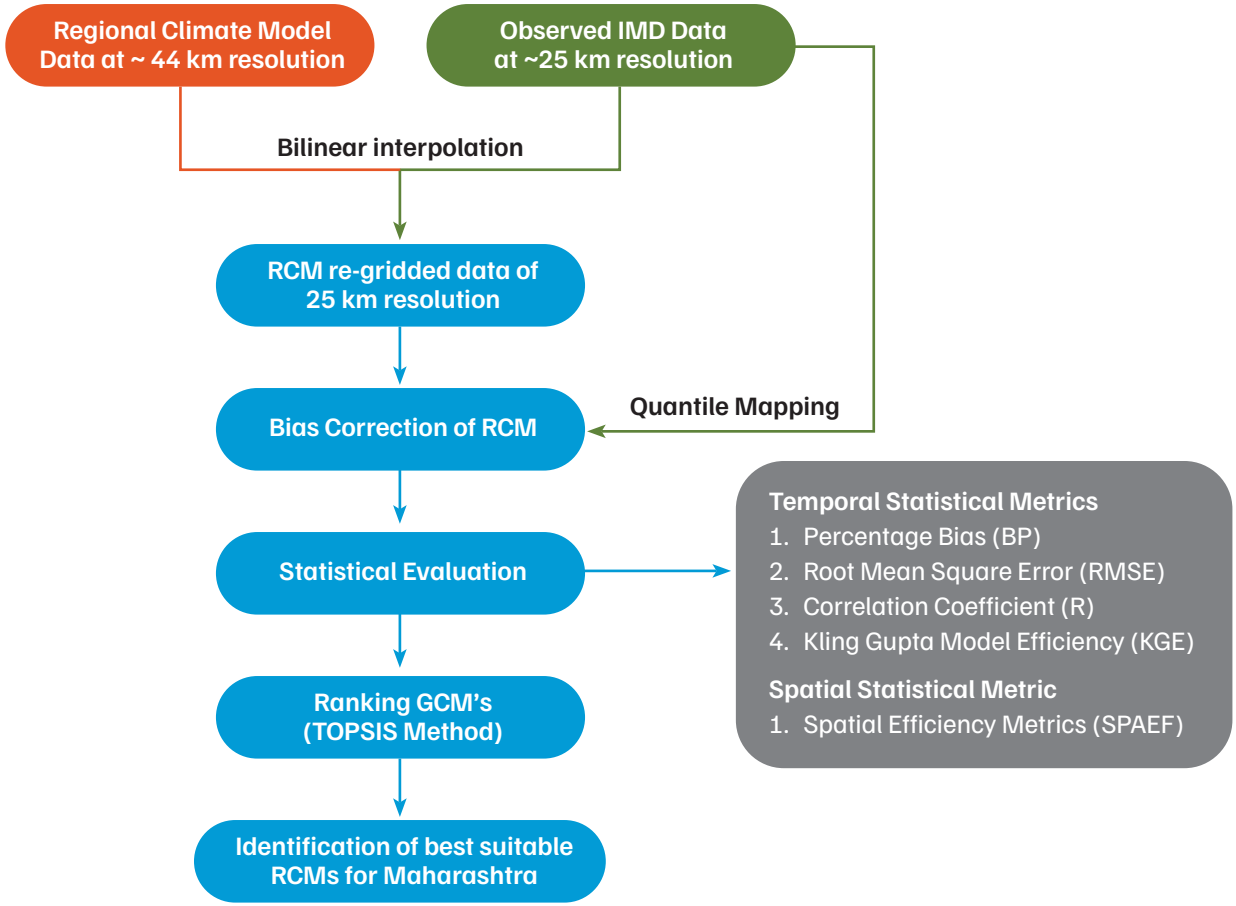
H Indicators for estimating the flood susceptibility 12

The flood susceptibility map, generated by integrating 12 topographic, geographic, and physiographic indicators, identifies the specific areas within the tehsil and district at the highest risk. This color-coded visualization clearly delineates “high” and “very high” risk zones, highlighting where immediate structural and non-structural interventions are needed most. To build long-term resilience, these risk-reduction strategies can be phased into short-, medium-, and long-term actions tailored directly to the susceptibility levels of the targeted areas.

Layer no.	Name	Unit	Weight (%)	Rationale	Relation to susceptibility
1	Elevation	Metres	13	AHP	Inverse
2	Slope	Percent rise	12		Inverse
3	Proximity to rivers	Metres	10		Inverse
4	Profile Curvature	NA	5		Inverse
5	Stream Power Index	NA	7		Direct
6	Topographic Wetness Index	NA	9		Direct
7	Land Use Land Cover	NA	11		Other
8	Normalised Difference Vegetation Index	NA	6		Inverse
9	Soil moisture	kg/kg or m^3/m^3	6		Direct
10	Groundwater level	mbgl	3		Inverse
11	Drainage density	miles/sq mile	10		Inverse
12	Soil type	% clay	8		Direct

Methodology for climate projections

To grasp future climatic patterns, the detailed downscaled projections from the **Coordinated Regional Climate Downscaling Experiment (CORDEX) South Asia** programme, overseen by the **Centre for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology (IITM), Pune**, have been used in this plan. These projections stem from the **CMIP5 (Coupled Model Intercomparison Projects, 5th generation)** climate models, a collaborative platform showcased in the **IPCC's fifth assessment report (AR5)**. Under CORDEX, regional models driven by CMIP5 data portray scenarios for **Representative Concentration Pathways (RCPs) – specifically, RCP 4.5 (mid-range emissions) and RCP 8.5 (high-end emissions).** These scenarios depict a time series of emissions, concentrations of greenhouse gases, aerosols, and land-use changes. While temperature projections are considered with high or moderate confidence, rainfall projections bear lower confidence, prompting the use of robust statistical methods for model selection and bias correction. Despite such corrections, the inherent variability in the Indian climate and coarse model resolution introduces some level of uncertainty.



Driving CMIP5 GCM	Contributing CMIP5 Modelling Centre
CCCma-CanESM2	Canadian Centre for Climate Modelling and Analysis (CCCma), Canada
NOAA-GFDL-GFDL ESM2M	National Oceanic and Atmospheric Administration (NOAA), Geophysical Fluid Dynamics Laboratory (GFDL), USA
CNRM-CM5	Centre National de Recherches Météorologiques (CNRM), France
MPI-ESM-MR	Max Planck Institute for Meteorology (MPI-M), Germany
IPSL-CM5A-LR	Institut Pierre-Simon Laplace (IPSL), France
CSIRO-Mk3.6	Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

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