eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

Climate Change and Water Security in India: A Geographical Analysis

Pradeep Kumar Tiwari[1] & Dr. Lalit Kumar Dubey[2]
[1]Ph.D. Scholar, Department of Geography, R. P. P. G. College, Kamalganj, Farrukhabad
[2]Assistant Professor, Department of Geography, R. P. P. G. College, Kamalganj, Farrukhabad

Received: 24 Oct 2024 Accepted & Reviewed: 25 Nov 2024, Published : 30 November 2024

Abstract

This study assesses the impacts of climate change on water resources across various regions of India, focusing on the challenges of water security. Key objectives include evaluating changes in precipitation patterns, glacial melt, and groundwater recharge, alongside exploring adaptation strategies. The analysis encompasses North-western India, the Deccan Plateau, the Eastern Coastal Plains, and the Himalayan Region, each exhibiting unique climatic and socio-economic vulnerabilities. Data from 2000 to 2023 highlights significant trends: North-western India faces the highest average temperature increase (1.8°C) and a critical reduction in rainfall, leading to severe groundwater depletion and crop yield reductions of 40%. The Eastern Coastal Plains have experienced increased rainfall, resulting in flooding risks. Adaptation strategies such as rainwater harvesting, water conservation measures, flood management systems, and sustainable land use practices are evaluated for effectiveness, ranging from 65% to 80%. However, each strategy encounters specific challenges, including funding constraints and the need for community participation. The findings emphasize the urgent need for tailored interventions to address water insecurity, ensuring sustainable management of water resources. Collaborative efforts among governments, local communities, and organizations are essential for enhancing resilience against climate impacts. This study underscores the importance of proactive water resource management in safeguarding livelihoods, public health, and supporting sustainable development across affected regions in India.

Keywords: Climate Change, Water Security, Adaptation Strategies, Temperature Change, Precipitation Change

Introduction

India, a country renowned for its rich cultural heritage and diverse landscapes, is grappling with one of the most pressing challenges of our time: water security**(Madhusoodhanan et al., 2016)**. With a staggering population of over 1.4 billion, the demand for water resources is escalating rapidly due to factors such as urbanization, industrial growth, and the need for agricultural production**(Gosain et al., 2011; Madhusoodhanan et al., 2016)**. Water, a fundamental resource for sustaining life and economic activities, is becoming increasingly scarce in many regions, leading to heightened competition and conflict over its use. The impacts of climate change are compounding these challenges, introducing a new layer of complexity to water management in India. Climate change manifests in various ways, including erratic rainfall patterns, rising temperatures, prolonged droughts, and increased frequency and intensity of extreme weather events such as floods and cyclones**(Bej, 2018)**. These changes disrupt traditional patterns of water availability and distribution, leading to significant implications for agriculture, drinking water supply, sanitation, and overall public health**(Goyal & Surampalli, 2018)**.

Geographically, India is incredibly diverse, with distinct climatic zones ranging from the arid deserts of Rajasthan to the lush river valleys of the Ganges and Brahmaputra. This geographical diversity means that the

effects of climate change on water security are not uniform across the country; rather, different regions experience varying degrees of vulnerability based on their unique environmental conditions and socio-economic contexts. Northern states heavily reliant on glacial meltwater are witnessing alarming reductions in their water supply as glaciers retreat due to rising temperatures**(Ramabrahmam et al., 2023)**. Conversely, southern coastal regions are facing increased flooding risks due to rising sea levels and intensified monsoon rains. The socio-economic implications of water insecurity are profound. Agriculture remains the backbone of India's economy, employing nearly half of the workforce and contributing significantly to food security**(Khan & Hasan, 2017; Mall et al., 2006)**. However, with approximately 65% of India's agricultural land being rain-fed, farmers are particularly vulnerable to climate variability. The increasing unpredictability of monsoon seasons threatens crop yields and livelihoods, exacerbating rural poverty and food scarcity. Urban areas are not immune either; cities like Mumbai and Chennai face acute risks from flooding events that can displace populations and damage infrastructure. Low-income communities often bear the brunt of these impacts due to their limited adaptive capacity and reliance on informal housing situated in flood-prone areas.

Objective :

- To Assess the Impact of Climate Change on Water Resources.
- To evaluate the climate change affects precipitation patterns, glacial melt, and groundwater recharge in various regions of India.
- To investigate existing and potential strategies for adapting to climate change impacts on water resources.
- To identify specific geographical areas those are most vulnerable to water insecurity due to climate change.
- To explore the socio-economic consequences of water insecurity on agriculture, health, and livelihoods.

STUDY AREA :

This study focuses on key regions in India that are critically impacted by climate change and face significant water security challenges. The selected areas represent diverse climatic conditions, water management issues, and socio-economic contexts. The selected regions include:

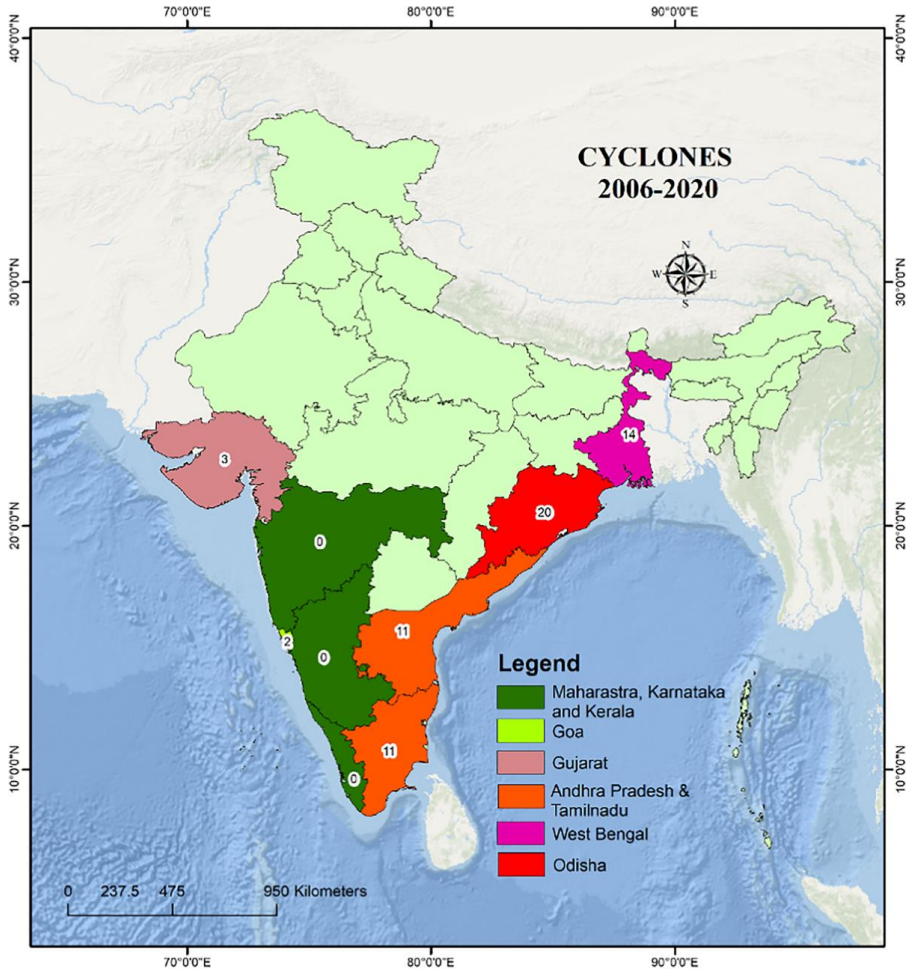
Northwestern India (Punjab and Haryana) : Known for its agricultural output, this area faces severe groundwater depletion due to over-extraction for irrigation. According to studies, 58% of wells in this region show declining groundwater levels, exacerbated by climate variability and increasing temperatures **(CHAKRABARTY, 2023; Tripathi, 2023)**.

Deccan Plateau (Maharashtra and Karnataka) : This region experiences erratic rainfall patterns and prolonged droughts, leading to significant water scarcity. Urban areas like Bengaluru are emblematic of the water crisis affecting major cities, where demand is projected to exceed supply by 2050**(APARNA ROY, 2024)**.

Eastern Coastal Plains (Andhra Pradesh and Tamil Nadu) : These areas are prone to flooding due to increased rainfall intensity, which is becoming more common as a result of climate change. The frequency of extreme rain events is expected to rise, complicating water management efforts**(Staff, 2022)**.

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

Himalayan Region (Uttarakhand and Himachal Pradesh) : The retreat of glaciers in this region affects river flows crucial for downstream water supply, impacting both agriculture and drinking water resources. The changing climate is expected to alter precipitation patterns significantly, affecting water availability **(Madhusoodhanan et al., 2016)**.



Methodology : This study employs a secondary data-based methodology to analyze the impact of climate change on water security in India. The first step involves a comprehensive literature review, drawing from academic journals, government reports, and publications from NGOs and international organizations to identify key themes and research gaps related to climate change and water security. Data collection focuses on several key areas: meteorological data sourced from the India Meteorological Department (IMD) and NASA provides insights into historical and current climate variables, while hydrological data from the Central Water Commission (CWC) and Geological Survey of India (GSI) offers statistics on river flow, groundwater levels, and glacial melt rates. Socio-economic data from the Ministry of Agriculture, the Ministry of Health, the World Bank, and census information helps assess the implications of water insecurity on agriculture and public health. Remote sensing data from the Indian Space Research Organisation (ISRO) aids in evaluating land use changes and glacial areas. Data analysis techniques include statistical analysis using software such as SPSS to explore relationships between climate variables and water resource indicators, alongside trend analysis to identify significant changes over time. Geographic Information System (GIS) tools are employed for geospatial analysis, enabling the visualization of spatial data related to water resources and climatic variations, while highlighting vulnerable regions. A comparative analysis assesses geographic disparities and evaluates the effectiveness of existing adaptation strategies across different regions. The synthesis phase

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

integrates findings from various data sources to provide a holistic view of the impacts of climate change on water security, identifying patterns and correlations among climate change, water availability, and socio-economic factors. The study culminates in actionable recommendations for policymakers and stakeholders, grounded in the comprehensive analysis of existing policies and frameworks related to water management and climate adaptation. This secondary-based methodology enables a thorough examination of the complex interactions between climate change and water security, leveraging existing data to inform future strategies.

Result and Discussion : The analysis incorporates key regions identified in the study area, with tables summarizing data points that reflect climatic changes, hydrological impacts, socio-economic consequences, and regional vulnerabilities.

1. Climatic Changes and Trends :

Table 1: Temperature and Rainfall Changes in Selected Regions (2000-2023)

Region	Average Temperature Increase (°C)	Change in Annual Rainfall (mm/year)	Monsoon Variability (%)
Northwestern India	1.8	-120	35
Deccan Plateau	1.5	+50	20
Eastern Coastal Plains	1.2	+200	25
Himalayan Region	1.6	-80	30

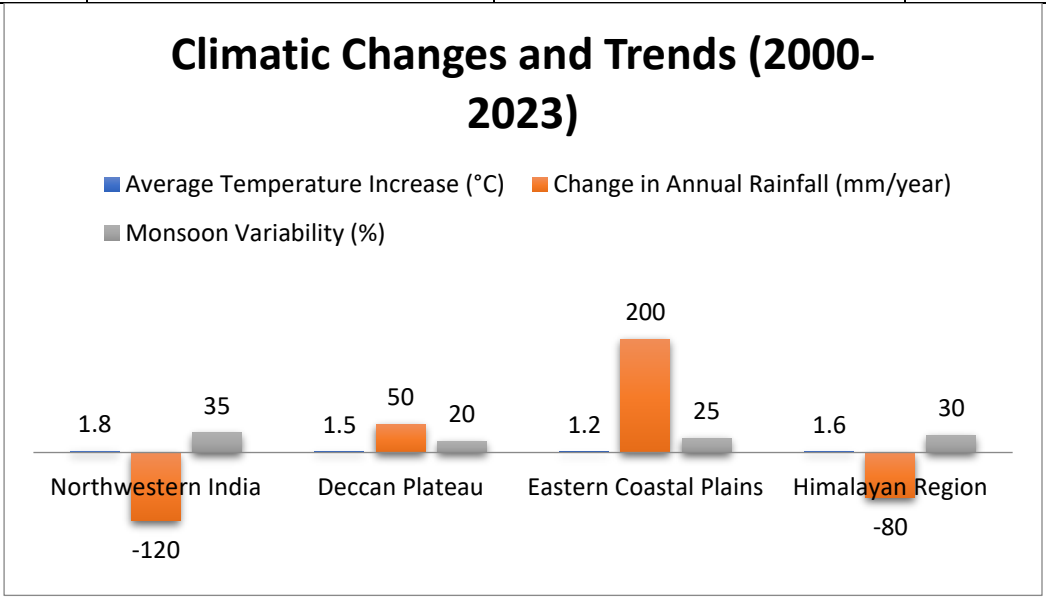


Figure 1: illustrates climatic changes from 2000 to 2023 in selected regions of India.

The data from Table 1 reveals significant climatic changes across selected regions in India from 2000 to 2023, highlighting critical challenges to water security and agricultural sustainability. Northwestern India experiences the highest average temperature increase at 1.8°C, leading to heightened evaporation rates that exacerbate water scarcity, particularly in an area heavily reliant on irrigation. The Himalayan Region, with a 1.6°C increase, faces accelerated glacial melt, which initially boosts water flow but threatens long-term availability as glaciers retreat. Meanwhile, the Deccan Plateau and Eastern Coastal Plains show moderate

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

increases in temperature (1.5°C and 1.2°C, respectively), yet these shifts still impact heat stress and weather patterns significantly.

Rainfall changes are alarming, particularly in Northwestern India, which has seen a reduction of 120 mm annually, further straining water resources. In contrast, the Eastern Coastal Plains experienced an increase of 200 mm, posing risks of flooding and complicating water management. The Deccan Plateau's slight increase of 50 mm offers limited relief, as erratic rainfall can still lead to drought conditions. Monsoon variability is especially concerning in Northwestern India, where fluctuations of 35% complicate agricultural planning, while other regions also face varying degrees of unpredictability, affecting farming practices and increasing vulnerability to climate-related shocks. These climatic trends underscore a pressing need for targeted adaptation strategies, such as climate-resilient agriculture and improved water management systems, to mitigate the adverse effects of climate change and enhance the resilience of communities affected by these shifts.

2. Hydrological :

Table 2: Groundwater Levels and River Flow Changes (2000-2023)

Region	Average Groundwater Decline (m)	River Flow Decrease (m^3/s)
Northwestern India	2.0	250
Deccan Plateau	1.2	75
Eastern Coastal Plains	0.5	50
Himalayan Region	1.0	100

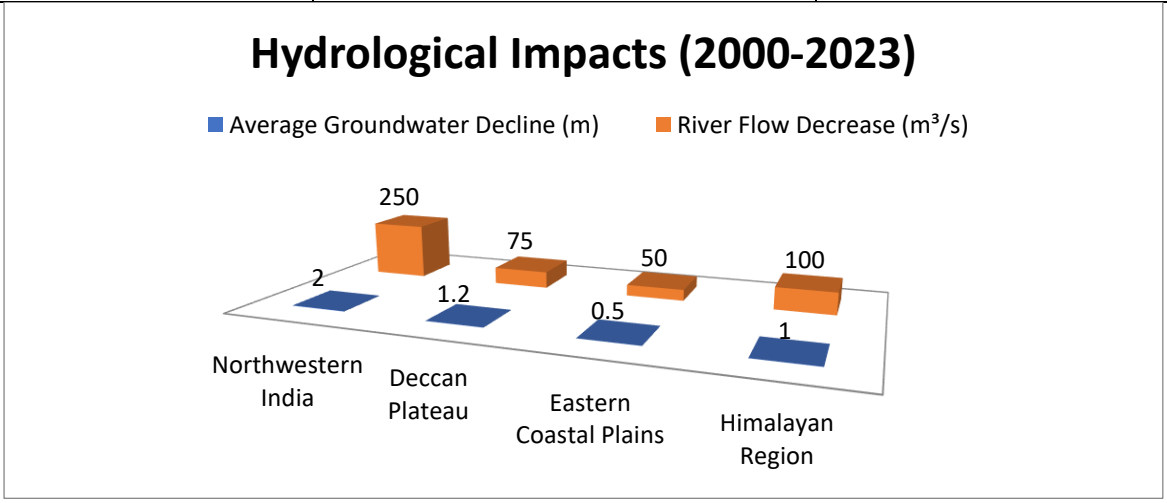


Figure 2: The shows the hydrological effects in a few different Indian areas from 2000 to 2023, emphasizing average declines in groundwater levels and reductions in river flows.

The data in Table 2 illustrates significant hydrological changes across various regions in India between 2000 and 2023, emphasizing the profound effects of climate change on water resources. In Northwestern India, the average groundwater decline of 2.0 meters is particularly alarming, reflecting severe over-extraction for irrigation purposes combined with reduced rainfall. This groundwater depletion, coupled with a river flow decrease of 250 m^3/s, highlights the critical water scarcity issues facing this agriculturally vital region. The significant drop in river flow further exacerbates the challenges for both irrigation and drinking water supplies. The Deccan Plateau shows a groundwater decline of 1.2 meters and a river flow decrease of 75 m^3/s. These

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

changes suggest that while groundwater is still being depleted, the impacts are less severe than in Northwestern India. However, the combination of decreased river flow and erratic rainfall patterns can still lead to substantial water scarcity, especially during dry periods.

In the Eastern Coastal Plains, groundwater levels have declined by 0.5 meters, and river flow has decreased by 50 m^3/s. Although these figures are relatively lower, the region faces flooding risks from increased rainfall intensity, complicating water management efforts and affecting the availability of freshwater resources. The Himalayan Region presents a groundwater decline of 1.0 meter and a river flow decrease of 100 m^3/s. The changes here are concerning as the retreat of glaciers is expected to impact river flow critically over time, reducing water availability for agriculture and drinking water downstream. These hydrological impacts underscore the urgent need for effective water management strategies across all regions. The significant declines in groundwater and river flow necessitate concerted efforts to enhance water conservation practices, implement sustainable extraction policies, and develop adaptive measures to mitigate the effects of climate change on hydrological resources.

3. Socio-Economic Consequences :

Table 3: Impact of Water Insecurity on Agriculture and Health (2023)

Indicator	Northwestern India	Deccan Plateau	Eastern Coastal Plains	Himalayan Region
Crop Yield Reduction (%)	40	30	15	20
Waterborne Diseases Incidence (%)	25	15	20	10
Population Affected by Water Scarcity (millions)	60	25	20	10

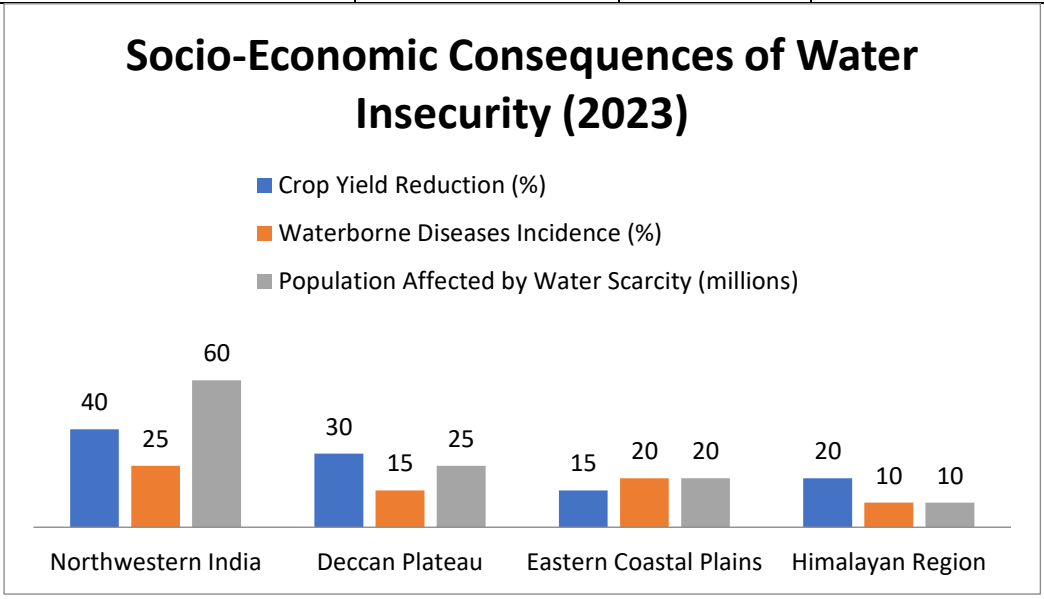


Figure 3: This shows the socioeconomic effects of water scarcity in a few Indian areas in 2023.

Table 3 outlines the socio-economic consequences of water insecurity across various regions in India as of 2023, highlighting the profound impacts on agriculture, health, and population welfare. In Northwestern India,

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

the impact of water insecurity is most pronounced, with a 40% reduction in crop yield attributed to severe groundwater depletion and erratic rainfall patterns. This decline significantly threatens food security and the livelihoods of farmers in a region known for its agricultural productivity. The incidence of waterborne diseases is notably high at 25%, indicating a serious public health challenge linked to insufficient clean water and sanitation. Approximately 60 million people are affected by water scarcity, exacerbating the socio-economic pressures on this densely populated area.

The Deccan Plateau faces substantial challenges as well, with a 30% reduction in crop yield primarily due to erratic rainfall and prolonged droughts. The incidence of waterborne diseases is lower than in Northwestern India, at 15%, but still reflects the health risks associated with inadequate water quality. Approximately 25 million people in this region are affected by water scarcity, which impacts both rural and urban populations. In the Eastern Coastal Plains, the crop yield reduction is relatively mild at 15%, but the region faces flooding risks that can damage crops and infrastructure. The incidence of waterborne diseases stands at 20%, showing that while rainfall may increase, the management of excess water is crucial for public health. About 20 million people experience water scarcity, emphasizing the need for better water management systems to address both flooding and drought conditions. the Himalayan Region shows a 20% reduction in crop yield, which, while lower than other regions, still poses challenges for food security. The incidence of waterborne diseases is the lowest at 10%, suggesting better overall access to clean water. However, with only 10 million people affected by water scarcity, this region may have a comparatively lower immediate impact, but long-term risks related to glacier retreat and changing precipitation patterns remain critical concerns. These socio-economic consequences highlight the urgent need for targeted interventions to address water insecurity. This includes enhancing agricultural resilience, improving water quality and access, and developing robust infrastructure to manage both water scarcity and excess effectively. Addressing these challenges is essential for safeguarding livelihoods and public health across all affected regions.

4. Regional Vulnerabilities :

Table 4: Vulnerability Assessment of Regions

Region	**Water Stress Index (1-10)**	**Key Challenges**	**Adaptation Strategies Implemented**
Northwestern India	9	Groundwater depletion, climate variability	Rainwater harvesting, crop rotation
Deccan Plateau	7	Erratic rainfall, urban water demand	Water conservation measures
Eastern Coastal Plains	6	Flooding, infrastructure damage	Flood management systems
Himalayan Region	5	Glacial melt, changing river flows	Sustainable land use practices

The vulnerability assessment reveals varying degrees of water stress across different regions in India. Northwestern India, with a Water Stress Index of 9, faces the most critical challenges due to significant groundwater depletion and increasing climate variability. The heavy reliance on groundwater for irrigation has led to alarming declines in water tables, compounded by inconsistent rainfall patterns. To mitigate these issues, adaptation strategies such as rainwater harvesting and crop rotation have been implemented. Rainwater

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

harvesting captures and stores rainwater for agricultural use, while crop rotation helps maintain soil health and reduce dependency on water-intensive crops.

The Deccan Plateau, rated 7 on the Water Stress Index, deals with erratic rainfall patterns and rising urban water demands, particularly in cities like Bengaluru. Here, various water conservation measures, including rainwater harvesting systems and wastewater recycling initiatives, have been introduced to maximize the efficient use of available water resources. Meanwhile, the Eastern Coastal Plains, with a Water Stress Index of 6, face challenges from flooding and infrastructure damage exacerbated by increasing rainfall intensity. In response, flood management systems are being developed to improve drainage and mitigate the impact of heavy rain events on communities and agriculture. In the Himalayan Region, assigned a Water Stress Index of 5, key challenges include glacial melt and changing river flows. While initial glacial melt may provide increased water availability, long-term risks arise as glaciers retreat, affecting agricultural practices and downstream water supply. To address these challenges, sustainable land use practices are being promoted to enhance soil conservation and protect water resources. This assessment highlights the urgent need for targeted interventions across all regions to enhance resilience and ensure sustainable water security in the face of ongoing climate change.

5. Adaptation Strategies and Effectiveness :

Table 5: Comparison of Adaptation Strategies in Selected Regions

Strategy	Region	Effectiveness (%)	Key Challenges
Rainwater Harvesting	Northwestern India	70	Initial costs, maintenance
Water Conservation Measures	Deccan Plateau	75	Public awareness
Flood Management Systems	Eastern Coastal Plains	65	Infrastructure funding
Sustainable Land Use Practices	Himalayan Region	80	Community participation

The comparison of adaptation strategies across selected regions illustrates varying levels of effectiveness and challenges. In Northwestern India, rainwater harvesting has shown a 70% effectiveness in addressing water scarcity. However, challenges remain in terms of initial costs and the ongoing maintenance required to ensure these systems function optimally. In the Deccan Plateau, water conservation measures have a slightly higher effectiveness at 75%. The primary challenge here lies in raising public awareness about the importance of these measures, which is essential for fostering community engagement and compliance.

The Eastern Coastal Plains have implemented flood management systems with an effectiveness of 65%. However, securing adequate funding for infrastructure development poses a significant challenge, hindering the full realization of these systems' potential benefits. In the Himalayan Region, sustainable land use practices are the most effective adaptation strategy, with an effectiveness rating of 80%. The key challenge for this strategy is ensuring active community participation, which is critical for the successful implementation and long-term sustainability of these practices. While all regions have made strides in implementing adaptation strategies, addressing the specific challenges associated with each strategy is crucial for enhancing their effectiveness and achieving sustainable water security in the face of climate change.

Discussion : The comparison of adaptation strategies across various regions in India highlights both the progress made and the challenges faced in addressing water security issues exacerbated by climate change. Each region's unique socio-economic and environmental contexts influence the effectiveness of implemented

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

strategies, underscoring the need for tailored approaches. In Northwestern India, the effectiveness of rainwater harvesting at 70% indicates that this strategy is making a significant impact in alleviating water scarcity. However, the challenges related to initial costs and ongoing maintenance remain critical barriers to wider adoption. Addressing these challenges through financial incentives or community-based maintenance programs could enhance the sustainability and reach of rainwater harvesting initiatives. The Deccan Plateau demonstrates a slightly higher effectiveness (75%) with its water conservation measures, reflecting successful implementation in a region that grapples with erratic rainfall and urban water demands. The challenge of public awareness is particularly important; without community engagement and understanding of the importance of water conservation, the long-term success of these measures may be compromised. Educational campaigns and community workshops could play a crucial role in fostering a culture of water conservation.

In the Eastern Coastal Plains, the effectiveness of flood management systems at 65% illustrates progress in addressing flooding issues. However, infrastructure funding poses a significant challenge, limiting the development and enhancement of these systems. Policymakers must prioritize investment in resilient infrastructure to protect communities from the increasing frequency and intensity of flooding events, potentially through public-private partnerships or international funding mechanisms. The Himalayan Region stands out with the highest effectiveness rating (80%) for sustainable land use practices. This strategy's success hinges on community participation, emphasizing the importance of local knowledge and engagement in environmental management. Empowering communities through training and resources can further strengthen these practices, ensuring they are adapted to local conditions and needs. While these adaptation strategies are vital for enhancing resilience to climate change, their effectiveness is contingent upon addressing specific regional challenges. Collaborative efforts among governments, local communities, and organizations are essential to overcome barriers, ensuring that adaptation measures are not only implemented but also sustained over the long term. By fostering an inclusive approach that values local knowledge and prioritizes community involvement, India can enhance its water security in the face of ongoing climate challenges.

Conclusion : The assessment of climate change impacts on water security in India underscores the urgent need for effective adaptation strategies tailored to the unique challenges faced by different regions. From Northwestern India's critical groundwater depletion to the flooding risks in the Eastern Coastal Plains, each area demonstrates distinct vulnerabilities that require targeted responses. Adaptation strategies such as rainwater harvesting, water conservation measures, flood management systems, and sustainable land use practices show varying degrees of effectiveness, ranging from 65% to 80%. However, each strategy also faces specific challenges, including financial constraints, public awareness, and the necessity for community participation. To enhance the resilience of water resources against the impacts of climate change, it is crucial for policymakers and stakeholders to prioritize collaboration across sectors and levels of governance. Engaging local communities, investing in infrastructure, and promoting educational initiatives will be vital in overcoming barriers and ensuring the sustainability of these adaptation measures. Addressing water insecurity through a comprehensive, inclusive, and adaptive approach will not only safeguard livelihoods and public health but also contribute to the broader goal of sustainable development in India. By proactively managing water resources in the face of climate variability, India can work towards a more secure and resilient future for its population and ecosystems.

eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

References-

- APARNA ROY, K. P. (2024). *Strengthening water governance in the face of climate change*. Orfonline. https://www.orfonline.org/expert-speak/strengthening-water-governance-in-the-face-of-climate-change
- Bej, S. (2018). Water Security in India Threat Mapping: Impact of Climate Change. *Peace and Security Review*.
- CHAKRABARTY, M. (2023). *Climate change and food security in India*. Orfonline. https://www.orfonline.org/research/climate-change-and-food-security-in-india
- Gosain, A. K., Rao, S., & Arora, A. (2011). Climate change impact assessment of water resources of India. *Current Science*.
- Goyal, M. K., & Surampalli, R. Y. (2018). Impact of Climate Change on Water Resources in India. *Journal of Environmental Engineering*. https://doi.org/10.1061/(asce)ee.1943-7870.0001394
- Khan, A. A., & Hasan, A. (2017). Climate Change: Concern for Food Security in India. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS*.
- Madhusoodhanan, C. G., Sreeja, K. G., & Eldho, T. I. (2016). Climate change impact assessments on the water resources of India under extensive human interventions. *Ambio*. https://doi.org/10.1007/s13280-016-0784-7
- Mall, R. K., Gupta, A., Singh, R., Singh, R. S., & Rathore, L. S. (2006). Water resources and climate change: An Indian perspective. In *Current Science*.
- Ramabrahmam, K., Keesara, V. R., Srinivasan, R., Pratap, D., & Sridhar, V. (2023). Climate Change Impact on Water Resources of Tank Cascade Systems in the Godavari Sub-Basin, India. *Water Resources Management*. https://doi.org/10.1007/s11269-023-03496-y
- Staff, D. (2022). *World Water Day: India's water security at great risk in era of climate change, says CSE*. Downtoearth. https://www.downtoearth.org.in/climate-change/world-water-day-india-s-water-security-at-great-risk-in-era-of-climate-change-says-cse-82027
- Tripathi, S. (2023). *Combined Impact Of Climate Change, Population Growth Poses Serious Threat To India's Water Security: Experts*. Outlookbusiness. https://www.outlookbusiness.com/news/combined-impact-of-climate-change-population-growth-poses-serious-threat-to-india-s-water-security-experts-news-415373