Minireview Article

Impact of Climate Change on Arid Region: Case Study of Rajasthan

Abstract

The climate is changing at a very quick rate adding to the expanded global concern. During the most recent couple of years, the noble Coronavirus held the world by a threat that caused huge financial mishaps and loss of lives. Simultaneously, the extreme weather events kept on adding to the outrageous climate crisis. To mitigate the effect of climate change, the entire world met up and made various commitments made in various UN conventions, culminating in the Paris Convention to both implement mitigation and adaptation measures to reduce the emissions. The Sustainable Development Goals plan was recognized by all individuals from the United Nations in 2012 at Rio De Janeiro with an expect to propel a sound and created future for the planet and its people. It was in 2015 the Sustainable Development Goals (SDGs) were embraced with 17 goals; with SDGs Goal No.13 addressing earnest activities to combat climate change and its impact in all topographical elements including arid areas. The paper is an attempt to give an overview of the Arid region, climate vulnerability, and to identify the main challenges which climate change presents to the region's future development. The paper further explores the impact of climate change in an arid area and the variation and alleviation ways to deal with address the worries of climate change and closes with methods of freeing the impact from climate change in a parched Rajasthan.

Keywords: - Sustainable Development Goals, Arid region, Bone - dry region, Mitigation, Adaptation

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1. Background

Climate change is the best worldwide test defying us today which through an enormous number of impacts addresses a danger to our nature, economy, and society. The *IPCC's Special Report on Climate Change and Land*, August 2019; says land-based carbon sinks are not boundless. (IPCC Special Report 2019) The report takes note that any sequestration gains are at risk from future loss set off by unsettling influences like flood, drought, fire, or future poor management."

Over the past 3.5 billion years, the planet's climate has been altered by volcanic emanations, changes in solar radiation, mainland's moving gradually on moving structural plates, impacts by huge meteors, and different elements. During the most recent 900,000 years, the atmosphere has encountered drawn out times of worldwide cooling and an unnatural weather change. The continuous anthropogenic climate change is basically achieved by an increment in how much ozone harming substances, especially carbon dioxide (CO2) in the atmosphere. (Dhote, De, 2021)

Indian Meteorological Department, Government of India had put out a statement on "Climate of India during 2020", published on 4th January 2021. As demonstrated by this record, the yearly mean land surface air temperature arrived at the midpoint of over India during 2020 was better than average. The year 2020 was the eighth most sweltering year on record since cross country records were started in 1901. (Ministry of Earth Sciences, 2021).

To mitigate the effect of climate change, the entire world came together and made various commitments made in various UN conventions, culminating in the Paris Convention (12th December 2015) to both carryout mitigation and adaptation measures to reduce the emissions. The Sustainable Development Goals plan was recognized by all individuals from the United Nations in 2012 at Rio De Janeiro to advance a sound and better future for the planet including its people. (United Nations SDGs, 2015). The Sustainable Development Goals (SDG) were taken on in the year 2015 with 17 goals; with SDG Goal13 recognized the pressing activities to battle climate change and its impact in all geological highlights

including Arid regions. Figure 1 mentioned the major extreme weather events that occurred during 2020.

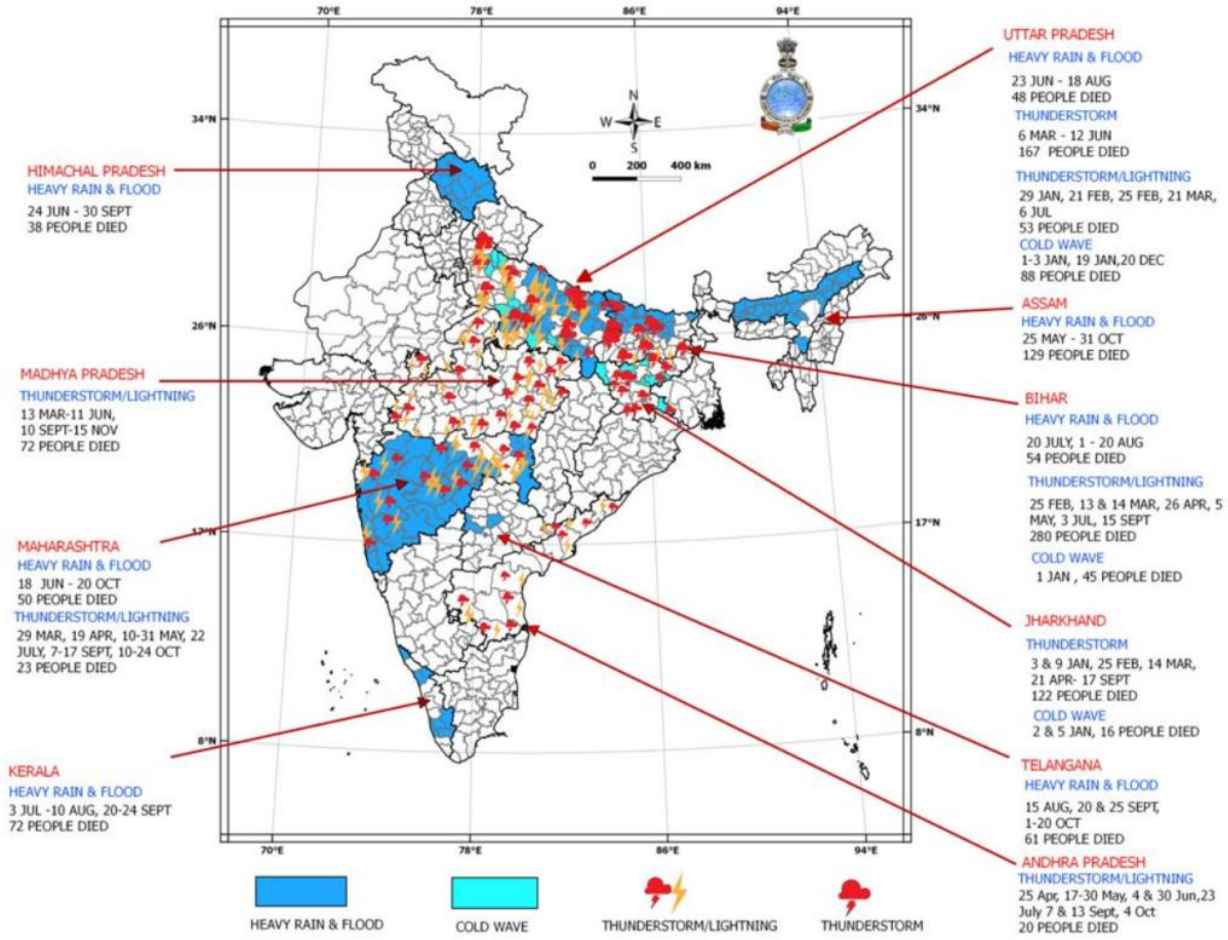


Figure 1: Major extreme weather events occurred during 2020 and associated casualties

Source: - https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1686173#:~:text=The annual mean land surface air temperature averaged, observed over India during 2016 %28%2B0.71 0 C%29.

The Constitution of India delineated the duties and obligations of Center, State, and Local Governments. To mitigate the effect of climate change and to monitor it, the Climate action portal was launched by India in 2020. The portal will give information on the distinctive climate drives taken by different line services enabling users to get refreshed status on these drives. The main parts of the portal are India's climate profile, India's NDC goals, two-sided and multilateral participation etc.

2. Objective of the Study: -

This study was undertaken to provide an overview of Arid Rajasthan's climate vulnerability and to revisit the past to understand the present-day trends.

3. **Research Questions**: -

To address the above objective, the following questions have been identified for research:

What is climate change with respect to arid regions? What are the adaptation and mitigation approaches addressing the concern of climate change regarding Rajasthan?

a) How does climate change affect arid regions? What are the main challenges which climate change presents to the region with respect to current and future development?

b) How much do the available planning documents addresses the issues of climate change and adaptation and mitigation measures appropriate in the Arid regions?

c) What are the steps taken by various stakeholders to reduce the effects of climate change in arid Rajasthan?

4. **Interrelationship between Climate Change and Arid area**: -

Arid areas including desert and Semi desert areas are the world's most vast land biomes, covering over 30% of the planet's surface. They are often anticipated to be among the most vulnerable species to global warming.

In any case, there are yet significant vulnerabilities in regards to the reasonable effects of expanding convergence of one or the other CO2 or future climate change in bone-dry (arid) systems. Understanding of some paleoclimatic information as the analogs to future climates suggests that worldwide climate change may make parched areas experience higher precipitation and accordingly to end up being more useful biological systems. Despite the exceptional vulnerabilities about the responsiveness of arid ecosystems to the continuous climatic changes, circumstances foreseeing expansions in precipitation in present-day deserts are at times deciphered as signs of a likely expansion in usefulness of parched zones on account of the CO2 increments. (Lioubimtseva, 2004).

The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) exhibits that the temperature has increased, and it is relied upon to increment further in the future aside from assuming measures are not taken. (Solomon, 2007) Wet regions are presumably going to become wetter and dry regions will become drier, expanding the water deficiency in these dry regions. Climate change will influence the sustainable development challenges that we face not just in environmental issues also in various other areas. It will also affect the arid ecosystems and its 2.5 billion inhabitants. (Dhote, De 2021)

The bone-dry (arid) regions (40% of world land surface) are home to multiple billion individuals, addressing 35% of the total populace. Around 55% of bone-dry (arid) occupants live in country regions. More than 90% of bone-dry (arid) occupants are in the developing nation and 70% in country regions. Generally, half of the least economically fortunate individuals on the planet live in parched regions. For the most part, a big part of the least economically fortunate people in the world live in dried locales. Most parched ecosystems are presently affected by expanding resource needs and unsustainable management practices, and human-incited climate change which adds huge new pressure. Most dry/ arid frameworks are delicate to both the extent and pace of climate change, and the susceptibility of individuals living there will increment in the future if their adaptive capacity doesn't improve.(El-Beltagy & Madkour, 2012).

5. **Study area – Arid Rajasthan**: -

Water is scant in a space overwhelmed by desert and semi desert environments, and land degradation is more due to Aeolian processes. Rajasthan is one of the examples of the arid ecosystem and is facing the problem of climate change peril during the last few decades.

5.1. About Arid Rajasthan: -

The Indian hot dry (arid) area is arranged between 22 30' and 32 05' N latitudes and from 68 05' to 75 45' E longitudes, covering the western part of Rajasthan (19.6 Mha, 69%), north-western part of Gujarat (6.22 Mha, 21%) and south-western part of Haryana and Punjab (2.75 Mha, 10%). A large portion of the hot parched zone goes under the northern-western part of Rajasthan covering 12 regions. Precipitation dispersion in the space is especially lopsided throughout reality.(Saxena, Goyal, Singh, Roy, 2014). This parched

region covers an area of 208,746 sq. km with a populace of around 27,115,542 people as indicated by Census 2011. The parched region particularly the study region makes up around 60.99 % area and 39.51 % populace of the state. Bone-dry Rajasthan involves 12 districts like Bikaner, Jaisalmer, Pali, Jodhpur, Nagaur, Churu, Sikar, Jhunjhunu, Barmer, Jalore, Hanumangarh and Sriganganagar. Figure 2 explains the location and relief of Arid Rajasthan.

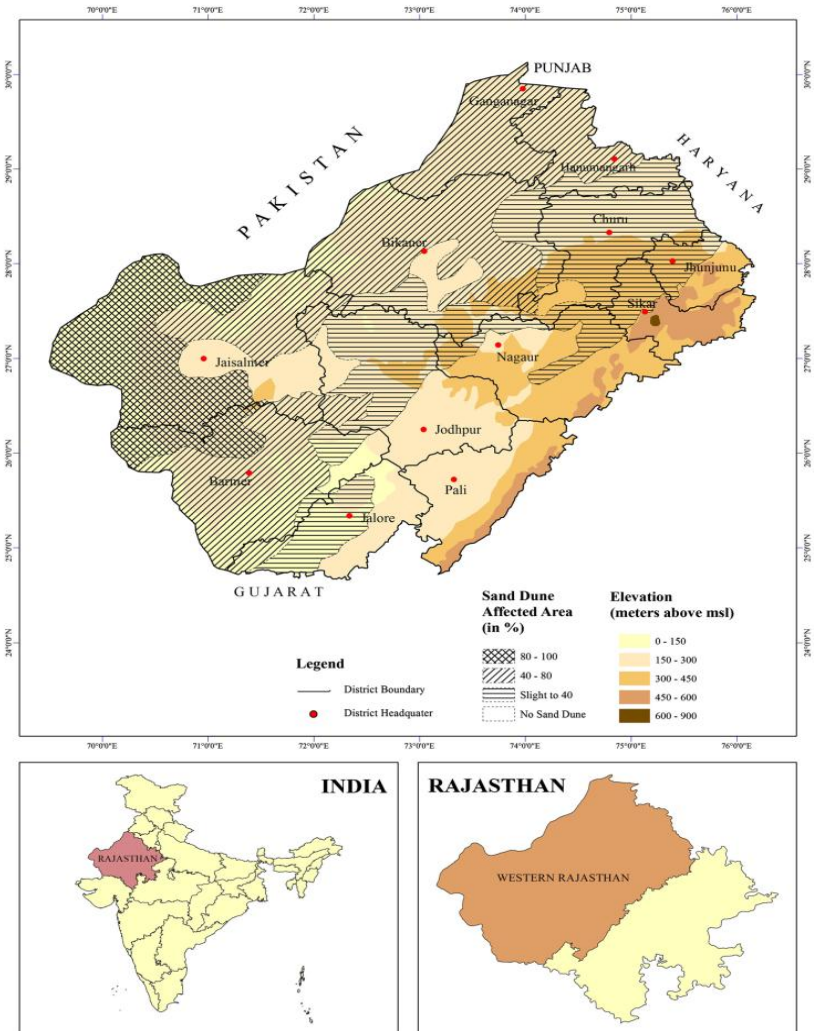


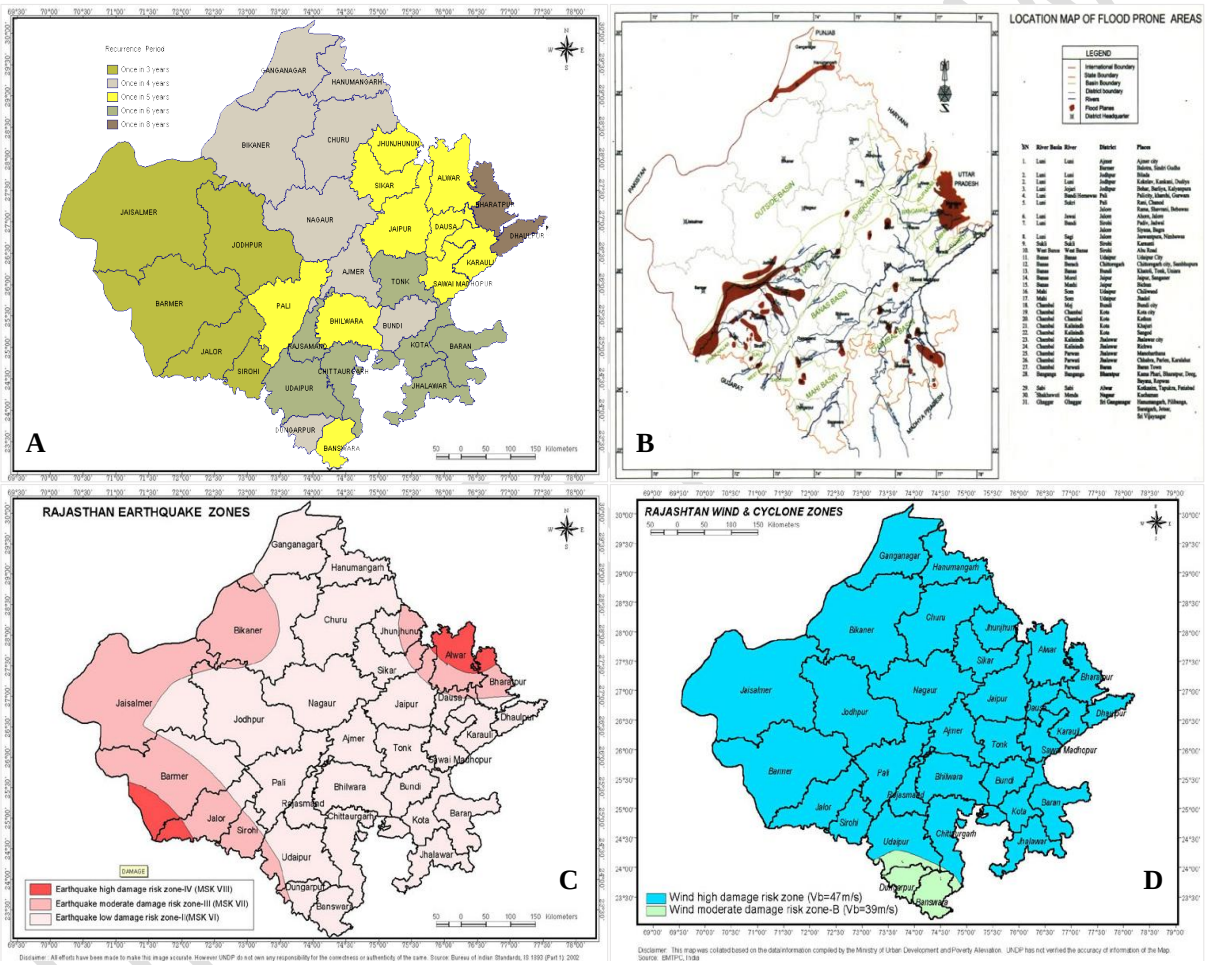
Figure 2: Location, Relief, and Sand dunes of Arid Rajasthan

Source - https://geoenvironmental-disasters.springeropen.com/articles/10.1186/s40677-015-0018-5

5.2. Impacts of Climate Change on Arid Rajasthan: -

Rajasthan is presumably going to encounter further water deficiency as a result of a general decrease in precipitation. Likewise, the State has the greatest susceptibility and

most minimal adaptive capacity to climate change difficulties. Despite the fact that a 20% ascent in all-India summer rainstorm precipitation is projected in Rajasthan, in general precipitation is projected to diminish, and evapotranspiration is probably going to expand, due to a dangerous atmospheric devation (global warming). (Singh, 2010). Figure 3 explains the climatic conditions of arid Rajasthan i.e., Western Rajasthan, which is prone to all types of disasters i.e., floods, Drought, Earthquake, Wind zones. During the last decade, Rajasthan has had the greatest probability of even floods in India.



Legend: - A. Drought Frequency, B. Flood Prone Area, C. Earthquake, D. Wind Zones

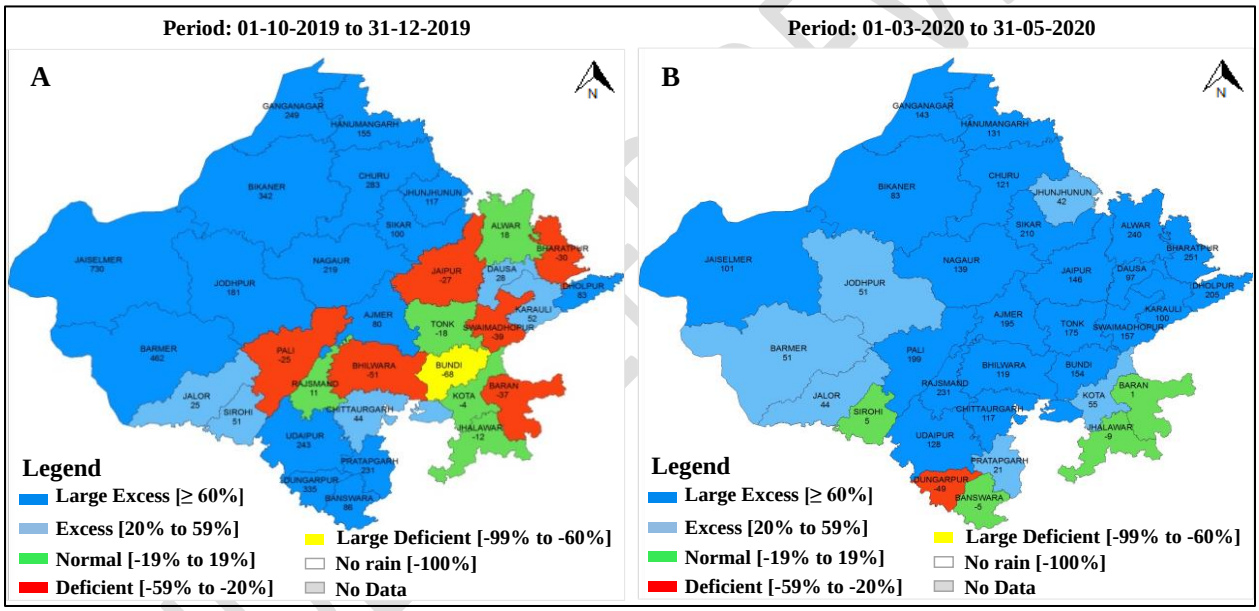
Fig 3: Disasters in Rajasthan

Source: - Disaster Management, Relief & Civil Defense Department Government of Rajasthan. Accessed from http://www.dmrelief.rajasthan.gov.in/index.php/citizen-charter/maps-of-rajasthan/multi-hazard-zones

During the post-storm 2019 season, Rajasthan had 42.2 mm or 136% above typical downpours. Western or Arid Rajasthan had 45.7 mm or 294% above typical precipitation, East Rajasthan had 37.8 mm, 47% above normal downpour. During the pre-rainstorm 2020

season, Rajasthan had a 44.9 mm storm, 114% above typical downpours. West Rajasthan had 44.7 mm, close to 99% above typical downpours. East Rajasthan had 45.2 mm or 138% above typical downpours. (SANDRP, 2020). Figure 4 explains the district rainfall departure map of Rajasthan.

The climate over Western Rajasthan is yet showing unequivocal signs of progress, with a reduction in precipitation and an expansion in temperature and aridity. The bone-dry (arid) climate belt has pushed eastward, heightening the course of land debasement (land degradation) and causing desertification. The water assets (resources) are sparse, adding to the susceptibility (vulnerability) of the area towards climate change.(R. B. Singh & Kumar, 2015).



Legend: A. Post Monsoon 2019; B. Pre-Monsoon 2020

Fig 4: District rainfall departure map of Rajasthan

Source: - SANDRP - South Asia Network on Dams, Rivers, and People

During the most recent twenty years, there has been a huge improvement of various water sources by the government authority in the region and on account of these undertakings, the north-western part of the locale has accomplished great farming production and yield. The improvement of channel water system in specific parts has strengthened the course of land debasement which should be overseen on fundamentally important premise to relieve the effect of climate change and its consequences on the arid Rajasthan.(R. B. Singh & Kumar, 2015).

6. Steps were taken by the Rajasthan government to mitigate the impacts of Climate Change: -

Detailing of a Climate Change Agenda for Rajasthan (CCAR) in 2010 was a significant stage towards tending to climatic risks in the state. As Rajasthan is the biggest state in the country with outstanding weaknesses to the extent openness to climatic limits and changing capacities for reacting to the dangers, and open doors that can be tapped, this was a significant drive taken by the state government.

Rajasthan released a **State Environment Policy (SEP)** in 2010 denoted the key environmental difficulties that the state should address to continue with sustainable development and monetary growth that is equitable. Inside the State Environment Mission, scarcely any areas have been perceived as being basic to the extent the climate change impacts on them. The previously mentioned areas incorporate human wellbeing, farming and livestock, upgraded energy effectiveness including energy from sun, and key information for climate change.(Swami, 2019).

Under the **Rajasthan Environment Mission**, the CCAR recorded a lot of state needs for adaptation and mitigation strategy and activity during the time period of 2010-2014. State-explicit missions for Rajasthan were made highlighting research gaps and needs close by significant policy and strategy measures, thinking about the state's weaknesses and limits. The CCAR perceived a rundown of methodologies under the going with seven state-level Task Forces contained under the concerned Principal Secretary/Secretary of the Department i.e., Water Resources, Agriculture and Animal Husbandry, Forestry and Biodiversity, and so on (Swami, 2019).

6.1. Rajasthan State Action Plan on Climate Change: -

The Rajasthan Action Plan on Climate Change (RAPCC) develops the basic regions as perceived under the CCAR by zeroing in on earnest areas of activity in a staged and time-bound way. This is in perception with the Rajasthan State Environment Policy and Environment Mission. The Rajasthan State Government set up a 'Climate Change and Clean Development Mechanism (CDM) Cell' in the Rajasthan State Pollution Control Board (RSPCB) to go probably as a nodal office for coordinating issues about climate change in the

State. The Cell was established in April 2010 and was locked in with the drafting of the CCAR. The State of Rajasthan has set up a team to zero in on the execution of the Environment Mission.(Singh V, Pandey D, Gupta A, Rabindranath N, 2010)

The vision of RAPCC is to achieve sustainable development by lessening susceptible (vulnerability) to climate change impacts and updating the adaptability of social, ecological and economic frameworks in Rajasthan. Figure 5 explains the RAPCC approach chart.

The RAPCC perceives activity focuses/strategies about environmental change. Key areas recognized under RAPCC are - Agriculture and Animal Husbandry, Strategic Knowledge for Climate change, Human Health, Energy Efficiency and Renewables, Forestry and Biodiversity, Urban Governance, Sustainable Habitats and Water resources.

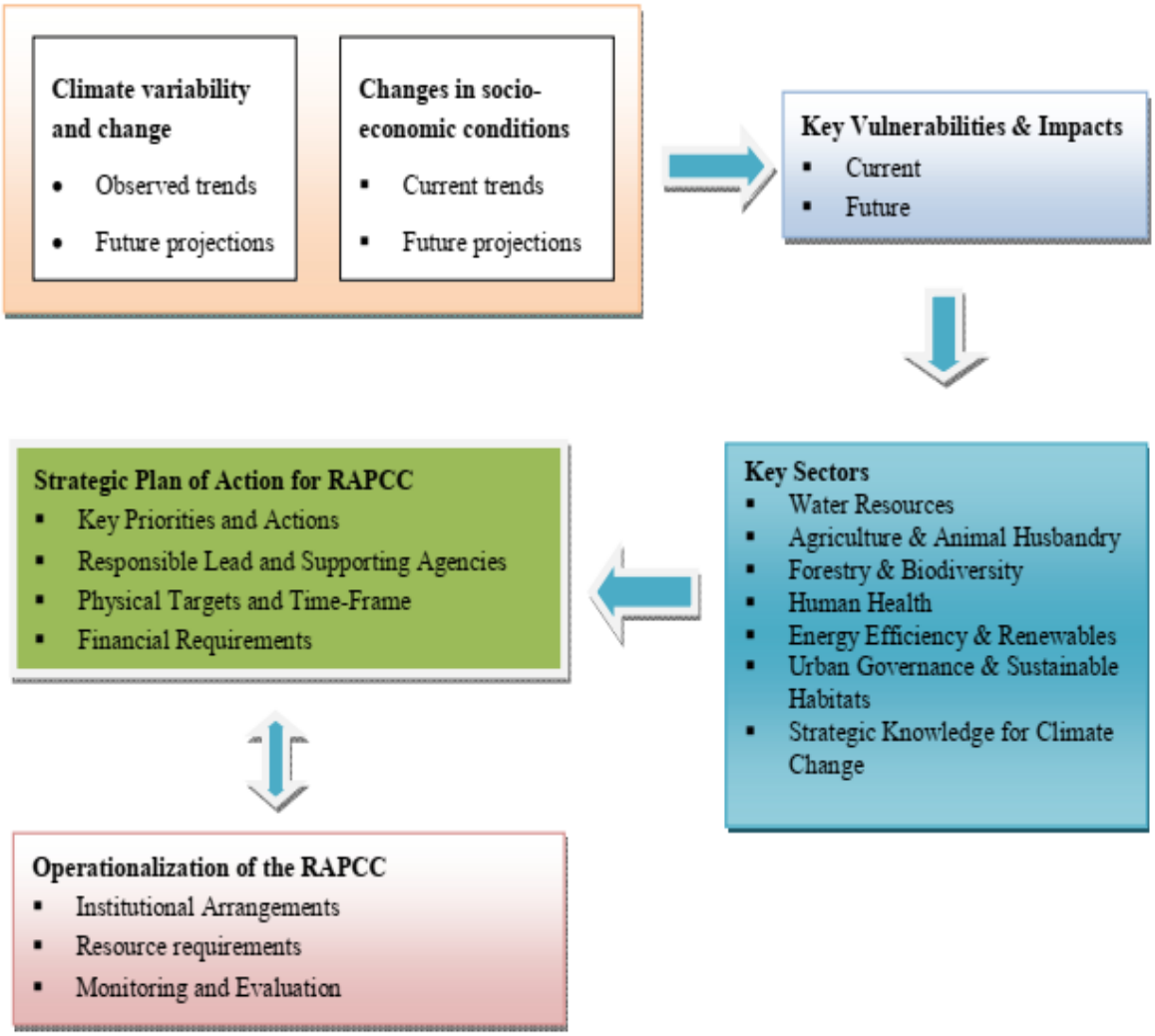


Figure 5: RAPCC Approach

Source: RAPCC Documents, Government of Rajasthan

Table 1 discloses the techniques to be embraced to relieve the effect of Climate Change in Rajasthan.

Table 1: Strategies to be adopted to mitigate the impact of Climate Change

Key Sectors	Strategies
Water Resources	Incorporated Water Resources Management; managing the Supply-side and demand - side association; setting up Integrated Impact Assessment using regional models, etc.
Human Health	Fortifying health services by normal exploration and observing; making public awareness and creating outreach programs uncommonly to battle the rising cases of diseases, and so on.
Renewable energy and Enhanced Energy Efficiency	By setting up energy consumption benchmarks for energy-intensive industrial areas and investigating the solar energy potential in the state.
Sustainable Agriculture	Agriculture practices can be built up by redesigns in agro-expansion services associated with seed advancement, on-ground displays of new procedures/ techniques, progression of better water system facilities and improvement in the recovery of saline or antacid soils, etc.
Forestry and biodiversity	Viably engaging forest communities in forest protection and conservation schemes; evaluating adaptation potential of the different forest species in the changing climate scenario, and investigating the carbon mitigation potential of forest conservation and so on
Approaches for State Mission on Strategic Knowledge on Climate Change	Facilitate studies associated with climate change susceptibility (vulnerability) and assess the effect for better preparation in Rajasthan. There is a need to assess likely future development situations in the State utilizing the optimization energy-environment modeling system. Mainstreaming climate concern into various developmental plans and policies can help in mitigation and adaptation in the State, etc.
Creating Sustainable Habitats	By capturing methane emissions from landfills; better implementation of Energy Conservation Building Codes and Green Certification guidelines for the structure and various development region projects; Green Fuel-Efficient urban transport network by using Compressed Natural Gas, etc.

Source: Compiled by the author, adapted from RAPCC documents, Government of Rajasthan

6.2. Mukhyamantri Jal Swavlamban Abhiyan :-

Typically, in Rajasthan, the duration of precipitation is huge which harms crop production. Due to the abatement in agricultural production of farmers and change of arable land to non-usable land, there is a shortage of fuel, feed and milk coming about in their weak financial condition. The shortage of water is the primary justification behind the present circumstance. (Central Ground Water Board, 2017) As State has a 75% provincial populace which relies upon farming and animal husbandry for their occupation. Therefore, considering these conditions of state, Mukhiya Mantri Jal Swavlamban Abhiyan was acquainted with utilize the Four Waters-Rainfall, overflow, Ground Water, and in-situ Soil Moisture keeping watershed or Cluster/index catchment as a unit for Western Rajasthan where there is insufficient precipitation and no characterized of drainage lines and it's the best illustration of climate change peril.

The Objectives of "Mukhya Mantri Jal Swawalamban Abhiyan" are: -(MMJSA, Government of Rajasthan)

- To ensure strong execution of water preservation and water harvesting related exercises in country regions through the mixing of plans and schemes of various organization keeping in view the current rules.
- Execution of manages people's support by convincing townspeople and recipients/ beneficiaries.
- Gathering of accessible overflow (water, groundwater, underground water, and in situ soil dampness) in-country district by treatment of catchment, legitimate use of accessible water collecting structures, upgrade of the non-usable water reaping designs, and advancement of new water harvesting structures.
- Improvement of Forest, land, water, and fauna ecosystems and keeping watershed/group/list as a unit for natural management of assets (resources).
- Enduring Solution of drinking water by making the Village independent on account of water.
- To extend the Irrigated area through water conservation and harvesting.

The project has reached phase V. The Creation of water stockpiling structures, reclamation of old designs, watershed improvement, water preservation, and water gathering related exercises are brought out through association of plans of different divisions and works are helped out through individuals' interest in the above-mentioned Programme.

7. Planning literature related to Climate Change: -

In this segment, the discussion will be on planning literature connected with climate change. The focus will be how much planning literature tends to climate concerns.

7.1. Master Plan provision related to Climate Change: -

In this subsection, various master plans of Western Rajasthan towns and cities are compared to investigate the master plan provision related to Climate change. The following table 2 mentioned the provisions related to climate concern in the Master Plans of Rajasthan.

Table 2: Provisions related to Climate change in Master Plans of Arid Rajasthan

City/ Town of Western Rajasthan	National Water Mission	Green India mission	National Solar Mission	National Mission for Enhanced Energy Efficiency	National Mission on Strategic Knowledge for Climate Change	National Mission on Sustainable Habitat	National Mission for Sustainable Agriculture	National Mission for Sustaining Himalayan Ecosystem
Jaisalmer (2011-2031)	Rainwater harvesting	Afforestation Programme, Focus on green highway	Not available	Construction of wind energy power station	Generate awareness among the people	Conservation of water	Krishi Seva Kendra	Not applicable
Jodhpur (2013 – 2031)- Draft	Rainwater harvesting, conservation of water bodies, water treatment planning	Afforestation Programme, Focus on green highway , Hill conservation zone	Solar panels in roads for solar light	Construction of wind energy power station	Disaster Management	Affordable housing policy, Rajiv Gandhi Awas Yojana, slum free city, Health care city	Krishi Upaj Mandi Samiti	Not applicable
Hanumangarh (2017-2035) - Draft	Rainwater harvesting, Rejuvenation of water bodies, river front development	Conservation of trees, Green Highway, Highway development control belt	Not available	Thermal Power plant	Environmental conservation Programme, Community participation	Sewage Treatment Plant	Krishi seva Kendra, Milk dairy farm	Not applicable
Sri Ganganagar (2001 – 2023)	Construction of Jet distributary canal	Public parks, Afforestation Programme	Not available	Thermal Power plant and Bhakra Nangal project	Not available	Not available	Grain distribution center, Indian oil distribution center	Not applicable
Bikaner (2001-2023)	Construction of Filter Plant	Parks in every sectors, Afforestation Programme	Not available	Thermal Power plant	Environmental conservation Programme	Community Participation	Dairy farming	Not applicable

Source: - Compiled by author from various Master Plans of Rajasthan (Master Plan, Rajasthan Government)

The key findings from master plan exercises are that it does not address climate change directly, but some provisions are mentioned in the Master Plans as discussed in table 2. Another finding is that Master Plans after 2008, tried to address almost all the components of the NAPCC. Yet, Master Plans before 2008, attempted to address few fundamental NAPCC components like water conservation, afforestation Program, and so on. For example, the Jodhpur master plan mentioned Solar panels, health cities, etc. Hanumangarh Master Plan mentioned about Environmental Conservation Programme, Sewage treatment plant, Thermal power plants, etc. Jaisalmer Master Plan mentioned indigenous knowledge, generating awareness among the people, green highway and Sri Ganganagar and Bikaner master plans mentioned about afforestation Programme, Community participation, etc.

7.2. Gaps mentioned on Rajasthan State Action Plan on Climate Change: - (RAPCC, 2014)

- RAPCC document of Rajasthan government doesn't execute till now.
- None of the Department of Urban Development and Local Self Government policies, programmes and guidelines address adaptation measures for climate change directly.
- Government guidelines just oblige preservation activities to the extent rules for conserving and empower an expansion in the green cover by compulsory afforestation.
- There is a need to either change/adjust the current ways to deal with address these impacts as well as meanwhile sorting out independent approaches to deal in basic areas like water supply, transport, stormwater drainage, etc.
- There is insufficient data on the impacts of climate change in different areas of the state.
- Further there is a shortfall of clear comprehension of important processes like desertification, which requires the observing of different parameters like changes in water quality and amount, biomass, biodiversity, soil saltiness, etc.
- No particular exploration has been directed to screen this interaction in the state.

7.3. Climate Change Mitigation and Adaptation for arid areas not mentioned in Urban and Regional development plan formulation and implementation guidelines (URDPFI) Volume 1: - (URDPFI Guidelines)

- There is a Separate Chapter on Sustainability guidelines in (URDPFI) volume 1.
- Case study of Climate Proofing Guwahati, Assam have been mentioned in this guideline. But doesn't mention specific guidelines about climate proofing in arid areas.
- Desert environment sensitive planning is essential at the provincial (regional) planning stage including planning of land debasement, dry spell observing, and demonstrating components for the State and District Disaster Management Plan for dry season preparedness and cautioning framework groups.
- At Development Plan and neighborhood level the accompanying key activities proposed in NEP, 2006 as given underneath should be thought of:
- a) Intensive water and dampness preservation through practices subject to conventional and science-based information and relying upon customary framework.
- b) Enhancing and growing green cover reliant upon neighborhood species.
- c)Reviewing the agronomic practices and progressing farming practices and assortments, which are especially changed in accordance with the desert environment.

7.4 Rural Area Development Plan Formulation and Implementation (RADPFI) Guidelines, 2016 not directly address Climate Change: - (RADPFI Guidelines, 2016)

- There is a separate chapter on Environmental sustainability and disaster management.
- There is a mention of Climate Change Mitigation and Adaptation in RADPFI with extraordinary accentuation on water security, use of hotness revoking materials in development, and restricting the utilization of substantial surfaces.
- The term "climate-proofing" is implied as an interaction that aims to identify risks that an investment project or development plan or an individual and their assets

might face due to climate change peril, and to decrease those risks to levels considered to be acceptable has been defined.

- Community Based Disaster Management (CBDM) is also mentioned in that guidelines.

8. Stakeholders: -

Climate Change has impacted almost all sectors of development making almost everyone a stakeholder. Stakeholders play an important role in taking forward environmental concerns. The five 'P's of sustainability – Planet, People, Participation, Peace, and Prosperity indicate the important role of people in taking forward the actions. Governmental bodies, Civil Society, Companies, and private sector, and finally the individuals with their collective efforts and action give shape to the various policies and strategies and finally translate them into actions.

8.1 Governmental bodies - With lawfully restricting power and the solidarity to implement decisions, have contributed towards making a forward Climate action. Rajasthan Climate Change Agenda has been arranged to take forward the arrangements of the NAPCC and to set up a nitty gritty action plan for adaptation and mitigation at the State level. Need has been given to those exercises in Rajasthan that meet a consolidated arrangement of different climate - proofing standards, which can be checked through quantifiable pointers for ecologically, economically and social sustainability. A portion of the NAPCC are as follows: - (I) Reduction or potentially sequestration of ozone harming substances, (ii) biodiversity preservation and biological system (ecosystem) functioning, and so forth.

8.2 Civil society - Civil Society establishes NGOs, private residents, casual groups, who put together discussions, gather criticism from the local level, inform the public authority by making their voices got and by influencing the public point of view on the side of themselves. These stakeholders have ordinarily reoriented governments' priorities, funds, and agendas through a huge number of actions and channels. From international NGOs such as WWF, ICRIER etc., which works at the National Level, SEWA Mandir, Tarun Bharat

Sangh their works cover almost all parts of Rajasthan to local level NGOs numerous organizations are working towards addressing the climate change concerns, through inputs into policies, practical and inclusive implementable models. (Surana, 2016)

8.3 Companies and the private sector - Companies and the private sector have been the vehicles of making monetary worth in the public arena especially society. Supply chains that impact individuals to pick one set of items over one more to start from these stakeholders, and the biggest organizations can change whole enterprises in a single decision. Hence, they are similarly the ones to bear a bigger piece of climate change and contamination obligation. Coca Cola as a Corporate Social Responsibility endeavor has contributed to water management in the Desert Areas of Rajasthan.

8.4 Individuals – Individuals hold the obligation as consumers of goods and services and as an actor whose actions have an impact on Climate Change. Everybody is likewise a citizen, an expert, an associate, an individual from this multitude of previous bodies and fields. In the long run, every social construction - from family to organization to government - are comprised of people, where made by people, and simply exist on the grounds that a people have trust in climate change as an issue and the need to follow up on it whether as an individual from a NGO, part of a Private Company or the Government Department. (Surana, 2016)

9. Architectural Heritage in Rajasthan: -

Rajasthan (India) is famous worldwide for its architectural heritage and highly evolved urbanism, created in harsh climatic and territorial conditions. Most of the urban settlements that developed here, (from the 12th to the 19th century) are undisputedly regarded as ecologically sensitive and climatically responsive examples of urban planning and design. The population here is traditionally accustomed to water scarcity, deep, and difficult to draw, ground resources, and a highly erratic and sparse rainfall regime. (Gupta, 2011)

The towns here owed their sustainability largely due to the strength of a culture that ensured that the people and governance systems gave due importance and priority towards the development, maintenance, and management of water structures created

alongside, and in harmony with the towns themselves. The respect for water was ingrained in the individual and collective psyche of the local population. (Gupta, 2011) Water harvesting, collection, storage, conservation, and its frugal and careful use began at the individual or household level and social as also religious norms and traditions exercised strict control on its judicious use as a common resource at the larger settlement level-be it urban or rural. Urban settlements here developed complex and sophisticated systems to deal with issues of scarce water. This traditional wisdom is the resource that an individual or group of individuals possess which needs to be taken forward to address climate concerns today.

10. Conclusion: -

In view of the above reports, Rajasthan has the most extreme exposure and least adaptable ability to climate change challenges. The state is probably going to experience further water shortage because of the overall reducing trend in rainfall. The climate over Western Rajasthan is showing clear signs of change, with an abatement in precipitation and an expansion in temperature and aridity. The arid climate belt has moved toward the east, strengthening the course of land debasement, and causing desertification. Rajasthan government has been taking various steps to mitigate the effect of Climate Change, for example, the Formulation of a CCAR, RAPCC and so on. Even, there are various Planning documents such as Master Plans provisions, URDPFI guidelines, RADPFI guidelines, etc., that directly or indirectly address the climate concerns. However, there are gaps in the Planning documents which may result in the inadequate implementation of the provisions. It is essential to include various stakeholders, for instance, Government bodies, Civil societies, Companies, Private sectors and Individuals, to advance area explicit approaches to address the impacts of climate change which can help in making forward the mitigation and adaptation moves in Arid Rajasthan.

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