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Social And Environmental Impacts Of Rehabilitation In Dam-Displaced Communities Of Anjunem Dam Goa

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Abstract:

Dam construction often results in the large-scale displacement of people from villages, forcing communities to relocate to newly developed resettlement areas. Rehabilitation refers to the process of restoring disturbed environments, displaced communities, and modified landscapes to a stable, sustainable, and functional condition. In India, rehabilitation broadly involves supporting individuals and communities in regaining their social, economic, environmental and psychological well-being after displacement caused by development projects, disasters, or other socio-economic challenges. Goa has experienced several rehabilitation-related issues arising from mining closures, dam-induced displacement, substance abuse problems, and environmental degradation. The construction of the Anjunem Dam is an example of development-induced displacement in the state. Morlem Colony is a rehabilitated settlement developed to resettle families displaced due to the construction of this Dam. Villages such as Gulem, Anjunem, Pansule, and Kelwade were submerged during reservoir construction, leading to the relocation of their inhabitants. This rehabilitation process marks a transition from traditional village settings to planned resettlement of colonies, where displaced communities have attempted to rebuild their housing, livelihoods, and social relationships. The primary goal of this study is to examine the social and environmental impacts of rehabilitation on people displaced by the Anjunem Dam. The study uses both primary and secondary data sources, collected through questionnaires, field observations and GIS-based methods. The findings suggest that rehabilitated villages now experience higher temperatures compared to their earlier settlements, mainly due to the loss of surrounding forest cover. In addition, social issues such as poor transport connectivity and declining water quality continue to adversely affect the daily life and overall well-being of the resettled population.

Keywords: Rehabilitation, displacement, social and environmental impacts, Forest loss, GIS.

Introduction:

Water is a vital natural resource essential for life, but rapid population growth, urbanization, and agricultural expansion have increased pressure on limited water availability, resulting in widespread water scarcity (World Bank, 2016). To address this challenge, India's National Water Policy emphasizes the development of multipurpose water resource projects, including dams, to ensure adequate water supply for drinking, irrigation, and other uses, provided such projects minimize adverse social and environmental impacts (Government of India, 2012). Historically, dams were constructed using natural materials, while modern dams are primarily built with concrete and advanced engineering techniques to create reservoirs that support irrigation, industrial use, domestic consumption, flood control, and recreation (World Commission on Dams, 2000). However,

dam construction has frequently led to the displacement of local populations, particularly rural and tribal communities. Although rehabilitation and resettlement policies aim to restore livelihoods through land allocation, monetary compensation, and infrastructure development, inadequate planning, poor resettlement conditions, and limited community participation often result in livelihood disruption, social stress, and long-term socio-economic hardship among displaced populations (Cernea, 1997; Fernandes, 2008).

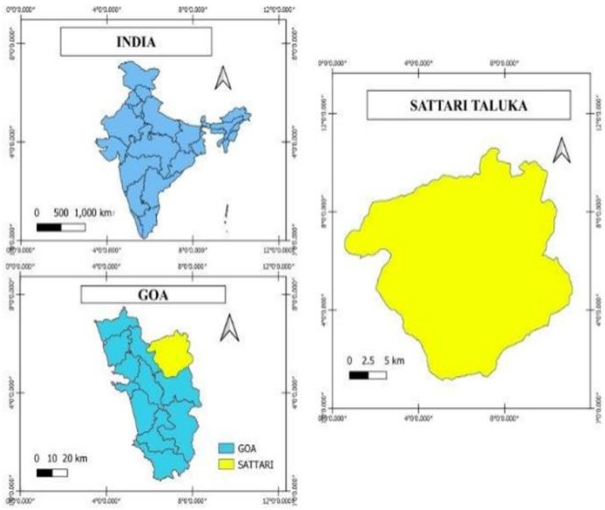
Objectives:

The aim of this study is to examine the social and environmental impacts of rehabilitation on communities displaced by the construction of the Anjunem Dam in Sattari Taluka of Goa.It further aims to assess how resettlement has influenced environmental conditions, livelihood patterns, and overall well-being in rehabilitated villages such as Morlem Colony, with the help of primary data, field observations, and GIS-based analysis.

Study Area:

Sattari is part of the interior of rural Goa. Sattari is a taluka of North Goa district in the state of Goa, India. There are 77 villages and 2 towns in Sattari Taluka. The headquarters of Sattari taluka is Valpoi municipal council. It lies in the north-eastern region of Goa where it is known for its greenery and dense forest. Part of the Western Ghats forms the eastern part of the Sattari Taluka. The Mandovi River (popularly known as Mhadei in Sattari taluka) is the lifeline of Sattari. The Anjunem Dam in North Goa submerges the villages of Gulem, Pansule, Kelawade, and Anjunem (the latter two sharing a name with the dam itself), displacing their residents and submerging cultural heritage sites like temples and megalithic structures. The ruins, particularly those of Gulem village, become visible during the summer months when water levels recede, offering a glimpse into the past, though access to these areas is now restricted for safety and environmental reasons.

Fig. 1 Locational aspects of Study Area



Source: Prepared by the Authors based on Survey of India Toposheet using QGIS software

The Anjunem Dam in North Goa submerged the villages of Gulem, Pansule, Kelawade, and Anjunem (the latter two sharing a name with the dam itself), displacing their residents and submerging cultural heritage sites like temples and megalithic structures. The ruins, particularly those of Gulem village, become visible during the summer months when water levels recede, offering a glimpse into the past, though access to these areas is now restricted for safety and environmental reasons.

The Submerged Villages:

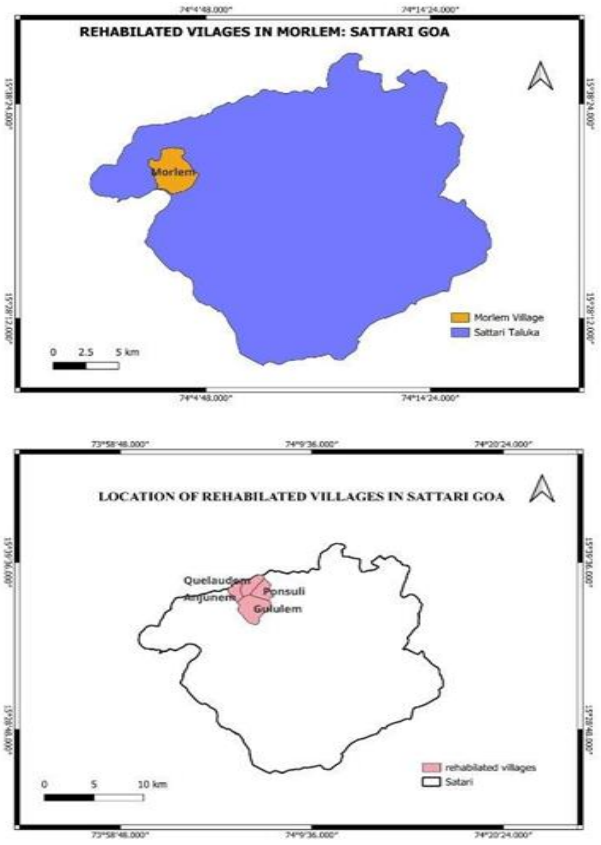
- Gulem: The most mentioned and explored of the submerged villages.
- Pansule: Another village whose cultural heritage is lost to the waters.
- Kelawade: One of the four villages that went under the Anjunem Dam.

- Anjunem: The fourth village, also sharing a name with the dam project, was submerged as well.

Location Of Resettled Villages:

Morlem is a village in Satari Taluk in North Goa District of Goa State, India. It is located 31 KM towards East from District headquarters Panaji. 4 KM from Satari. 31 KM from State capital Panaji

The resettled Morlem colony is the rehabilitation site for people who lost their homes when the Anjunem Dam was built. Villagers from Anjunem, Ponsuli, Gullem, and Kelavade were among those who were rehabilitated in this area. The Anjunem Dam, also in the Sattari taluka, was constructed to create a reservoir by submerging several surrounding villages. During the summer, when the water level recedes, the ruins of these submerged villages, including their temples, can emerge.



Source: Prepared by the Authors based on Survey of India Toposheet using QGIS software

Data Source and Methodology:

The study adopts an integrated methodology using both primary and secondary data to assess social and environmental impacts of rehabilitation in Morlem Colony and Ravana colony. Primary data of 120 sampling were collected through field observations, household questionnaires, and interviews to document housing, infrastructure, land use, livelihoods, and socio-economic changes before and after rehabilitation. Secondary data included satellite imagery, government records, census data, and relevant literature. Stratified sampling, data triangulation, and GIS analysis ensured reliability, while ethical principles such as informed consent and anonymity were strictly maintained.

Review Of Literature:

Youliang Huang (2018) examines the social and economic impacts of dam-induced displacement in China through a comparative analysis of resettlement strategies across regions. The study shows that compensation type strongly influences livelihood outcomes, with land-for-land resettlement providing greater stability than lump-sum monetary compensation. Using mixed methods, including household surveys and stakeholder interviews, the research finds improvements in material conditions such as housing, but also identifies significant losses in social cohesion, cultural continuity, and informal support networks. Transitional income instability and gendered impacts, particularly reduced livelihood opportunities for women, are also highlighted. The study critiques uniform resettlement policies and emphasizes the need for participatory planning, phased livelihood support, and long-term monitoring. It concludes that sustainable resettlement requires context-specific, inclusive strategies, while noting research gaps related to mental health and intergenerational effects

The study by Ranasinghe (2012) examines the predicted environmental and social impacts of a proposed drinking water reservoir at Peraru, Vavuniya, using environmental impact assessment methods along with community consultations. The study identifies major environmental concerns such as habitat loss, altered water flow, and increased sedimentation, while social impacts include loss of agricultural land, livelihood disruption, and potential health risks related to stagnant water bodies. To address these issues, the author suggests mitigation measures including buffer-zone development, reforestation, improved water-treatment systems, and compensation and livelihood restoration for affected communities. The study emphasizes the role of public participation in designing mitigation strategies to ensure acceptance and sustainability. It also highlights uncertainties related to climate variability and data limitations, recommending adaptive management, strong institutional enforcement, and continuous environmental and social monitoring. Overall, the study concludes that while mitigation measures can reduce negative impacts, environmental and social trade-offs in reservoir projects cannot be completely avoided.

Marta Pereira da Luz (2023) proposes a progressive Land Use/Land Cover (LULC) mapping approach to analyze environmental changes around the Batalha hydroelectric reservoir in Brazil. Using remote sensing, GIS techniques, and ground validation, the study maps landscape transitions at increasing levels of spatial detail to capture changes associated with reservoir construction, road development, and agricultural expansion. The results reveal growing pressure on surrounding ecosystems, altered erosion patterns, and increased sediment inflow into the reservoir. High-resolution mapping helps identify vulnerable riparian zones requiring restoration and supports the prioritization of conservation areas. The study highlights the importance of seasonal imagery and accuracy assessment for reliable classification, while noting limitations such as cloud cover and infrequent data updates. The author recommends integrating socio-economic data and conducting regular LULC monitoring to support sustainable reservoir management.

Kushgra Sharma's (2023) study on dam-induced displacement in Odisha critically examines the socio-economic impacts of resettlement within existing policy frameworks. The study reveals that displacement extends beyond the physical loss of land to include disruption of livelihoods, weakening of social networks, and erosion of cultural identity, often leading to long-term impoverishment due to inadequate compensation. It highlights that land-for-land compensation is more effective than cash-based compensation in ensuring livelihood continuity, while housing provision alone does not guarantee improved well-being without access to sustainable livelihoods. The research also identifies significant gendered impacts, particularly the increased burden on women and their limited participation in post-resettlement decision-making, and underscores the psychological stress associated with forced relocation. Critiquing top-down planning approaches, the study emphasizes the need for participatory resettlement processes and demonstrates that outcomes are strongly influenced by institutional capacity and implementation transparency. It recommends longitudinal monitoring, early integration of livelihood restoration in project planning, clearer entitlement frameworks, timely compensation, and effective grievance redress mechanisms, conceptualizing resettlement as a complex, long-term socio-economic process rather than a one-time administrative intervention.

The study "Q.G. Wang (2021): Study Environmental impact post-assessment of dam and reservoir projects: A review This review synthesizes evidence from post-construction environmental assessments of dam and reservoir projects, identifying recurring impacts such as biodiversity loss, water quality degradation, and sedimentation. It highlights the gap between predicted impacts in EIAs and actual long-term outcomes, emphasizing that many projects lack systematic post-assessment despite environmental commitments. The review notes that ecological restoration and mitigation measures often remain only partially implemented, while social impacts like livelihood disruption, health changes, and cultural loss are underreported in long-term evaluations. The authors advocate standardized monitoring indicators, improved transparency, and independent audits to ensure accountability. Emerging tools such as remote sensing and community-based monitoring are highlighted as promising solutions. Limitations include inconsistent data availability across projects, while recommendations emphasize the need for legally mandated, well-funded monitoring programs. Overall, the review argues for strong post-assessment frameworks as key to understanding cumulative impacts and improving future dam-management practices.

Findings:

A household survey of 120 families across four villages revealed multiple social and environmental challenges faced after displacement and rehabilitation. The survey report indicates major impacts this are listed below.

Land Availability: The survey shows that displaced households were allotted about 400 sq. m of residential land and approximately 10,000 sq. m of agricultural land for cultivation.

Heat and forest area resources: Relocation to rehabilitated villages led to increased heat exposure, causing health-related issues. The absence of nearby forest resources forced households to shift from firewood to gas for cooking.

Transportation: Due to the remote location of the rehabilitated villages, residents face difficulties in accessing public transportation for daily travel.

Road Construction: As part of development initiatives, the government has undertaken road construction and improvement projects to enhance connectivity and transportation facilities.

Healthcare Facilities: For advanced medical check-ups, villagers must travel nearly 2 km to Sakhakim town, as Morlem villages have only small health sub-centers.

Government Jobs for Youth: During rehabilitation, many male family members were provided government employment and continue to work in this sector. However, the survey indicates rising unemployment among the younger generation.

Quality of Housing: Initially, the government provided small pucca houses with two rooms and a kitchen. With improved income levels, many households have since constructed larger and better-quality houses.

Cultural and Traditional Practices: Traditional customs continue to be practiced, with festivals like *Shigmo* celebrated in March. Religious idols were relocated during displacement and reinstalled in newly established places of worship in the rehabilitated settlements.

Discussion:

The findings indicate that rehabilitation in Morlem and Ravana colony villages has produced mixed outcomes, combining initial livelihood support with persistent socio-environmental challenges. While the allocation of land,

provision of government jobs, road development, and gradual improvement in housing quality have contributed to economic stability, issues such as increased heat stress, loss of forest resources, limited transportation, distant healthcare facilities, and rising youth unemployment continue to affect daily life. Despite these challenges, the continuation of cultural and Traditional practices reflect strong community resilience, highlighting the need for long-term, inclusive rehabilitation strategies that integrate livelihood diversification, social infrastructure, and environmental considerations.

Conclusion:

The study concludes that the rehabilitation of villages displaced by the Anjunem Dam to Morlem Colony has resulted in significant socio-environmental transformations. While the resettlement process ensured basic provisions such as housing, land allocation, road connectivity, and initial employment opportunities, it also led to notable environmental and social challenges. Changes in local climate conditions, loss of access to forest resources, limited healthcare and transportation facilities, and emerging youth unemployment have affected the overall quality of life of the rehabilitated communities.

Despite these constraints, the communities have demonstrated resilience through improvements in housing conditions, adaptation to new livelihood practices, and the continued observance of cultural and traditional customs. The findings suggest that rehabilitation has achieved partial success by securing physical resettlement, but long-term sustainability depends on strengthening social infrastructure, creating diversified livelihood opportunities, addressing environmental stressors, and adopting participatory, community-focused planning approaches to enhance well-being in Morlem Colony.

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