AN APPROACH FOR BUILDING RESILIENCE OF RURAL SETTLEMENTS IN MELGHAT REGION, MAHARASHTRA, INDIA

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ABSTRACT

Rural areas today are confronted with a spectrum of changes, particularly in developing countries, which have multiple characters and vary from changes in geographic location. The settlements in and around the protected areas are exposed to additional issues as man-animal conflicts, lack of tenure, poor accessibility, policy gaps, etc. The settlements at remote locations are further poorly accessible during the case of disasters and this leaves the residing population on themselves. The adaptive capacities of the settlements play a key role in curbing the threatening impacts of the frequent disasters. This study aims to understand the concept of resilience in context of remote rural settlements in India. It explores various conceptual models and indicators used around the world, for determining disaster resilience in rural areas and the methods of evaluating them. A location-specific indicator set and a common rating scale to identify the core vulnerabilities, in and around forest areas of Melghat region, Maharashtra is prepared so as to relate the indicator scores to the prioritisation of settlements for relocation. The recommendations are based on the identified inter-linkages between the development sectors.

Keywords: Indicators, Melghat, Forest Areas, Risk Resilience, Rural Vulnerabilities

Introduction

India's rural areas are diverse in terms of demography, geography, economy and social structure. The diversity ranges from areas that are remote and suffer from depopulation and decline, to peri-urban areas which are under increasing pressure from urban centres. The conflicts in policy making for rural areas in India are never going to be resolved taking into consideration the poor categorisation of villages in India. The different and varied needs of villages in different geo-climatic zones, varying urban influence, different population size, etc., have not been considered for policy making. This is the reason that even though the government authorities are increasingly concerned about the rural areas, various schemes have been launched for uplifting rural population, but still most of the rural

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population is deprived of even the basic necessities as electricity, water supply, etc. The common policy approach for entire rural India results in inequitable distribution of resources. This necessitates the idea of preparing area-specific policies so as to cater to the needs of target population in a genuine and conventional way. The concept of resilience that remains an unexplored and neglected aspect of rural development strategies, needs to be considered and reviewed, as it fosters an idea of building the adaptive capacities of rural systems by analysing the capabilities of the systems and responding to situations independently.

In India, the poor categorisation of rural areas is the ultimate and major setback for inappropriate development strategies for settlements at different geo-climatic zones, exposed to extreme conditions. The settlements in forest areas, deserts, hilly areas, etc., are all exposed to varying issues and need to be addressed accordingly. The development strategies for forest areas like Melghat have to be area-specific, and different from those of deserts and hilly areas.

This study focuses on settlements in Melghat forest areas having low urban influence and with population size of less than one thousand, as majority of Indian rural settlements i.e. 57 per cent of rural settlements have population less than thousand (Shukla 2015). The main objective of the study is to identify the key areas of intervention, which hamper and limit the development of other sectors. The study promotes an ideology to identify such sectors and prioritise

development strategies wherein even the small change would lead to improvement in other development sectors simultaneously. To identify the inter-linkages between the development sectors in the region, the study comes up with a location-specific indicator set and a common rating scale to rate all the indicators from a resilience perspective. The comprising indicators are specific to the context of Melghat and are carefully selected based on the discussion with the native population and government officials, though the conceptual models explored to study the indicators are not location-specific. The study identifies the importance of all the indicator sets explored and then based on the regional applicability of indicators, the final indicator set is prepared. The dimensions of resilience are considered independently for measurement purpose and the resilience scores do not represent any kind of linkage between these dimensions or the indicators in the measuring stage.

Understanding Rural Livelihoods

For selecting the area-specific indicators for measuring resilience in rural areas, the first and most important task is to understand the livelihoods of the target population, so as to get well versed with the regional scenario. It is very important to take into consideration the traditions, cultures and beliefs of the local population so as the development strategies to be prepared are befitting and in accordance with the regional priorities.

Various agencies have conceptualised and used various frameworks to understand livelihoods and intervene. Of these, the livelihood

frameworks adopted by the Department for International Development (DFID), Cooperative for Assistance and Relief Everywhere(CARE) and International Fund for Agricultural Development (IFAD) are widely recognised. All these frameworks adopt the same basic approach and only differ in the manner in which the livelihood objectives are listed and the way in which the contextual factors are presented.

Livelihood outcomes are the achievements or outputs of livelihood strategies. The livelihood outcomes are: more income, increased well-being, reduced vulnerability, improved food security and more sustainable use of natural resources (GLOPP 2008). The multiple components of the vulnerability context affect people in different ways. Thus, natural shocks may adversely impact agricultural activities but not urban employment. Understanding the nature of vulnerability is a key step in sustainable livelihood analysis. Interventions can focus on any of these elements-livelihoods assets, vulnerability context, structures and processes and livelihood strategies.

Livelihoods have four characteristics. Appropriate changes in these four characteristics (referred to as four arrows) constitute livelihood improvement. The households use six capitals towards achieving the four arrows as natural, physical, social, financial, human and spiritual capital. The households, the four arrows and the six capitals exist in a situation that can be analysed as four contexts (Muralidhar, G. 2012).

Given the inter-relationships that exist among the different parameters, improvement in livelihoods can occur. These relationships (Figure 1) provide the required leads to identify the interventions required. These frameworks make it easier to understand and analyse all the influencing factor elements at a time by bringing them together to get the broader picture. The study parameters are selected based on a proper understanding of rural livelihoods and all the capitals are considered for analysing resilience of settlement.

Figure 1: Livelihood Framework (Modified from Muralidhar, G. 2012)
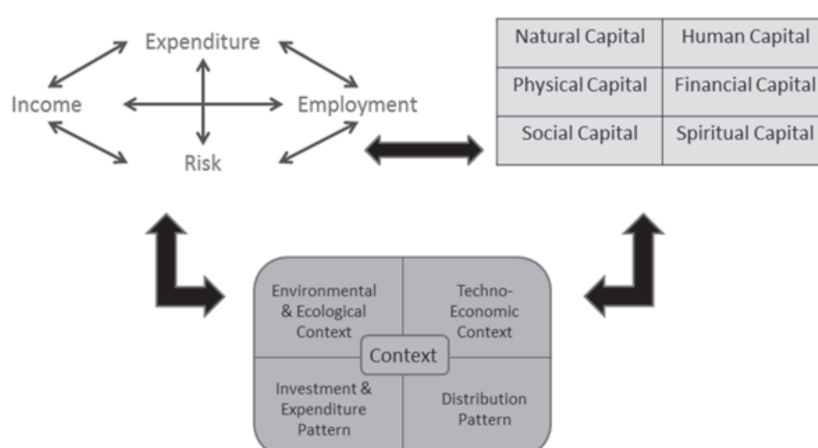
Evolving Indicators

Resilience can be assessed by quantitative (mathematical) as well as qualitative (Mapping, Graphs) approaches. Table 1 explains about various conceptual models used around the world to determine resilience. The comparison highlights the approaches considered in different case studies, based on graphs, software and mathematical models to determine resilience.

The study focus is on identifying the rural vulnerabilities and that necessitates the use of method of indicator scoring (quantitative approach). From the case study comparison, it has been observed that the indicators vary corresponding to the regional characteristics and also the method of scoring of indicators are different. Thus, it is evident that the indicators and the scoring methodology play a key role in validating the relevance of study and need to be properly defined based on the study area.

The only study based in India is that of Sunderbans, based on the coastal context and five dimensions namely, Socio-Economic, Physical, Natural, Coastal-Zone Management and Institutional. The research methodology used is that of Climate Disaster Resilience Index 'CDRI index' wherein scores for all the five dimensions are determined by five indicators each. This approach is found suitable for the study of Melghat provided the dimensions be changed into the context of forest areas. So the first task identified was to identify the dimensions of resilience. Referring to the wide literature available through the internet, the studies showed that there are at least five defined and measurable domains for community disaster residence including Social, Economic, Institutional, Physical, and Natural (Ostadtaghizadeh et al. 2015). Hence, these five dimensions were considered as the base for the indicator set. Regarding inter-dependency between and among the dimensions and indicators of community disaster residence, there is a need to use appropriate and effective means to quantify and weigh them based on their relative contributions to resilience (and to assess show weightings change spatially and over time).

Although, the assessment of disaster resilience in national and regional level would be useful, local arid community disaster resilience measurement is more appropriate for disaster risk reduction and management. So, the indicator set to be prepared for the study area is aimed to be place-specific and with major focus on disaster resilience of a place. It considers place- specific hazards rather than restricting only to climate related hazards.

Table 1: Comparing Different Approaches to Resilience (Compiled by Author)

	R4 FRAMEWORK (Tierney and Bruneau 2007)	VULNERABILITY RESILIENCE INDEX (ILLA 2015)	MPAT (Barua, Katyaini, and Mili 2012)	CARRI (Cutter et al. 2008)	VULNERABILITY ASSESSMENT MODEL (Liu et al. 2013)	COASTAL RESILIENCE (Das Gupta and Shaw 2015)
Case Study	MCEER	Niger	Sikkim	University of South Carolina	Middle Inner Mongolia of China	Indian Sunderbans
Classification	Robustness Redundancy Rapidity Resourcefulness	Exposure Sensitivity Adaptive Capacity	10 Components & 30 Sub-Components	Social Vulnerability Built Environment and infrastructure Natural Systems and Exposure Hazard Mitigation	Exposure Sensitivity Adaptive Capacity	Socio-Economic Physical Institutional Coastal Zone Management Environmental & Natural Resilience
Methodology	Resilience= Function (Damage, Human Activities, Time)	Vulnerability = Adaptive Capacity (Exposure + Sensitivity)	Analytical Hierarchy Process	Community Resilience = Social Vulnerability+ Built Environment+	Vulnerability = Exposure + Sensitivity- Adaptive Capacity	Composite Resilience Score
Attributes	Resilience Triangle	Principal Component Analysis	Comparative Analysis	Exposure Hazard Mitigation Mapping Vulnerabilities through GIS	Principal Component Analysis & SPI	Resilience Scores
Approach	Qualitative	Quantitative	Quantitative	Qualitative	Quantitative	Quantitative

Study Area

Melghat region lies in northern part of Amravati district of Maharashtra State in India (Wikipedia 1994) and comprises Dharni and Chikaldhara blocks (Figure 2). The study area Melghat is a complex region owing to the presence of Melghat Tiger Project that comprises five different protected areas and 349 settlements (India G. 2011), scattered across the region at contrasting geographic locations. Melghat has been in 'Limelight' for past 20 years on account of malnutrition deaths of children and is one of the most remote areas in Amravati district. An estimated 5,000 tribal children died of malnutrition in Melghat during the year 1992-97. Only in 1997 nearly 1,500 children died in Melghat due to malnutrition and lack of proper healthcare (Datta 2013).

Figure 2: Location Map of Amravati District and Melghat Region

Melghat is recognised as a tribal area and the locals have eternally been dependent on the forest resources, but after the advent of Melghat Tiger Project in the year 1973-74, the Government has acquired the forest area and that has affected the local livelihoods to high extent. The local people are not able to fulfil their basic needs derived from forest produce which they have been dependent on for generations. Due to the remote location, the local population is deprived of even the basic facilities and have poor access to schools, hospitals, electricity, telephone network, internet, etc. Additionally, there are frequent floods in the region due to the presence of hilly areas which seasonally isolates many villages (Jawale 2015).

"The pied pipers of death in Melghat are Government policies and failures, specifically discrimination against indigenous projects, bondage of adult members of the tribe to their creditor employers, the lowest daily minimum wage approved by the Government of Maharashtra and land grabbing by usurious creditors" (Datta 2013).

Unemployment, poverty, migration, health problem, poor living condition, scarcity of water, soil erosion, difficult terrain, development conflict

with forest, village resettlement and the loss of traditional wisdom are the major issues in this region. It is observed that all the issues are interlinked and the cause lies in unemployment and the cycle of migration(Mahakalkar 2005).A study conducted by the Tirpude Institution of Social Action and Research claims that around 25000 families Korku tribe have perished in the tribal region of Melghat as a result of malnutrition death during last 20 years. If malnutrition continues to rock the region at the same rate, the Korku tribe might become extinct after some years (Jawale 2015). The overall growth of the communities residing in Melghat seems to have been paused and allegedly the government schemes and policies are the only hope for revamping the lifestyle of the tribal people belonging to Melghat region (Gudadhe 2013).

Survey Procedure

Indicator Selection : The indicator selection is based on both the sectorial approach as well as the territorial approach. Agriculture and forestry being predominant in the region are taken as separate indicators in environment dimension (sectorial approach).The population size of around 1000 is considered for selection of settlements for the study.Also the factors such as remoteness, resources, etc., are considered to select the case study settlements having varying characteristics (territorial approach).

The initial phase of identification of appropriate indicators involves extensive background literature survey dealing with resilience, rural areas, forest areas, tribal settlements and natural disasters in order to capture the elements of community resilience in the Melghat region.The final list of major dimensions, indicators and variables were developed after an iterative discussion with the local stakeholders as local government officials and community groups. The framework considered five standard dimensions of disaster resilience i.e., Social, Economic, Physical, Institutional, Environmental and under each dimension, five major indicators and twenty five variables were framed.

Table 2: Final Indicator Set

DIMENSIONS

SOCIAL	ECONOMIC	ENVIRONMENT	PHYSICAL	INSTITUTIONAL
DEMOGRAPHY	EMPLOYMENT	DISASTER IMPACT	TRANSPORTATION	COORDINATION
HEALTHCARE & EDUCATION	OPPORTUNITIES	FOREST MANAGEMENT AGRICULTURE	ELECTRICITY TELE- COMMUNICATION	GOVERNANCE EMERGENCY
SPIRITUAL & HUMAN CAPITAL	INVESTMENT & SUBSIDY INCOME & SAVINGS	NATURAL RESOURCES	WATER & SANITATION	RESPONSE PLANNING
SOCIAL COHESION	TOURISM			RESPONSE & RECOVERY
KNOWLEDGE SHARING		TOPOGRAPHY & CLIMATE	HOUSING	DISASTER MANAGEMENT

The five dimensions of resilience and five indicators considered under each dimension are shown in Table 2. The indicators of Social Cohesion, Knowledge sharing and Spiritual capital which play a key role in the sustenance of rural communities have been included in the Social dimension based on the established understanding of rural livelihoods and social structures in Melghat region. The indicators as Agriculture, Forest Management, Tourism, etc., have been added based on the regional profile and the forest areas. The study adopted a 5 * 5 * 5 harmonised approach (5 Dimensions * 5 Indicators * 5 Variables) based on the composite resilience index developed by Das Gupta and Shaw (2015). It takes into account a total of 25 indicators under 5 dimensions (as shown in Table 2) and the resilience score for each indicator is determined through their respective five variables and as explained in section 5.2. The total number of variables for all the 25 indicators sum up to 125.

Common Rating Scale : The estimation of resilience scores for all the 125 variables is done based on a questionnaire prepared from resilience perspective. The speculated responses to each of the questions were scaled between 1 to 5 (as shown in Table 3) with score of 1 indicating undesired condition and 5 being the most ideal situation. The respondents to the questionnaire survey belonged to various age groups, caste, occupation, etc. To consolidate the observations through questionnaire survey, focused group discussions were held with the local communities and the responses were recorded for absolute score of each variable in present day scenario. This approach patently provides valid responses as the scores holistically represent the mutual perception of all community members.

Table 3: Rating Scale for Variable Migration Impact

SOCIAL DIMENSION ===> DEMOGRAPHY ===>MIGRATION IMPACT					
Does migration of people to other regions \create a negative impact on the remaining population?					
Very Poor	Poor	Satisfactory	Good	Very Good	Actual Value & Comments
1 High migration has a negative impact on remaining people provoking them to migrate too	2 Seasonal migration to cities in search of jobs. Others are satisfied with the jobs within the village	3 People having enough assets do migrate. The remaining population stay in the village	4 Very less people migrate but that doesn't impact others	5 No migration No impact	

The quantitative method used to analyse the scores for indicators is average sum method as used in 'the Vulnerability Index' given by 'The Cyprus Institute' (Deems Holly &Bruggeman Adriana, 2010) wherein the score for each indicator is the average sum of scores for five selected variables'. This approach is selected owing to the rural context wherein it is difficult to determine the weightage of the indicators because of varying priorities.

A sample of the calculation method used is as shown below:

1) The average score of 5 variables determines the resilience score of 1 indicator-

Ex: Demography = (Population Change + Migration Impact + Dependency Ratio + Language Competency + Gender Inclusion) /5

2) The average score of 5 indicators determines the resilience score of 1 dimension-

Ex:Social = (Demography + Healthcare & Education + Spiritual & Human Capital + Social Cohesion + Knowledge Sharing)/5

3) The average score of 5 dimensions determines the overall resilience score-

Ex: Resilience = (Social + Economic + Environmental + Physical + Institutional) /5

Settlement Selection : Nine settlements are selected from different parts of the region having varied characteristics in terms of nature of issues, levels of exposure and degrees of accessibility. The settlements thus selected cover different tahsils and forest zones (core, buffer and outside forest areas). The zone-wise (core area, buffer area, outside forest) location of settlements is as shown in Figure 3 and their general details are as shown in Table 4.

**Figure 3: Location Map for Settlements (Modified from Melghat Tiger Project 2016)**
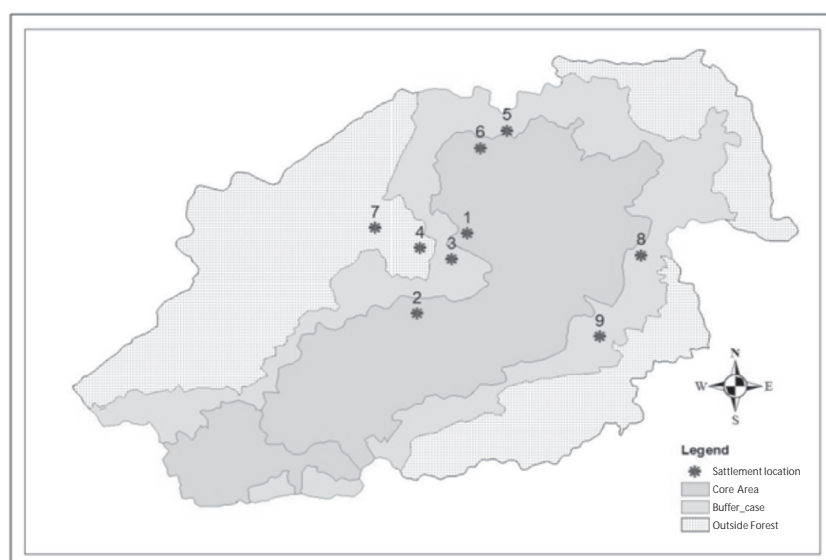
**Table 4: Details of Selected Settlements (India G.2011)**

S.No.	Name of the Village	Name of Tahsil	Zone	Population
1	Rora	Dharni	Buffer Zone	449
2	Adhau	Chikaldhara	Core Zone	592
3	Patkahu	Chikladhara	Core Zone	339
4	Kotha	Dharni	Outside Forest	1064
5	Khokmar	Dharni	Buffer Zone	342
6	Chopan	Dharni	Core Zone	466
7	Lawada	Dharni	Outside Forest	1787
8	Bhawai	Chikaldhara	Buffer Zone	312
9	Aladoh	Chikaldhara	Outside Forest	279

Survey Analysis

The survey analysis highlights the average resilience scores for nine settlements studied. For each and every indicator, the results displayed are an average of the nine settlements studied. The scores for all the variables are determined through primary surveys and then based on the scores of variables, the scores for all indicators and dimensions of resilience are determined. The following Figure 4 illustrates the resilience scores for all the indicators and dimensions obtained from the surveys in the form of spider maps. Some critical observations made based on the scores of all indicators and dimensions are also listed.

Figure 4. Spider Maps Showing Resilience Scores for All Five Dimensions

Figure 4.(a) Social Dimension   **Figure 4.(b). Physical Dimension**
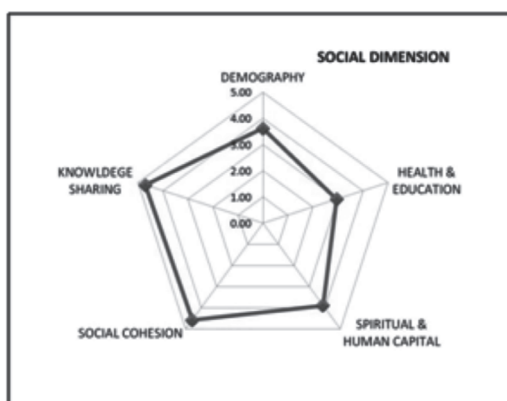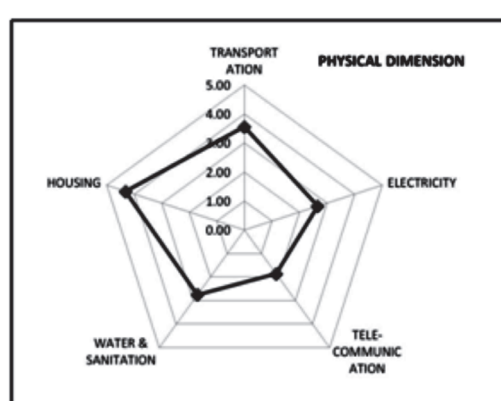
Figure 4.(c). Economic Dimension
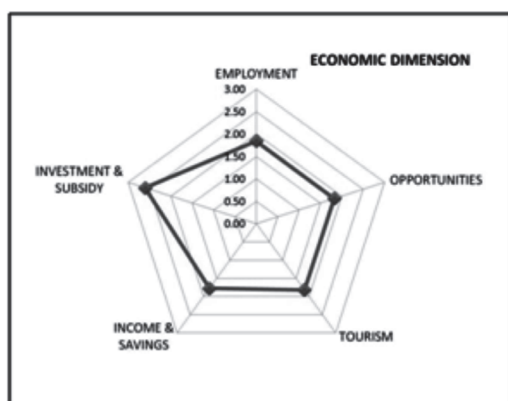
Figure 4.(d). Environment Dimension
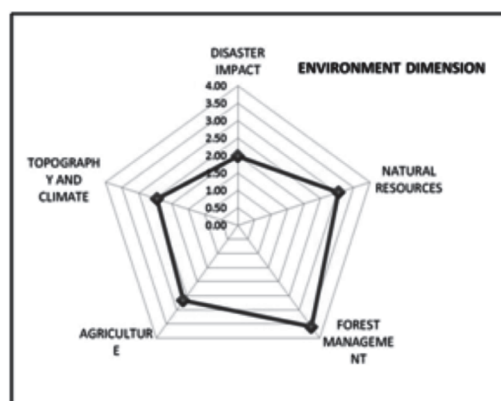
Figure 4.(e). Institutional Dimension
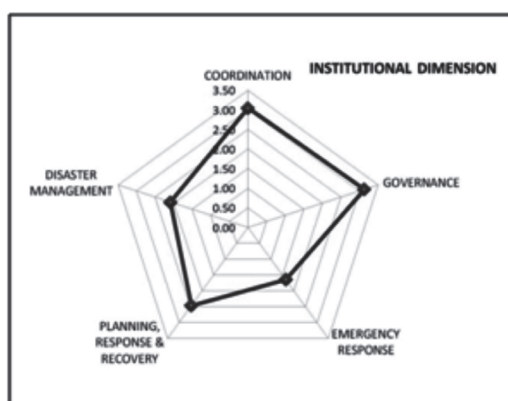
Figure 4.(f). Overall Resilience Scores
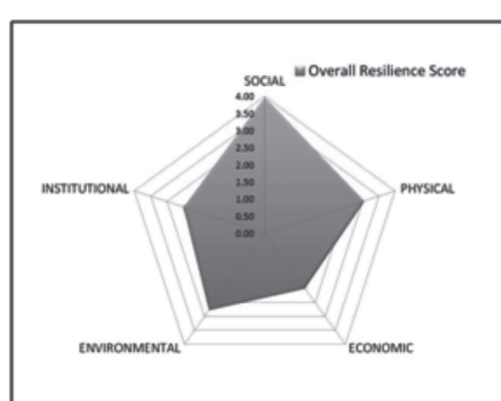
Observations

1. The Social dimension (3.95) is found to have the highest resilience scores amongst all other dimensions (Figure 4.f). The indicators Social Cohesion (4.58), Knowledge Sharing (4.71) and Housing (4.31) are having very high resilience scores (Figure 4.a)which reflects the strong social bonding, traditional wisdom and the indigenous knowledge are the strengths of Melghat region.

2. In Physical dimension (Figure 4.b), Housing (4.31) and Transportation (3.56) are having higher scores. Electricity (2.67), Water and Sanitation (2.76) are having low scores whereas tele-communication (1.87) has the lowest score. These figures depict the setbacks of remoteness and poor infrastructure provision in forest areas.

3. The Economic dimension (1.97) has the lowest resilience score highlighting the

income related issues in forest areas (Figure 4.f). The economic dimension is weak as all the comprising indicators as Employment, Opportunities, Income and savings, Tourism are all having resilience scores less than 2. Investment and Subsidy (2.60) has a comparatively higher score as the government subsidies on food produce and oil, etc., are the only means for survival for the local population. (Figure 4.c)

4. In the Environment dimension (Figure 4.d), Forest Management (3.60) and Natural Resources (3.04) are having higher scores but still are subjected to degradation. Agriculture (2.67) and Topography and Climate (2.44) are all inter- related and have low scores. The impact of disasters in the region is very high which is highlighted through the lowest score (1.98).

5. In Institutional dimension (Figure 4.e), the Coordination amongst stakeholders (3.04) and Governance (3.13) are having satisfactory scores whereas Planning, Response and Recovery (2.47) along with Disaster management (2.09) are limited

and have low scores. Emergency response (1.64) has the lowest score. The presence of forest areas within the region adds to conflicts, due to the varying norms of forest department and other government bodies.

6. Though the social and physical dimensions have score above 3, the overall resilience score for settlements in Melghat region has come to be 2.82 (Figure 4.f) which has below satisfactory level as per the prepared rating scale criteria.

Recommendations

Settlement Relocation: In the zone-wise settlement analysis (Figure 5), it is found that the settlements inside the forest areas are more vulnerable (low scores) to the impacts of shocks and stressors compared to those outside forest areas. The resilience scores for the nine settlements surveyed are as shown in Table 5. Notably, the three settlements selected for the study, which come within forest area are having poor scores. The major reason for the poor scores in these settlements is alleged to be the poor connectivity and restrictions of forest department.

Figure 5: Chart Showing Area-wise Comparison of Settlement Scores
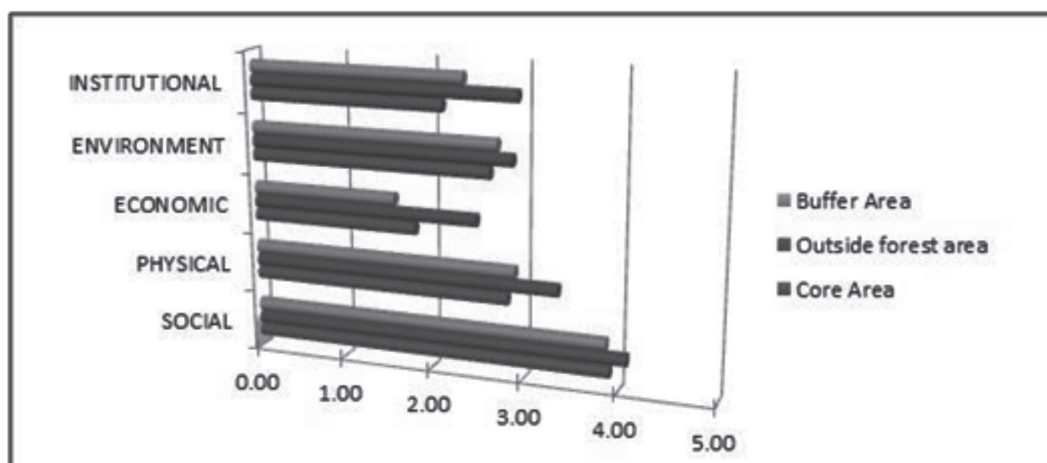
Table 5: Settlement-wise Resilience Scores (Settlements within forest areas are shaded)

S.No.	Name of the Settlement	Zone	Resilience Score	Population
1.	Rora	Buffer Zone	2.99	449
2.	Adhau	Core Zone	2.65	592
3.	Patkahu	Core Zone	2.82	339
4.	Kotha	Outside Forest	2.92	1064
5.	Khokmar	Buffer Zone	2.42	342
6.	Chopan	Core Zone	2.36	466
7.	Lawada	Outside Forest	3.35	1787
8.	Bhawai	Buffer Zone	2.83	312
9.	Aladoh	Outside Forest	3.18	279

Evidently, a total number of 33 villages from the core areas of Melghat forest were identified for relocation in the year 2000, of which only 14 villages have been relocated till date. The relocation process is on voluntary basis and the local populations hold the ultimate decision. The process has been allegedly going slow due to lack of funds and lack of suitable areas around the region for relocation (Melghat Tiger Project 2016). Taking into consideration the slow process of relocation, the study recommends that prioritisation of settlements be done so that the most vulnerable settlements are relocated on priority.

Apparently, the selection of settlements for relocation is done by forest department only based on the population size, and levels of accessibility to infrastructures in these

settlements. The existing criteria do not address other pertinent factors such as socio-cultural aspects as well as prevailing socio-ecological systems that may determine the need and nature of relocation of forest settlements. The parameters considered under present frameworks also do not consider vulnerability perspective. This study, therefore, purportedly pushes for a holistic approach to relocation strategy by considering vulnerabilities as well as adaptive capacities of the local populations that are critical in determining their resilience.

To substantiate the need for a holistic approach, the infrastructure mapping for all three settlements within the core zone (Adhau, Patkahu, & Chopan)has been done considering schools, hospitals, roads, rivers, electricity sub-stations, network coverage as shown in Figure 6. The accessibility to services is checked by a buffer circle of 3 km around all the selected settlements. When comparing the access to existing infrastructure in the said three settlements, with their respective resilience scores (Table 5), it has been observed that the relocation prioritisation comes to be similar. The settlement 'Patkahu'

which is located in proximity to the major road has higher resilience score (2.82), while 'Chopan' which is located at the remotest location is found to have the least score (2.36). Additonally, from the infrastructure mapping, it can be observed that infrastructure accessibility is far higher for the 'Patkahu' settlement (Figure 6.(b)) than the remotely located 'Chopan' settlement (Figure 6.(a)). This comparison validates that the derived scores from the study indicator set provide authentic responses holistically and would be very effective for prioritising settlements with identical population and infrastructure accessibility.

A similar approach, therefore, may be adopted for prioritising the relocation of other remaining notified settlements within forest areas, using the set of resilience indicators and their evaluation proposed through this study. This prioritisation method aspires to be inclusive in nature by considering the key parameters for settlement resilience and by involving local communities through participatory ways to derive socially relevant and viable approach for development from resilience perspective.
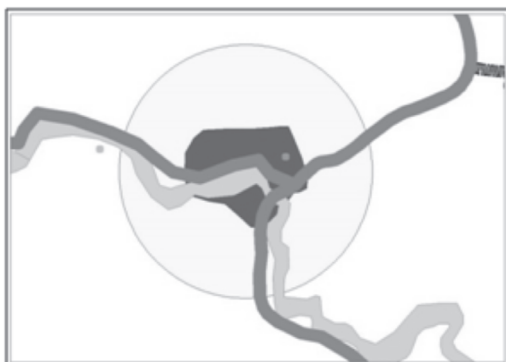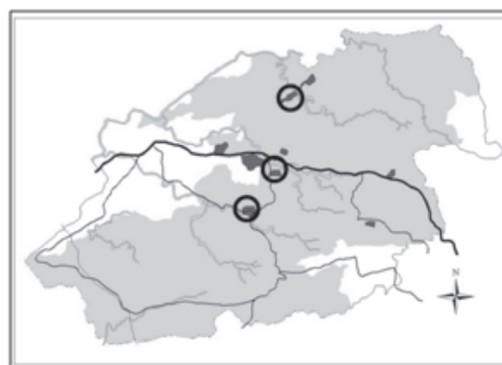
Figure 6: Infrastructure Mapping for Three Settlements (within core areas) Studied

Figure 6.(a). Chopan Village
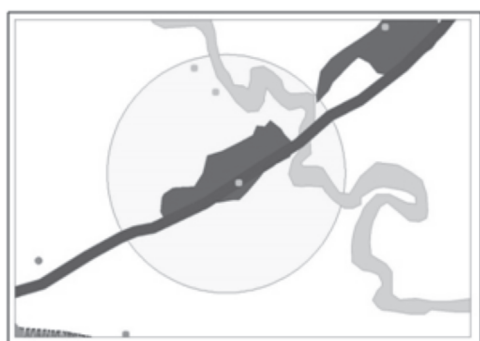
Figure 6.(b). Patkahu Village
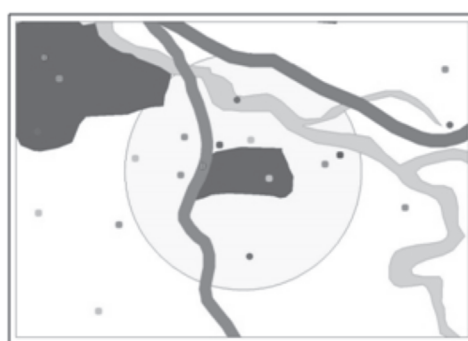
Figure 6.(c). Adhau village   **Figure 6.(d). Location map for settlements**

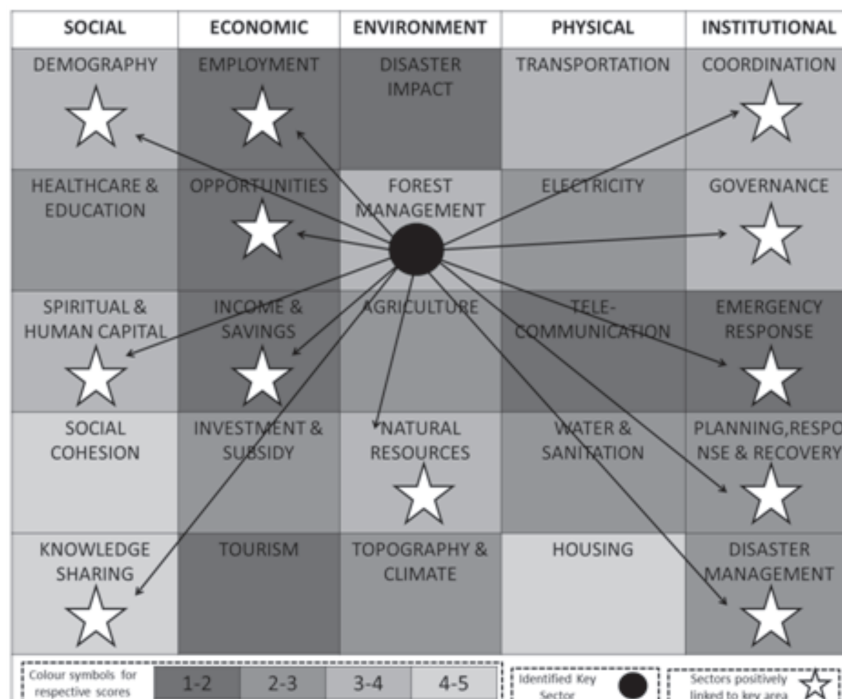**Figure 6 : (e). Legend for Infrastructure Mapping**

Promoting Identified Inter-linkages : The study asserts that the inter-linkages between the development sectors need to be identified to find the key areas of intervention. The resilience scores of all the indicators obtained through the surveys are represented symbolically (Figure 7) to understand the existing scenario. Figure 8 depicts the importance of 'Forest Management' through the identified inter-linkages with various other development sectors and highlights the development sectors that would simultaneously improve with the development of 'Forest Management' aspect. The identified linkages illustrate that strengthening the strong sectors can positively bring improvements in the sectors having low scores.

Figure 7: Figure Showing Symbolic Representation of Scores for All Indicators

Figure 8: Figure Showing the Identified Inter-linkages with 'Forest Management'

The Melghat area is rich in forest resources but still the region has poor economy and one of the main reasons is that, no legal rights are given to dwellers for the collection of Non-Timber Forest Produce and Minor Forest Produce which have high potential and are the main strengths of forest areas (District Planning Office 2014). The study alleges that the aspect 'Forest Management' can make the people capable of earning livelihoods, making them self-dependant as they have been since generations.

Joint Forest Management (JFM) has proved to be a major thrust of forest policy in India. JFM promotes agreements between the State forest department and local communities about protecting degraded forests and establishing plantations. In return for their participation, the local communities are given rights to collect and harvest certain forest products for domestic use or sale. The villagers protect, maintain, and further enrich the forest. They enjoy total ownership of minor forest produce, whereas the major harvest is shared equally between government and the village (R.J. Fisher et. al. 1997).The capability of people to carry and continue with their indigenous knowledge, traditions and practices is in itself a resource. The presence of forest areas around can very efficiently be utilised to generate economy and sustainable livelihoods. Hence this approach is more appropriate for the region as it makes the system resilient from the grassroots level.The best practices of biogas (Ministry of New and Renewable Energy 2012) and bamboo (Mathur 2015) in the region have proved to be highly productive and supportive for the local population.The study promotes similar activities based on forest produce that generates employment for the local people and maintains a healthy socio-ecological relationship

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