

**Social Vulnerability and Resilience to Climate Change
in Gujarat
- A Social Work Response to Vulnerable Communities**

**A Thesis Submitted to
The Maharaja Sayajirao University of Baroda
for the award of
Doctor of Philosophy
In
Social Work**

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January, 2013**

Certificate

This is to certify that the contents of this Thesis entitled Social Vulnerability and Resilience to Climate Change in Gujarat- A Social Work Response to Vulnerable Communities by Ms. Mital Petiwale submitted to The Maharaja Sayajirao University of Baroda for the Award of Degree of Doctor of Philosophy in Social Work is original research work carried out by her under my supervision.

This thesis has not been submitted either partly or fully to any other university or institute for award of any degree or diploma.

Research Guide

Prof. (Dr.) Aruna Khasgiwala

Declaration

I hereby declare that the conceptual framework of the thesis has been developed based on the literature survey as shown in the bibliographical references. The sources of different statistical data, remarks and the opinion of the expert and other secondary information collected from various books, periodicals, journals, internet and other reading material have been provided.

All other opinion, inferences, interpretation and analysis of the primary information are developed by own work during the period of May 2009 to January 2013 under the guidance of Prof.(Dr.) Aruna Khasgiwala, Faculty of Social Work, The M. S. University of Baroda, Vadodara and the strategic guideline and models presented are of original creation.

I, hereby declare that I have not been conferred before, any degree, diploma or distinction either by this university or any other for the work performed in the thesis.

Date: 03 January 2012

Place: Vadodara

Researcher

Ms. Mital Petiwale

Preface

As we enter the 13th year of the 21st century, as global citizens, we have accomplished great achievements to emerge as a powerful knowledge society. Today, the global citizens with their endeavors in field of various sciences, arts and commerce have contributed in making human lives better and healthier. Today mankind has reached avenue once thought beyond its reach like the outer space and continues to discover and explore the nature for enhancement of human dignity and life.

In the race for better amenities and lifestyles, the human race resorted to exploiting the natural resources as products and raw material. This started with industrial revolution and continued in form of liberalization, modernization and globalization. With the maddening competition at the global level, this race led to over exploitation and degradation of natural resources which had an inverse impact on the environment and the ecology. Today, this has taken form of a global crisis called global warming and climate change. Much of the climate change phenomenon is attributed to the anthropogenic cause then the natural cause as cited by the International Panel on Climate Change (IPCC), a consortium of intergovernmental panel. The climate change has adverse impact on the extreme events like cyclones, floods, extreme cold and hot weather etc along with sea level rise. Across the globe, the impacts have been scaring amidst total confusion and chaos. Already there was a rising concern to disaster vulnerability due to the physical, economic and social vulnerabilities in various nooks and corners of the world when all of a sudden the world had to face the wrath of climate change impacts especially in a negative connotation. Various countries came together with the help of international platforms in form of IPCC and UNFCCC (United Nations Framework Convention on Climate Change). The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenges posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. IPCC is for

assessment of climate change. It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. Its assessment reports have exhibited for each region the climate change impacts and vulnerability and adaptation measures.

At the country level, India being a party to IPCC and UNFCCC, it has through its National Communications and National Action Plan on Climate Change which states eight national missions in form of National Solar Mission, National Mission for Advanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for sustaining the Himalayan Ecosystem, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge on Climate Change, paved a way for its own climate change adaptation and mitigation measures. The National Mission on Strategic Knowledge on Climate Change encourages the research at various levels by various academic and research institutes.

The researcher, being a social work professional, has worked in the field of disaster management for seven years. The rich experiences of working in different phases of relief to preparedness of disaster preparedness during various Bhuj Earthquake, Kashmir Earthquake and Indian Ocean Tsunami provided the insights into the field of disasters management. Similarly, leading a Community Based Disaster Preparedness project in Porbandar in Gujarat provided an in depth knowledge and work experience in the field of community preparedness with concept of integration of disaster management into developmental planning. The focus of the project was to make communities resilient. Working on School Safety Program in Gujarat, provided a holistic structural and non structural preparedness knowledge. Moreover, working on the social vulnerability project for Maldives also provided an understanding of research in the field at national level. All this experience led to an emerging interest in making communities resilient.

Being from the field of social work, the inquisitiveness about what are the social indicators that makes a community vulnerable or resilient prompted the researcher to work on these issues during the projects.

The present research topic is totally a new topic, was undertaken by the researcher based on the work experience, interest and the emerging need to contribute in the uncertain field of climate change which is the need of the hour.

Acknowledgement

Writing acknowledgement is one of the most difficult tasks for a researcher. It looks like one single thesis but it's the encouragement, inspiration and support of hundreds of people who over the period of time has enabled me to undertake this topic.

First and foremost I would like to express my sincere gratitude to my friend, philosopher and guide Prof. (Dr.) Aruna Khasgiwala for her faith in me and for supporting and encouraging me constantly thought out the entire phase. Without her support and valuable inputs, this thesis would not have seen its present genesis. Her excellent persona and compassionate nature helped me in times of personal crisis during the phase.

I acknowledge Prof. (Dr.) M. N. Parmar and the entire teaching and non teaching staff of Faculty of Social Work, The M. S. University of Baroda for supporting me in all the endeavors related to the PhD work. A special thanks to Dr. Ila Rawal for her constant encouragement.

A special thanks for the experts Prof. (Dr.) Nikhil Desai, Prof. (Dr.) S. Sabnis and Dr. Bella Uttekar for their valuable inputs for the paper presentations. Their valuable inputs have enriched the working knowledge of the subject.

I also acknowledge the endeavors of the various university officials and staff members in supporting this thesis.

Most importantly, I express my heart felt gratitude to the respondents and people of both the communities and the various leaders and officials who contributed their precious time and interest in making this thesis a reality. A special thanks to Shri Dineshbhai Goswami and Shri Jigneshbhai Gohil from Prakruti Nature Club, Kodinar and Shri Naveenbhai Tandel and Smt. Munniben Tandel from Umarsadi for introducing me to the community at Madhvad and Umarsadi respectively and enabling me to collect the data from

the respective communities. I also thank Smt. Sushma Parekh for helping me with quantitative data analysis.

As special heart felt thanks to my former employer SEEDS INDIA and my former bosses Dr. Manu Gupta and Dr. Anshu Sharma for providing me exposure through various projects and for encouraging me to take up this entirely new top for research. I also thank all those numerous persons who have knowingly or unknowingly contributed to the completion of this thesis.

Last but not the least this thesis would not have been completed without the evergreen support, encouragement and motivation from my entire family, especially - My Papa, Sudhirkaka, Kaki, Mirali, Brinda and Parind and my friend- Brijesh Bhatt, Dharmishta Nanavati, Kshama Upadhyay and Nikita Zala. .

Above all, I thank the almighty and my late mummy for making me realize my dream come true and enable me to contribute my part to the society. It is their constant blessings and unconditional love which has constantly driven me in the right direction.

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CHAPTER ONE

INTRODUCTION

Outline of the Chapter:

Environment

Climate Change

Disasters

Vulnerability

Resilience

Global Impact and Initiatives

Indian Impact and Initiatives

Definitions and Concept

Social Work Response

Conceptual Framework

Introduction of the chapter:

The Introduction chapter is the first chapter of the thesis. It introduces the topic of research with the help of various theories and concepts and finally leads to the conceptual framework.

The chapter starts with an understanding of what is the environment and socio ecological are and how they are falling prey to disturbances due to climate change. It further tries to develop understanding about what is climate change, definition of climate change, what are causes and what are the adverse impacts of climate change. The chapter further focuses on the link between climate change and disaster risk reduction and explains what are disasters, its types, vulnerability in terms of natural disasters etc. It further explains the importance of climate change adaptation and sustainable development.

Further, it tries to conceptualize vulnerability by focusing on vulnerability , its concept, vulnerability to natural hazards and climate change, social vulnerability and different definitions. It also conceptualizes resilience by taking into consideration what do we mean by resilience, social resilience and the importance of the same.

With this in background, the chapter explains the impacts at global level, in Asia and in specifically in India. It also focuses on the social dimensions of climate change and some of the initiatives undertaken by India through research.

Towards the end, the chapter outlines the scope of social work response and social work concerns leading to a conceptual frame work for the present research.

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Global Environment and Socio Ecological Systems:

Growing interest in global environmental change has focused attention on the inter-relationships between natural and human systems. Climate change is increasingly accepted as a major issue facing human societies in the 21st century. Climate change is one of the most important global environmental challenges facing humanity with implications for food production, natural ecosystems, freshwater supply, health, etc.

The Second Assessment Report of the Inter-governmental Panel on Climate Change (IPCC) clearly demonstrates that both the ecosystem and the human system will be adversely affected by climate change. The changes in natural systems at alarming rates induced by global warming would cause land degradation and desertification; loss of lands and vegetation; overall decline in tropical forest areas; problem in fresh water storage and delivery infrastructure due to alteration in the timing and amplitude of runoff from snow melt; degradation of wetlands due to alteration of their hydraulics and inundation of low-lying coastal areas due to sea level rise. All such physical effects will result in disequilibrium in the natural and the human systems as well as the existing symbiosis between humans and the nature. As a result, the production and social systems could be seriously disrupted.

The issue of largest importance to developing countries is reducing the vulnerability of their natural and socio-economic systems to projected climate change. Their concerns include increasing food security, reducing freshwater scarcity, protecting the livelihoods of forest dwellers, dry land farmers and coastal settlements and reducing health risks. Social and ecological systems are so complex that our knowledge of them and our ability to predict their future dynamics will never be complete. Social and ecological systems cannot be considered in absence of one another but needs to be understood as related and coupled systems. It is the intersection of the two that ensures sustainable development. In the advent of natural disruption in form of

disasters, it becomes seemingly difficult for both the systems to adhere themselves to their marked boundaries. Social and ecological systems are sufficiently complex that our knowledge of them and our ability to predict their future dynamics will never be complete. Social and ecological systems cannot be considered in absence of one another but must be understood as related and coupled systems. It is the intersection of the two that ensures sustainable development. In the advent of natural disruption in form of disasters, it becomes seemingly difficult for both the systems to adhere themselves to their outlined boundaries.

Climate Change

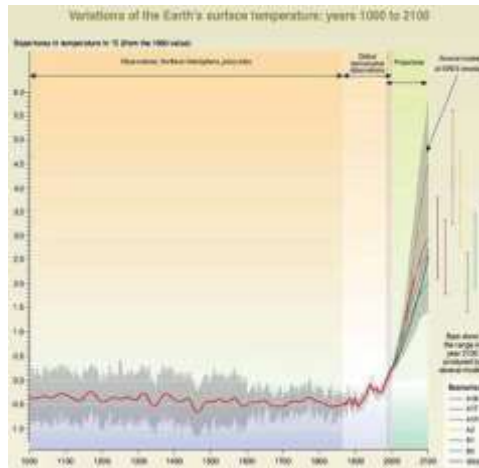
What is Climate Change?

The Earth is the only planet in our solar system that supports life. The complex process of evolution occurred on Earth only because of some unique environmental conditions that were present: water, an oxygen-rich atmosphere, and a suitable surface temperature. Only Earth has an atmosphere of the proper depth and chemical composition. About 30% of incoming energy from the sun is reflected back to space while the rest reaches the earth, warming the air, oceans, and land, and maintaining an average surface temperature of about 15 °C.

The chemical composition of the atmosphere responsible for life is nitrogen and oxygen utilized by animals for survival and only a small percentage is made up of carbon dioxide which plants require for photosynthesis completing the ecological cycle.

Greenhouse gases (for example, carbon dioxide, methane, nitrous oxide, water vapor, ozone), re-emit some of the heat to the earth's surface trapped within the earth's atmosphere each day. If they did not perform this useful function, most of the heat energy would escape, leaving the earth cold (about -18 °C) and unfit to support life.

However, ever since the Industrial Revolution began about 150 years ago, man-made activities have added significant quantities of GHGs to the atmosphere. The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have grown by about 31%, 151% and 17%, respectively, between 1750 and 2000(IPCC001).



From year 1000 to year 1860 variations in average surface temperature of the Northern Hemisphere are shown (corresponding data from the Southern Hemisphere not available) reconstructed from proxy data (tree rings, corals, ice cores, and historical records). The line shows the 50-year average, the grey region the 95% confidence limit in the annual data. From years 1860 to 2000 are shown variations in observations of globally and annually averaged surface temperature from the instrumental record; the line shows the decadal average. From years 2000 to 2100 projections of globally averaged surface temperature are shown for the six illustrative SRES scenarios and IS92a using a model with average climate sensitivity. The grey region marked "several models all SRES envelope" shows the range of results from the full range of 35 SRES scenarios in addition to those from a range of models with different climate sensitivities. The temperature scale is departure from the 1990 value.

(Source IPCC Third Assessment Report: Climate Change 2001, Synthesis Report)

An increase in the levels of GHGs could lead to greater warming, which, in turn, could have an impact on the world's climate, leading to the phenomenon

known as climate change. Indeed, scientists have observed that over the 20th century, the mean global surface temperature increased by 0.6 °C . They also observed that since 1860 (the year temperature began to be recorded systematically using a thermometer), the 1990's have been the warmest decade.

However, variations in temperature have also occurred in the past - the best known is the Little Ice Age that struck Europe in the early Middle Ages, bringing about famines, etc. It is therefore difficult to determine whether current observations of increasing temperature are due to natural variabilities or whether they have been forced by anthropogenic (man-made) activities.

Scientific studies and projections are further complicated by the fact that the changes in temperature that they have been observing do not occur uniformly over different layers of the lower atmosphere or even different parts of the earth.

The Earth's climate system constantly adjusts so as to maintain a balance between the energy that reaches it from the sun and the energy that goes from Earth back to space. This means that even a small rise in temperature could mean accompanying changes in cloud cover and wind patterns. Some of these changes may enhance the warming (positive feedback), while others may counteract it (negative feedback). Negative feedback (causing a cooling effect) may result from an increase in the levels of aerosols (small particles of matter or liquid that can be produced by natural or man-made activities). Positive feedback may result from an increase in water vapor (because of greater evaporation with temp rise), which itself is a GHG and can further add to the warming effect.

All the factors described above complicate the work of scientists who try to predict the fallout of climate change. Despite these uncertainties, the Third Assessment Report published by the IPCC states, 'there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities'

Definition of Climate Change

United Nations Framework Convention on Climate Change (UNFCCC)

definition of climate change: A change of climate, which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’.

Intergovernmental Panel on Climate Change (IPCC) defines “climate

change” as “a change in the state of the climate that can be identified ... by changes in the mean and / or the variability of its properties, and that persists for an extended period, typically decades or longer”.

Climate Change and Disaster Risk Reduction

Climate change adaptation (CCA) and disaster risk reduction (DRR) have similar aims and mutual benefits. However, to date the climate change and disaster risk management communities have operated largely in isolation from each other – for a number of reasons. This situation must change as a matter of urgency. Adaptation and DRR policy makers, experts and practitioners must communicate and collaborate with each other effectively to ensure a comprehensive risk management approach to development at local, national and international levels of government. This could result in the following benefits:

- 1 Reduction of climate-related losses through more widespread implementation of DRR measures linked with adaptation.
- 2 More efficient use of financial, human and natural resources.
- 3 Increased effectiveness and sustainability of both adaptation and DRR approaches.

Closer collaboration on these issues is particularly critical as governments negotiate on the adaptation pillar of the post-2012 framework under the United Nations Framework Convention on Climate Change (UNFCCC). DRR

must be a key component of the post-2012 framework if an effective, sustainable approach to adaptation is to be achieved.

Disasters

Generally speaking, disaster is an event which gives rise to casualties, loss of property, damage to infrastructure, essential services and means of livelihood on a scale which the affected community cannot cope up unaided. Disasters ruins years of investments in development process. It places new demand for reconstruction and rehabilitation.

The UN defines disaster as “The occurrence of a sudden or major misfortune which disrupts the basic fabric and normal functioning of a society.”

The World Health Organization (WHO) describes disaster as an occurrence that causes damage, economic destruction, loss of human life and deterioration in health services on a scale sufficient to warrant an extraordinary response from outside the affected community or the area.

Thus generally speaking, disaster may be termed as an event which causes great loss of life and property. They pose a serious threat to the normal life as well as the process of development. It is an event triggered by natural or man made causes that lead to disruption of normalcy within society. They can be sudden and powerful, damaging national economy and can cause hardship to population and are the largest concerns for most of the nations rendering multi dimensional economic and social consequences for communities affecting human, environmental, domestic ,social, economic and political aura. The impacts are felt at the individual, familial and community level.

Types of Disasters

The High Powered Committee set up by Government of India in August 1999, under the chairmanship of Dr. K. C. Pant has classified disasters into the following major types:

1. Water and Climate Related

Floods, Cyclones, Tornadoes, Hurricanes, Hailstorms, Cloud burst, Heat and Cold Wave, Snow Avalanches, Droughts, Thunder and Lightening, Sea Erosion

2. Geologically Related

Landslide, Earthquakes, Dam failures/Dam bursts, Mine fires

3. Chemical, Industrial and Nuclear Related disasters

Chemical and Industrial Disasters, Nuclear Disasters

4. Accident Related Disasters

Forest Fires, Urban Fires, Mine Flooding, Oil Spills, Major Building Collapse, Serial Bomb blasts, Festival related disasters

5. Electrical disaster and fires

Air, Roads and Rail accidents, Boat Capsizing, Village Fire

6. Biologically related disasters

Biological disasters and epidemics, pest attacks

The disasters can also be classified on the basis of whether they are man made or natural, sudden onset or slow onset etc.

Vulnerability of India to Natural Disasters

The multi hazard map of India depicted in the Vulnerability Atlas of India (BMTPC, New Delhi, India) shows that out of the total geographical area of 32, 87, 263 sq. kms, about 60% of the land mass is prone to earthquakes of various intensities, over 40 million hectares is prone to floods, about 8% of total area is prone to cyclones and 68% of the area is susceptible to drought. Coast line of 8041 km exposed to tropical cyclones. Many parts are prone to Landslides, hailstorm and avalanches. Thus, Indian Subcontinent highly vulnerable to drought, floods, cyclones and earthquakes. Among the 32 States/ Union Territories, 22 are disaster prone.

Disasters**Vulnerable States**

E, F, C, D

Gujarat, Maharashtra and West bengal

E, F, D

Andhra Pradesh, Bihar, Haryana, Jammu & Kashmir, Karnataka, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and Goa

E, F

Himachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, Tamil Nadu, Kerala, Mizoram and Tripura

Disasters: Cyclone -C; Drought -D; Earthquake-E;Flood-F

Loss due to Natural Disasters**Country profile for Natural Disasters from 1900 – 2006**

- No of events*: 513
- No of people killed*: 9,105,799
- Average killed per year*: 85,904
- No of people total affected*: 2,233,336,428
- Average total affected /year*: 21,069,212
- Economic Damage (US\$ X 1,000)*: 35,717,502
- Economic Damage/year (US\$ X 1,000)*:336,958

(*: Reported-Source of data: "EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium" / Data version: v06.06)

Key Terminology for Disaster Risk Reduction provided by International Strategy for Disaster Risk Reduction:

Adaptation

The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Contingency planning

A management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations.

Coping capacity

It is the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.

Disaster risk

The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.

Disaster risk management

The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

Disaster risk reduction

The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property,

wise management of land and the environment, and improved preparedness for adverse events.

Exposure

People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

Greenhouse gases

Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds.

Hazard

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Hydro meteorological hazard

Process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Mitigation

The lessening or limitation of the adverse impacts of hazards and related disasters.

Preparedness

The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

Prevention

The outright avoidance of adverse impacts of hazards and related disasters.

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Response

The provision of emergency services and public assistance during or immediately

after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

Risk

The combination of the probability of an event and its negative consequences.

Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Vulnerability

The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Climate Change and Natural Hazards/ Disasters:

Natural hazards by themselves do not cause disasters; it is the combination of an exposed, vulnerable and ill prepared population or community with a hazard event that results in a disaster. Climate change will therefore affect disaster risks in two ways, firstly through the likely increase in weather and climate hazards, and secondly through increases in the vulnerability of communities to natural hazards, particularly through ecosystem degradation,

reductions in water and food availability, and changes to livelihoods. Climate change will add yet another stress to those of environmental degradation and rapid unplanned urban growth, further reducing communities' abilities to cope with even the existing levels of weather hazards.

Climate change increases disaster risk in a number of ways. It changes the magnitude and frequency of extreme events (meaning that coping and response mechanisms and economic planning for disasters based on past vulnerabilities may no longer suffice). It changes average climatic conditions and climate variability, affecting underlying risk factors, and it generates new threats, which a region may have no experience in dealing with. The climate change and disaster management communities need to work together in addressing these issues. If climate change adaptation policies and measures are to be efficient and effective they must build on and expand existing DRR efforts. And if DRR approaches are to be sustainable they must account for the impact of climate change.

Similar Aims of DRR and Climate Change

While their scope and specific interests may differ, adaptation and DRR have very similar aims in terms of seeking to build resilience in the face of hazards. They both focus on reducing people's vulnerability to hazards by improving methods to anticipate, resist, cope with and recover from their impact. In so doing, climate change adaptation clearly focuses on *climate-related hazards*, such as floods, droughts and storms. The disaster risk management community has a long history of dealing with such events, and therefore a wealth of experience relevant to adaptation. Importantly, both adaptation and DRR seek to build resilience to hazards in the context of sustainable development. Climate change adaptation requires the re-shaping and re-designing of development, social and economic practices to respond effectively to new or anticipated environmental changes. Likewise DRR seeks to influence development decision-making and protect development aspirations from environment related risks. The effectiveness of both

adaptation and DRR are limited if they are not viewed within the broader context of sustainable development.

The World Resources Institute (WRI) presents a model of adaptation which helps to illustrate how closely DRR is linked with adaptation. The WRI frames adaptation as a 'continuum of responses to climate change', divided into four types of adaptation efforts, ranging from 'pure' development activities at one end of the continuum to very explicit adaptation measures at the other. The four types of adaptation are:

1. Addressing the drivers of vulnerability (i.e. factors making people vulnerable to harm).
2. Building response capacity (laying the foundation for more targeted actions).
3. Managing climate risk (reducing the effects of climate change on resources/livelihoods).
4. Confronting climate change (highly specialized activities, such as relocating communities in response to sea level rise).

While DRR measures typically fall under the middle two categories of building response capacity and managing climate risk, they can fit into *every category* of the adaptation continuum, addressing drivers of vulnerability as well as confronting climate change.

Apart from the above similar aims, both the communities also use **Non Structural Measures**. These measures refer to policies, knowledge development/awareness and methods and operating practices, including participatory mechanisms, which can reduce risk and related impacts. These nonstructural measures are well placed to serve both a DRR and a climate change adaptation agenda. The dynamism associated with training and awareness-raising means that people and institutions can apply skills and knowledge in different circumstances as they emerge. With context to **Poverty Reduction and Underlying Risk**, both climate change and disaster

risk management communities recognize and accept that the poor are disproportionately affected by hazards. This is due to a lack of access to the means by which they can improve their resilience, whether this is in economic, social, physical, or environmental terms. So for both adaptation and DRR, poverty reduction and sustainable natural resource management are essential components of reducing vulnerability to hazards and climate change. The approach of Community Based Disaster Risk Management which enables the local communities to participate in adaptation and decision making is already strongly embedded in the DRR community. Both the communities also call for **Mainstreaming in sustainable development**. It is increasingly recognized that adaptation and DRR must be integral components of development planning and implementation, to increase sustainability. In other words, these issues need to be 'mainstreamed' into national development plans, poverty reduction strategies, sectoral policies and other development tools and techniques. At the World Conference on Disaster Reduction in 2005, governments agreed to adopt a mainstreamed approach to DRR. In the policy debate on climate change there has been growing recognition of the importance of adaptation, and within this, the need to improve the capacity of governments and communities to address *existing* vulnerabilities to current climate variability and climatic extremes. This development has taken place in parallel to the shift from disaster management to disaster *risk* management, which is adopting a more anticipatory and forward-looking approach. Climate change adaptation and DRR, therefore, have merging remits and highly significant **converging political agendas**.

Climate Change and Sustainable Development:

Sustainable development has become part of all climate change policy discussions at the global level, particularly due to adoption of Agenda 21 and the various Conventions resulting from the UNCED-1992. The generally accepted and used definition as given by the Brundtland Commission is 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Sustainable

development has become an integrating concept embracing economic, social and environmental issues. Sustainable development does not preclude the use of exhaustible natural resources but requires that any use be appropriately offset. Further, sustainable development cannot be achieved without significant economic growth in the developing countries. Three critical components in promoting sustainable development are economic growth, social equity and environmental sustainability. The decline and degradation of natural resources such as land, soil, forests, biodiversity and groundwater, resulting from current unsustainable use patterns are likely to be aggravated due to climate change in the next 25 to 50 years.

For developing countries, the climate benign actions are best driven as a part of the sustainable development priorities derived from the Millennium Development Goals and channelized in national development goals and targets. This approach is well articulated in India's Initial National Communications: 'Since the goals of sustainable national development are favorable to the issue of climate change, the achievement of these goals would accrue a double dividend in terms of added climate change benefits. The cascading effects of sustainable development would reduce emissions and moderate the adverse impacts of climate change, and thereby alleviate the resulting loss in welfare'.

Vulnerability

Vulnerability Concept

The word "vulnerability" is derived from the Latin word **vulnerare**, meaning "to wound." At a very basic level, vulnerability can be defined as "the capacity to be wounded" or the "potential for loss". However, general definitions of vulnerability do not specify the type of loss or the individuals, groups, or societies experiencing loss.

Despite differences in the conceptualization of the term "vulnerability," two main perspectives have emerged. The first major research theme treats

vulnerability as a pre-existing condition and focuses on potential exposure to hazards. Studies conducted in accordance with this perspective tend to assess the distribution of some hazardous condition, the human occupancy of the hazard zone, and the degree of loss of life and property resulting from a particular event.

The second major perspective on vulnerability suggests that not all individuals and groups exposed to a hazard are equally vulnerable; rather, affected people display patterns of differential loss. In addition to exposure to some stress or crisis, this differential vulnerability also depends on the *coping ability* of those affected. Coping ability has been defined as a combination of *resistance* (the ability to absorb the damaging impacts of a hazard and continue functioning) and *resilience* (the ability to recover from losses quickly).

Vulnerability to climate change has always been a major concern of human beings. Since climate change is a multidimensional phenomenon, a single index or definition may not be appropriate and hence composite vulnerability indices that can incorporate economic, social, and environmental dimensions need to be developed.

Definition of Vulnerability:

A. The latest edition of the Oxford Dictionary of English gives the following definition of “vulnerable”

1. Exposed to the possibility of being attacked or harmed, either physically or emotionally,
2. Bridge (of a partnership): liable to higher penalties, either by convention or through having won one game towards a rubber.

The Oxford Dictionary of English provides the following example sentence with the first definition:

“Small fish are vulnerable to predators”.

It follows from the definitions and the example sentence that vulnerability is a relative property: it is vulnerability of something to something. In addition, both the definitions and the example sentence make it clear that vulnerability has a negative connotation and therefore presupposes a notion of “bad” and “good”, or at least “worse” and “better”. It also follows that vulnerability refers to a potential event (e.g., of being harmed); not to the realization of this event.

Vulnerability to natural hazards:

Chamber (1983) defined that vulnerability has two sides. One is an external side of risks, shocks to which an individual or household is subject to climate change and an internal side which is defenselessness, meaning a lack of means to cope without damaging loss.

Blaikie *et al.*, (1994) defined vulnerability as the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impacts of natural hazards and states that vulnerability can be viewed along a continuum from resilience to susceptibility.

Vulnerability to Climate Change:

The IPCC's Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC) defined vulnerability as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity" (McCarthy *et al.*, 2001).

Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. Vulnerability depends on the level of economic development of a country. Vulnerability to climate hazards is changing because of rapidly changing social, economic, institutional, technological, and

governance conditions. Hence, constant adaptation measures need to be considered for the changing situations.

Social Vulnerability

Vulnerability is the exposure of individuals or collective groups to livelihood stress as a result of the impacts of climate extremes and climate change. Social vulnerability to climate change is made up of individual and collective aspects which can be disaggregated, but are linked through the political economy of markets, institutions etc. The indicators of individual vulnerability are the incidence of poverty and the risk of income sources to extreme events. Changes in collective vulnerability are indicated through changes, in distribution of resources within a population, and by institutional changes, which can either enhance security or exacerbate vulnerability

The central insight brought by social scientists to the process of adaptation is that vulnerability is socially differentiated. Vulnerability is not the same for different populations living under different environmental conditions or faced with complex interactions of social norms, political institutions and resource endowments, technologies and inequalities. The causes of vulnerability are related to the environmental threat and fundamentally to the economic and institutional context. Indeed changes in the social causes of vulnerability often happen at much more rapid temporal scales than some of the environmental changes

The idea of social vulnerability to external change and stress is at the centre of much research into human adaptation and interaction with the physical environment. This is particularly the case where social and natural scientists have attempted to explain the role of hazards and of periodic and extreme events within the cycle of resource use. Human life and livelihood is at risk from natural phenomena such as earthquakes, volcanoes, floods, droughts, tsunamis and other hazards with human origins. In these cases vulnerability has been used to describe the state of risk, usually associated with a geographical location rather than with individuals or social groups.

There have been three major approaches to the study of natural hazards. Firstly there are engineering approaches to hazard management which stress objective risk. Secondly a related social science approach stresses the management of such risks by institutions such as governments and markets. A third approach is a critique of both of the previous technical natural and social science approaches, which stresses structural social causes of vulnerability to hazards. Hewitt (1983) and colleagues initiated this third approach in the 1980s, providing a challenge to what they regarded as a dominant view which described the causality of risk from hazards as 'running from the physical environment to its social impacts'. Thus even social science analysis of hazards, up to that point, were primarily 'technocratic' and prescriptive, by incorporating the human element in hazards as an input to designing planning, warning and coping systems. The radical reversal suggested by Hewitt (1983) and others, was to emphasize economic and social structure as a cause of vulnerability, rather than as a contribution to hazard mitigation. The causes of vulnerability to hazards under the Hewitt approach are therefore lack of access to resources: poverty and marginalization translate into vulnerability through the mechanisms of coping behaviour and stress.

Within the social sciences, at least within geographical approaches to hazards, this third conceptualization of hazards has gained greater credence. This credence is reflected in later work by Kasperson et al. (1995), who review the concepts surrounding vulnerability in the context of an assessment of critical 'regions at risk' from environmental change. They conclude that vulnerability 'appears to be emerging as the most common term in ... discussions of the differential susceptibility of social groups and individuals to losses from environmental change'

The origins of the use of vulnerability to describe the state of society environment interactions under stress lead to a number of general observations on vulnerability which can be applied in the climate change context. Vulnerability has an historical and time dimension; is related to economic aspects of livelihood and land use; power and political dimensions

are important in contextualizing vulnerability; individuals and groups exhibit differential vulnerability; and extreme events are the key climate change context. Thus vulnerability for individuals or groups can change over time; is differentiated between and within groups through their institutional and economic position; and is affected by environmental change. Existing policies and practices in agriculture, forestry and coastal resource management, as well as the inequitable distribution of productive resources, in themselves can have perverse effects of increasing vulnerability, and hence can be 'maladaptive'. Stress, under this definition, is associated with unplanned disruption and can incorporate the coping and recovery aspects of vulnerability.

Definition by different authors and researchers

1. Social vulnerability is the exposure of groups or individuals to stress as a result of social and environmental change, where stress refers to unexpected changes and disruption to livelihoods. This definition emphasizes the social dimensions of vulnerability, in contrast to the predominant views on vulnerability to the impacts of climate change which concentrate on the physical dimensions of the issue. (W. Neil Adger 98-02)
2. Social vulnerability to climate change is defined as the exposure of groups or individuals to stress as a result of the impacts of climate change and related climate extremes. Change in social vulnerability from its baseline level incorporates notions of economic development, as well as adjustments to livelihoods based on adaptation to climatic conditions, and changes in institutional and political structures. If institutions fail to plan for changing climatic conditions and risks, social vulnerability increases. It is helpful to disaggregate social vulnerability into the two distinct aspects of individual and collective vulnerability in order to clarify the scale issue and the unit of analysis. (W. Neil Adger CSERGE Working Paper GEC 98-02)

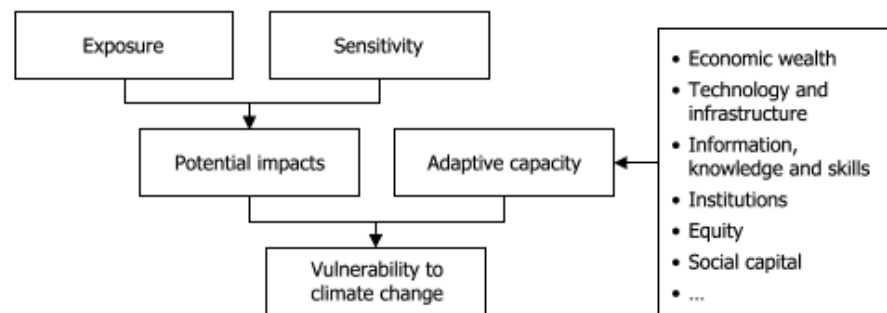


Figure 1: Graphical representation of the conceptualisation of vulnerability to climate change in the IPCC Third Assessment Report.

3. UNEP(1999)

Vulnerability is a function of sensitivity to present climatic variability, the risk of adverse future climate change and capacity to adapt...The extent to which climate change may damage or harm a system; vulnerability is a function of not only the systems' sensitivity, but also its ability to adapt to new climatic conditions.

Resilience

What is Resilience?

Nearly all of the literature refers in one manner or another to various works by C.S. Holling. His single most important work, as cited by the resilience literature, is his 1973 article "Resilience and Stability of Ecological Systems", where the author defines resilience as "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables". In 1986, Holling refines this definition and defines resilience as "the ability of a system to maintain its structure and patterns of behavior in the face of disturbance". Holling offers up a third definition in *Barriers and Bridges to the Renewal of Ecosystems and Institutions*, which builds on the first two, stating that resilience is the buffer capacity or the ability of a system to absorb perturbations, or the magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behavior. (Holling et al., 1995 cited in Adger, 2000).

Stuart Pimm's 1984 article on the stability of ecosystems offers the only other moderately cited definition without strong affiliation to the work of C.S. Holling. He defines resilience as the measure of the speed of a system's return to equilibrium following a perturbation.

Social Resilience

Social Resilience is measured by the time it takes for a community (or organization) to rebound from a natural (or man-made) hazard. The longer it takes a community or organization to "bounce forward" after a natural or man-made hazard, the greater the risk of damage to the social fabric that holds a community or organization together. Similar to the notion of "broken families", the effect of psychological or relationship dysfunction reaches beyond the economic impact of that lack of functioning.

With an increase in urbanization, and decrease in the ability of the nuclear family unit to be self sustaining and supporting, it is up to the private sector and faith based organizations to provide the redundancy that is needed to expedite recovery from hazards. The role of government would be to provide assistance to those not receiving it from other sources. This strategy is particularly important in the developing world.

Social Resilience includes:

1. **Redundancy** through overlapping social networks
2. Strengthening **response capacities**
3. Supporting **self-organization**
4. Fostering **learning and education**
5. Encouraging **adaptation**

Using a "Human Impact Preparedness" lens which focuses directly on people-needs (rather than on technology or infrastructure) organizations of all types can prepare and mitigate the effects of hazards on their various stakeholders and thus support and ensure increased Social Resilience. Enhancing Social

Resilience requires cooperation and collaboration of all stakeholders: private sector, government (public sector), Non-Governmental Organizations (NGO's) and other community organizations (such as faith based organizations).

Increasing the strength of a society is about increasing the strength and scope of the internal connections between the people, organizations and environment that form that society. Moving away from the doctrine of independence to embracing a culture of *interdependence* is the key to both harmony and development.

Social Resilience, is measured by time. Specifically – how long would it take for the community to respond to the event, self organize and incorporate the lessons learned before returning to a [new] normal way of functioning. The amount of time it takes to recover from an occurrence of a hazard affects not only the economic viability of a community, but also its social fabric or “glue” that keeps it together. The longer it takes to recover, the more likely it is that the community will break up – because of people leaving, economic stagnation, and rampant psychological and emotional distress.

It is also a reflection of the reality that the longer it takes to move from response to rebuilding and reconstruction, the more deleterious and long lasting the negative effects of the disaster will be. In the field of human trauma it is known that while people need some amount of time to recuperate from traumatic events, they should try to resume their regular or necessary activities as soon as possible.

Two definitions that are especially comprehensive are the following:

- ...”the ability to face internal or external crisis and not only effectively resolve it but also learn from it, be strengthened by it and emerge transformed by it, both individually and as a group.” (Brenson-Lazan, 2003).
- “The resilience of an eco-system is its capacity of absorb disturbances while maintaining its behavioral processes and structure. It can be defined as the

capacity to buffer perturbations, to self-organize, and to learn and adapt.” (ResAlliance.org).

These definitions include four main components: Response, Self-Organization, Learning, and Adaptation. These components apply equally to all social units – from individuals, through families to communities or organizations. Moreover, they necessitate voluntary participation by all involved: one cannot force or require an individual to be resilient. Rather, resilience is the outcome of developing those four components. While poverty reduction (the cornerstone of reducing social vulnerability) is a complex process involving factors beyond the individual or even a community, developing Social Resilience is a grassroots process that does not require an intervention on a macro level. Social Resilience can be achieved at the level of the individual family, isolated village or at the other end of the spectrum – a mega-city.

In the social sphere, Social Resilience assumes a certain amount of redundancy. Traditionally, the redundancy was created through family ties. People were cared for by their extended family when in need (e.g. Disaster, illness, old age). With the phenomenon of migration to more urban areas, that system of Social Resilience cannot always provide support. In these situations the creation of redundancy is expected of the central or local government which is supposed to take care of the citizens and residents when they cannot care for themselves. With globalization, population migration and other social phenomena of the late 20th century we need to rethink the way in which redundancy and Social Resilience are achieved. An increasing number of people are living in urban areas (at least 50% of the world population by some estimates), and thus are exposed to different types of social ties. Faith based communities, workplace communities, neighborhoods, dwellers of high-rise buildings all can provide the redundancy necessary for Social Resilience. Of this list, the first two have a particular vested interest in Social Resilience. Most (if not all) organized religions have as part of their tenets a moral code calling for social responsibility.

Similarly, most (if not all) companies and businesses depend on people for their functioning and revenue. It seems logical then that those organizations (faith based and businesses) should be involved in the process of enhancing Social Resilience. Not just out of a sense of social responsibility, but out of a realization that Social Resilience is critical and essential to their continued viability. A business will cease to function if it does not have employees, customers or suppliers. Even if it has all three, the longer the disruption to operations, the more money the business will lose. Similarly, a faith based community will fail its constituents if it does not offer social support. With many more alternatives in an urban setting, worshipers are more likely to choose a community offering them organized, practical and sustained support in times of crisis and disaster.

Introducing a greater degree of redundancy into prevention and mitigation of the impact of hazards reduces the pool of people who are dependent solely on governments , NGO's and other organizations for care, thereby facilitating a greater efficiency in response to hazards.

To effectively enhance *Social* Resilience one needs to focus on the *social* and psychological factors which are inextricably intertwined. An important aspect of this approach is the adoption of a decentralized component to enhancing Social Resilience – much of this process is a local, bottom-up approach, rather than the traditional top down approaches. In this respect it differs from many of the policies aimed at reducing social vulnerability. Many such programs are dependent on central governance to assist in attaining the goals. Social Resilience is developed community by community. Assistance from centralized or local government is of secondary importance. As long as there is buy-in from organizations in the community – employers, businesses, faith based organizations, community groups, etc. -- one can efficiently and cost-effectively enhance the ability of communities to “bounce forward” after a potentially devastating event.

Social dimensions of vulnerability to climate change are predominantly about the internal side—that is, what assets, institutions, and relationships do

people have to deal with these external threats, and how in turn will their social organization be affected? Social vulnerability is assessed at the level of individuals, households, or groups, but incorporates factors that exist at local, regional, national, and sometimes global scales. The concept therefore relates to the ability of individuals or groups to act within the social, political, and environmental contexts in which they live.

If vulnerability determines the extent to which individuals or a community will potentially suffer from climate-related events, then resilience is the ability to manage and adapt. It incorporates the notions of self-organization and the ability to learn, cope, and maintain future options. Rather than a concern about how to stop, change or minimize impacts, resilience is the ability to manage change. People's resilience or capacity to manage and adapt to change is determined by both their assets—including the amount and quality of knowledge and labour, physical and financial capital, and social relations and networks—and the services they can access—such as transport and communication, access to credit, markets, and emergency relief and recovery systems.

One important asset that can prevent households from becoming more vulnerable is the ability to act collectively through strong community networks, known as social capital. The strength or weakness of social networks affects how a community collectively manages natural resources and systems, resolves disputes, distributes benefits, and takes advantage of new opportunities.

Therefore, the presence or lack of social capital influences a community's ability to confront poverty and vulnerability. Strong social capital can potentially enhance the resilience of both social and natural systems.

Global Impact and Initiatives

Impact of Climate Change on the world:

Severe storms, floods and droughts since the eighties have served as reminders that climate change is a global problem. The most dramatic change has been in the temperature, with measurement records suggesting that warming by 0.3-0.6 °C has already taken place since the 1860s. The last two decades of the 20th century were the warmest in this period.

Over the next hundred years, the earth's surface temperature is projected to increase by 1.4 to 5.8 °C which will be greater than that experienced over the last 10 000 years.

Climate changes have occurred in the past, but always gradually, over thousands of years, giving ecosystems time to adapt. The rapid change that is currently taking place will leave ecosystems vulnerable. The large quantities of water locked in the polar ice caps and glaciers will be released as a consequence of warming. This, together with an increase in the thermal expansion of the oceans, will make the global mean sea level rise by 9 cm to 88 cm.

The effects of global warming are difficult to quantify because of the complicated relationships between air temperature, precipitation quantity and pattern, vegetative cover and soil moisture. However, it is likely that the frequency, intensity and duration of storms and other extreme weather events could increase.

Climate change is likely to have an impact in the following ways (IPCC)

- By the 2080's, substantial dieback of tropical forests and grasslands is predicted to occur, particularly in parts of South America and Africa.
- The availability of water in the rivers of Australia, India, southern Africa, South America, Europe and the Middle East is expected to decrease.
- Cereal yields in Africa, the Middle East and India are likely to decline.

- A rise in sea level could inundate and erode coastal areas, increase flooding and salt-water intrusion; this will affect coastal agriculture, fisheries and aquaculture, freshwater resources, human settlements and tourism.
- The incidence of water-borne diseases, heat stress and vector-borne diseases such as malaria is expected to increase.

Impact of Climate Change on Asia

All developing countries facing the problems of population and economic growth will be put under even greater stress as a result of these impacts. Asia's sustainable development will be challenged as climate change compounds the pressures that rapid urbanization, industrialization, and economic development have placed on natural resources. One of the main issues will be the availability of adequate fresh water, which by the 2050s will be a concern for possibly more than one billion people. The continued melting of glaciers in the Himalayan region is projected to increase flooding and rock avalanches and to adversely affect water resources in the next two to three decades. Asia's coastal areas, and especially its heavily populated delta regions, will become even more prone to increased flooding because of both rising sea levels and river flooding. More heat waves will increase the number of deaths, particularly among the elderly, the very young, or among people who are chronically ill, socially isolated or otherwise especially vulnerable.

- Increased drought in some regions will likely lead to land degradation, damage to crops or reduced yields, more livestock deaths, and an increased risk of wildfire.
- Such conditions will increase the risks for populations dependent on subsistence agriculture, through food and water shortage and higher incidence of malnutrition, water-borne and food-borne diseases, and may lead to displacements of populations.
- Increased frequency of high precipitation in some regions will trigger floods and landslides, with potentially large losses of life and assets. These events will disrupt agriculture, settlements,

commerce and transport and may further increase pressures on urban and rural infrastructure.

- Increases in the number and intensity of very strong cyclones (typhoons and hurricanes) will affect coastal regions, with potentially large additional losses of lives and assets.
- Sea-level rise, coupled with coastal storms, will increase the impacts of storm surge and river flooding and damage livelihood systems and protective ecosystems. Low-lying settlements may become unviable, which may result in increased potential for movement of population and loss of infrastructure.
- Higher temperatures and melting glaciers may cause glacial lake outbursts that could flood downstream settlements.

The Third Assessment Report (2001) identifies various key adaptive capacity and vulnerability constraints of various regions. The developing countries of the Asian region have been identified as most vulnerable to climate change related impacts due to their poor adaptive human systems. The following major vulnerability factors are mentioned for Asia:

- Extreme events have increased in temperate and tropical Asia, including floods, droughts, forest fires, and tropical cyclones.
- Decreases in agricultural productivity and aquaculture due to thermal and water stress, sea-level rise, floods and droughts, and tropical cyclones would diminish food security in many countries of arid, tropical, and temperate Asia; agriculture would expand and increase in productivity in northern areas.
- Runoff and water availability may decrease in arid and semi-arid Asia but increase in northern Asia.
- Human health would be threatened by possible increased exposure to vector-borne infectious diseases and heat stress in parts of Asia.

- Sea-level rise and an increase in the intensity of tropical cyclones would displace tens of millions of people in low-lying coastal areas of temperate and tropical Asia; increased intensity of rainfall would increase flood risks in temperate and tropical Asia.
- Climate change would increase energy demand, decrease tourism attraction, and influence transportation in some regions of Asia.
- Climate change would exacerbate threats to biodiversity due to land-use and land-cover change and population pressure in Asia. Sea-level rise would put ecological security at risk, including mangroves and coral reefs.
- Poleward movement of the southern boundary of the permafrost zones of Asia would result in a change of thermokarst and thermal erosion with negative impacts on social infrastructure and industries.

Indian Impact and Initiatives

Generic Impact

In India, climate change could represent additional pressure on ecological and socio-economic systems that are already under stress due to rapid urbanization, industrialization, and economic development. With its huge and growing population, a 7500-km long densely-populated and low-lying coastline, and an economy that is closely tied to its natural resource base, India is considerably vulnerable to the impacts of climate change.

Most countries in temperate and tropical Asia, with India being no exception, have already felt the impact of extreme climate events such as droughts and floods. The intensity of extreme rainfall events is projected to be higher in a warmer atmosphere, suggesting a decrease in return period for extreme precipitation events and the possibility of more frequent flash floods in parts of India, Nepal, and Bangladesh ([Lal M, Meehl G A, and Arblaster J M. 2000](#)).

- Increases in temperature and seasonal variability in precipitation are expected to result in more rapid recession of Himalayan glaciers. In fact, the Gangotri glacier is already retreating at a rate of 30 meters a year.
- An increase in rainfall is simulated over the eastern region of India but the northwestern deserts may see a small decrease in the absolute amount of rainfall.
- Warmer and wetter conditions would increase the potential for a higher incidence of heat-related and infectious diseases. The incidence and extent of vector-borne diseases, which are significant causes of mortality and morbidity in tropical Asia, are likely to spread into new regions on the margins of present endemic areas as a result of climate change.

(Source IPCC Third Assessment Report: Climate Change 2001 -Impacts, Adaptation & Vulnerability, Chapter 9, Human Health; Chapter11, Asia; Chapter 4, Hydrology and Water Resources)

Sector-wise impacts in different regions of India

Water resources

Study of one large catchments in the western Himalayas (the Chenab, a tributary of the Indus) show that the average snowmelt and glacier-melt contribution to the annual flow is 49.1%; a significant proportion of runoff is derived from snow in the dry season, when water demand is highest. Climate change-related increases in temperature also could increase the rate of snowmelt and reduce the amount of snowfall, if the winter is shortened. If climate change does alter the rainfall pattern in the Himalayas, the impacts could be felt in the downstream countries-that is, India and Bangladesh. Catchments in Nepal supply about 70% of the dry-season flow of the Ganges River, and tributaries of the Brahmaputra River originating in Bhutan supply about 15% of the total annual flow of that river. If climate change disrupts these resources and alters mountain hydrological regimes, the effects will be felt not only in the montane core of Tropical Asia but also downstream, in countries that depend on this water resource.

Forests and biodiversity

Mangroves may be affected by climate change-related increases in temperature and sea-level rise. Although the temperature effect on growth and species diversity is not known, sea-level rise may pose a serious threat to these ecosystems. In Bangladesh, for instance, there is a threat to species in the three distinct ecological zones that make up the Sunderbans-the largest continuous mangrove area in the world. If the saline water front moves further inland, *Heritiera fomes* (the dominant species in the landward freshwater zone) could be threatened. Species in the other two ecological zones (*Excoecaria agallocha* in the moderately saltwater zone and *Ceriops decandra* in the saltwater zone) also could suffer. These changes could result in economic impacts: Direct employment supported by the Sunderbans is estimated to be in the range of 500,000-600,000 people for at least half of the year (ESCAP, 1987), and a large number of these people - who are directly employed in the industries that use raw materials from the Sunderbans (e.g., woodcutting; collection of thatching materials, honey, beeswax, and shells; fishing) - may lose their sources of income.

Using climate scenarios generated by ECHAM3, Achanta and Kanetkar (1996) have linked the precipitation effectiveness index (PEI) to net primary productivity of teak plantations in Kerala State, India. They estimate that a projected depletion of soil moisture would likely cause teak productivity to decline from 5.40 m³/ha to 5.07 m³/ha. The productivity of moist deciduous forests also could decline, from 1.8 m³/ha to 1.5 m³/ha.

The Ganges-Brahmaputra delta is one of the world's most densely populated areas, and the combined effects of subsidence and sea-level rise could cause serious drainage and sedimentation problems, in addition to coastal erosion and land loss.

Wildlife

The Rann of Kutch in India supports one of the largest Greater Flamingo colonies in Asia (Ali, 1985; Bapat, 1992). With sea-level rise, these salt

marshes and mudflats are likely to be submerged (Bandyopadhyay, 1993), which would result in decreased habitat for breeding flamingoes and lesser floricans (Sankaran et al., 1992). In addition, about 2,000 Indian wild asses in the Rann of Kutch could lose their only habitat in India to rising sea level (Clark and Duncan, 1992).

Agriculture

In a study done in Madhya Pradesh by Lal et al., (1999) it was found that the yield of soyabean would vary from -22 % to + 18 %. This was done by assuming a scenario with no adaptation with +2,+4°C rise; ± 20 , $\pm 40\%$ precipitation and included the direct effect of CO₂.

In a study in northwest India, Lal et al. (1996) also found that reductions in yield resulting from a rise in surface air temperature offset the effects of elevated CO₂ levels; the projected net effect is a considerable reduction in rice yield.

Coastal areas

Major delta areas of Asia are likely to be subjected to stresses associated with sea-level rise, changes in water regimes, saltwater intrusion, siltation, and land loss. Low-lying coastal cities will be at the forefront of impacts; these cities include Shanghai, Tianjin, Guangzhou, Jakarta, Tokyo, Manila, Bangkok, Karachi, Mumbai, and Dhaka, all of which have witnessed significant environmental stresses in recent years.

Health

During 1987-1990, kala azar (black fever or visceral leishmaniasis) reached epidemic form in the Indian state of Bihar and spread rapidly to surrounding areas. WHO (1996a) estimated that about 110 million people were at risk from kala azar. Major endemic foci are reported in border areas between India (states of Bihar and West Bengal), Bangladesh, and Nepal. In Bangladesh, kala azar already has reached epidemic form; the most vulnerable populations are poor and rural cattlekeepers. In a warmer climate, the

incidence of kala azar also may increase (IPCC 1996, WG II, Section 18.3; WHO, 1996b).

Drought-affected areas

In India, chronically drought-affected areas cover the western parts of Rajasthan and the Kutch region of Gujarat. However, drought conditions also have been reported in Bihar and Orissa. These drought disasters are more frequent during years following ENSO events. At least half of the severe failures of the Indian summer monsoon since 1871 have occurred during El Niño years. In the event of enhanced anomalous warming of the eastern equatorial Pacific Ocean, a higher frequency of intense extreme events across Asia is possible.

Other Incidences

India being a young developing country is facing the challenge of maintaining the pace of development and saving its environment /natural resources so as not to be one of the eminent polluters contributing to climate change. The Indian philosophy talks about need based use of resources so that a green earth can be passed on to its generations. But with the increasing population, there is a dearth of resources both material and non material. In India, there are pockets like the sunder bans, the Himalayas, the costal regions, the desert cities like Badmer, etc which have started witnessing the ill effects of climate change. The communities residing in these areas have been adapting to the situation over centuries but now the rate of change calls for a system to deal for the drastic effect on the communities residing in these areas. Examples are the displaced communities from the Sunderband islands which are witnessing submergence of island habitat due to Sea Level Rise. Similarly apple orchards owners in Himachal Pradesh are facing livelihood problems due to change in the climatic conditions and are citing examples of vanishing apple trees. There are more communities at risk due to the increased incidence of extreme weather events in terms of increased cyclonic frequency in coastal regions, heat waves in Andhra Pradesh, Chattishgarh and Orissa, flooding especially in the eastern region, drought situations in the

entire country and similar increased incidence in the weather related disasters.

Social Dimensions of Climate Change

The Social Dimensions of Climate Change – Differentiated Impacts:

The impacts of climate change will be overlaid onto existing vulnerabilities of both the rural and urban poor and excluded, such as vulnerability to seasonality, to poor health and to market fluctuations (e.g. food and fuel price volatility). Poor communities are not homogenous however, and it is important to understand the differentiated social impacts of climate change based on gender, age, disability, ethnicity, geographical location, livelihood, and migrant status. Some specific examples include:

Gender and climate change

Men and women have distinct roles in water use and management, leading to different needs and priorities. Climate change will increase the time taken to collect water in rural areas, a task mainly done by women and girls, due to traveling greater distances to find water. In urban areas, water collection is also an issue as women and girls may spend hours queuing for intermittent water supplies

The Elderly and climate change

The elderly are likely to be particularly vulnerable especially where social protection is limited or non-existent. They are at high risk from climate change related impacts like heat stress and malnutrition and in rural areas can face restricted access to healthcare, as they are often unable to travel long distances to the nearest health facility

Children and climate change

Children are at highest health risk from inadequate water supplies during drought, and also predicted changes in vector-borne diseases. They are also at highest risk of malnutrition, with long-term implications for overall development. Children may also be at risk of early entry into work and

exploitation in order to cover lost income from agriculture. Understanding the intra-household dynamics around how age and gender influence resource access and time expenditure, and anticipated impacts of shocks, is critical for addressing future adaptation needs.

Initiatives by India for climate impact

India, as a Party to the United Nations Framework Convention on Climate Change (UNFCCC) that is a Global Treaty to consider what to be done to reduce global warming and cope with the inevitable temperature increases, accords great importance to sustainable development and climate change. India accords high importance since large populations in India are directly dependent on the climate sensitive sectors. In its recent Initial National Communication to the UNFCCC, India identified the following climate change related impacts as important for the country:

- Water stress and reduction in the availability of fresh water due to potential decline in rainfall.
- Threats to agriculture and food security, since agriculture is monsoon dependent and rain-fed agriculture dominate in many states.
- Shifts in area and boundary of different forest types and threats to biodiversity with adverse implications for forest-dependent communities.
- Adverse impact on natural ecosystems, such as wetlands, mangroves and coral reefs, grasslands and mountain ecosystems.
- Adverse impact of sea-level rise on coastal agriculture and settlements.
- Impact on human health due to the increase in vector and water-borne diseases, such as malaria.
- Increased energy requirements and impact on climate-sensitive industry and infrastructure.

Research Carried Out in India

A. Vulnerability of Indian Agriculture to Climate Change

Pooling the expertise of TERI (The Energy and Resources Institute), India; CICERO (Centre for International Climate and Environmental Research, Oslo), Norway; and IISD (International Institute for Sustainable Development), Canada, this collaborative research project is funded by the Government of Canada through the Canadian International Development Agency and by the Government of Norway through the Ministry of Foreign Affairs. The project commenced in April 2001, and concluded in March 2004.

B. Vulnerability and Climate Change: An analysis of the Eastern coastal districts of India

Unmesh Patnaik and K. Narayanan, Department of Humanities and Social Sciences, Indian Institute of Technology Bombay, India. The study aims to build a vulnerability index and rank the various coastal districts of these highly vulnerable states in terms of their performance on the index.

C. Community-level Climate Change Adaptation Case Study from Gujarat:

The Graduate School of Global Environmental Studies, KYOTO UNIVERSITY, Japan. The goal of this study was to study the interrelationship of environmental impacts, and suggests possible mitigation measures as policy options, and prepare a community adaptation model. The study was conducted in close cooperation with a wide range of stakeholders, which included: national government (National Institute of Disaster Management), state government (Gujarat State Disaster Management Authority) and district governments (Porbandar and Kutch district offices), and non-government organizations (SEEDS and KMVS).

Social Work Response

Scope for social work response in India

India has strong reason to be concerned. Climate change is projected to impact tropical countries more negatively than temperate ones. As a tropical country, our geography is our destiny. India's 7500 km coastline will be particularly hard-hit by storm surges and sea-level rise displacing millions, flooding low-lying areas, and damaging economic assets and infrastructure. The encroaching salt water will poison fields and make coastal agriculture unviable, deepening the crisis that is already full blown in India's farm sector. These impacts alone could severely test India's governance systems and its institutional and social resilience. Unless dealt with effectively they could also quickly turn into political challenges.

For the 700 million people in rural India who are dependent on the most climate-sensitive sectors for their livelihoods - agriculture, forests and fisheries - the future brings declining crop yields, degraded lands, water shortages and ill health. It also brings confusion and helplessness as people lose their traditional capacity to 'read' the weather and adjust accordingly.

When the rains do not come and when the natural world does not behave as it should, societies which have survived by observing the world and adapting to it lose essential coping skills.

Climate change, at a most profound level, disempowers by rendering traditional knowledge useless. How this will affect identity and culture amongst India's tribal and indigenous communities is something we are yet to properly understand. As for the more tangible impacts of climate change: floods, droughts, heat waves, cyclones, storm surges, displacement, disease and pestilence... these are not just projections for a distant future. The future is now. Phenomena consistent with climate change projections for India can already be seen across the country. 2007 has brought 'wild weather' to South Asia with the worst floods in living memory and 20 million people displaced.

Islands and villages in the Bay of Bengal have been lost to sea-level rise causing a drift of ecological refugees to cities such as Kolkata. The Super Cyclone of 1999 – our equivalent of Central America's Hurricane Mitch – wreaked havoc on Orissa, knocking decades off its development and killing more than 30,000. Heat waves across the country have caused untold deaths and human distress. Diseases such as malaria and dengue have increased their geographical range to metropolises such as Mumbai. Rising temperatures and a retreating snow-line in Himachal have fatally affected its once-legendary apple industry and crippled local economies.

The rapid melting of the Himalayan glaciers - the source of our major river systems - is a cause for particular alarm. Latest IPCC estimates suggest that they may shrink to one-fifth of their volume within a few decades. Initially this may cause floods as the waters melt - and then a water crisis of unprecedented proportions as the rivers dry. Seven of the world's major river basins originate in the Himalayan and Tibetan plateaus. They are the source of water for 40% of humanity. China, India, Nepal, Bhutan and Burma all share these borders. If the rivers do run dry, a more serious cause of regional destabilization can scarcely be imagined. When it happens, it will make India's current water conflicts such as between Karnataka and Tamil Nadu over the Cauvery look like a walk in the park in comparison.

But this is not only a story of human impact. It is estimated that up to 50% of the country's flora and fauna could be threatened, with at least a quarter of our biodiversity lost.

For a country with such a long and mythic self-identification with our plant and wildlife, the loss of our natural heritage will carry both socio-cultural as well as significant livelihood implications on the various communities residing in the region.

What should be the Social Work Response?

Thus the issue of social vulnerability of these communities at risk is of utmost concern. There are issues of livelihood, health, education, social problems and so encompassing most of the communities, households and individuals. Thus the already vulnerable communities are about to become more vulnerable as drawn out by research studies done on the eastern coastal region of India. Since India is a vast country with cultural and social diversities, social vulnerability needs to have local solutions since adaptation will have to be in terms of prevailing community in these diversified regions. Apart from the geographical locations and demography, there are other aspects which make social vulnerability more complex.

Thus as a social work professionals, there is a need to develop a social vulnerability and resilience index or indicators for the various communities at risk which would be a tool for the policy makers, development practitioners and community workers to refer to when intervening on issues of climate change. The researcher firmly believes that the social work profession can really enable communities to act as guides from their vast experience of adaptation and contribute in generating social vulnerability and resilience indices or indicators for the communities residing in our country. The adaptation practices of the vulnerability can act as guidance for the larger community for them to become more resilient.

Social Work Concerns:

Research across the globe has increasing awareness about the contribution of social aspects in vulnerability analysis and resilience as a tool of adaptation and mitigation for Disaster Risk Reduction.

Due to the climate change faced by the entire world today, countries like India where there are evidential facts of increase in extreme events, drought spells, increase in sea level rise, heat waves etc as an impact of global warming is an issue of great concern. Researchers across the globe are more in

agreement that social dimensions of vulnerability analysis and resilience have long been neglected. So far, more importance has been provided to physical and economic dimensions of vulnerability which has failed to adapt or mitigate different the effects in the communities. There is an increasing felt need for covering the societal or social aspects without which the research of vulnerability and resilience as tool for adaptation and mitigation is unable to produce the desired results.

India has a very complex nature of social fabric with people coming from different diversified backgrounds in terms of religion, caste, culture, class, beliefs etc. All this has resulted in a complex web of inter and intra social relationships, social institutional arrangements, formal and informal networks of relationships etc. There is already registered vulnerability in terms of resources due to conflict of resources resulting from excess stress and large pool of utilizes. More over, unlike developed countries where there are more resources then utilizes, it is not possible to have additional forces to meet the demands of crores of people. But it is marked that due to existing vulnerabilities due to lack of resources both material and non material, impact of climate change would render many communities more vulnerable. There is conflict not only at International, Regional or state level, but it will finally penetrate more into the social fabric at community, household and individual levels. The poor are expected to be worst sufferers. Also the vulnerable are likely to be more vulnerable and hence the adverse impact of climate change is likely to beget the achievement or fulfillment of the Millennium Development Goals aiming at social and sustainable development.

The top down approach has not worked well in reducing the risk of disasters because it fails to take into account the social vulnerability and resilience. There is a clear cut differentiation and integration of disaster risk reduction and climate change research which is an integral part of sustainable development. It can be short term or long term. One of the ways to adapt and mitigate is to take into consideration the social resilience at community, household and individual levels.

The Conceptual Framework:

Disaster Risk Reduction and Climate Change Adaptation:

Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) are interconnected thematic areas which both deal with common themes and address similar issues such as the impact of extreme weather events on vulnerable people as well as aim to reduce this vulnerability. Adaptation to recent and expected Climate Changes implies three tasks in particular: first adaptation to gradual changes, such as changes in average temperature and sea level rise, secondly reducing and managing the risk linked to extremes weather related events, such as cyclones, floods etc. Thirdly, address the shifts of climate zones which might subject some regions to risks which previously had not been experienced. Climate Change and Climate Change Adaptation (CCA) became the subject of particular attention in the wake of the IPCC Fourth Assessment Report (AR4) in 2007, which confirmed that the geographic distribution, frequency and intensity of natural hazards will be significantly altered by Climate Change. The AR4 report called for strategies for adaptation to Climate Change, and made reference to the increase in disasters and the relevance of disaster risk management. On the other hand, in the last few years, the UN International Strategy for Disaster Reduction (UNISDR) and the UN Framework Convention for Climate Change (UNFCCC) have stressed the need to link goals, strategies, frameworks, measures, tools and funding at the institutional and political levels. Under the Hyogo Framework for Action (HFA) endorsed by the United Nations General Assembly, member states are expected to promote the integration of risk reduction and adaptation to climate change strategies. The 2007 Bali Action Plan acknowledged the linkages between DRR and CCA through its calls for enhanced actions on adaptation, including disaster reduction strategy consideration and means to address loss and damage associated with climate change impacts in developing countries. It is an acceptable fact that to mainstream disaster reduction and climate change adaptation in country development strategies in order to minimize vulnerabilities to natural hazards.

Role of Community Based Disaster Preparedness in Disaster Risk Reduction:

Disaster management meant different for different players. For many decades prior to Major catastrophes like Orissa Super Cyclone (1999), Gujarat Earth quake & West Bengal Floods (2000) disaster management for respective state governments was to emphasis on early warning, evacuation, post disaster compensation, rehabilitation, shelter construction, i.e., basically reactive.

There are many models of disaster risk reduction and disaster management. While the traditional ones focused on the relief and recovery, the much more modern ones focused on the rehabilitation and preparedness ones. One such model was CBDP (Community Based Disaster Preparedness). While preparedness is vital in reducing the loss of lives, more important is changing the context of communities that make them vulnerable. The context in this case is their risky habitations, poor housing and sanitation conditions. They are in this context due to abject poverty, lack of health awareness and education. Sustainability of disaster preparedness lies in addressing these vulnerability conditions and changing their context, while organizing them to deal with disasters.

Initiator	Focus	Strategies	Activities	Scope and work area
Oxfam Since 1998	Address Factors of Cyclone & Flood Disaster Vulnerability	Community Empowerment, Multi stakeholder Involvement, Vertical & Horizontal expansion of disaster preparedness	Contingency planning Task force groups Formation, Livelihood promotion Disaster risk sharing Health, hygiene promotion, housing and drinking water.	Disaster (1996) affected communities in Communities in Coastal Andhra Pradesh, Orissa & Gujarat with a special focus on most marginalized communities.
UNICEF Since 2000	Address survival needs of communities in the first few weeks after massive flooding. Sustaining these initiatives with or without NGO intervention	Create equal ownership of Government & Communities. Use SHGs as entry point. Integrate with polio eradication programs, NGOs provide facilitation support and training.	Contingency Planning. Task force groups Formation, Family survival, child survival and pregnant woman survival kits. Promotion of low cost life saving kits, <i>Machans</i> , <i>elevated tube wells</i>	Communities affected by floods in the year 2000 in West Bengal
UNDP Since 2002	Local Level Risk Management	Capacity building to Institutionalize DRM systems in government	Multi- hazard preparedness and mitigation plans for DRM at State, district, block, village and ward levels	169 districts of 17 selected most multihazard prone States of India
CUBA Since 50 Years	Culture of Preparedness	Development model that reduces disaster risk	Appropriate legal Framework, National and local level contingency plans. Creation of social and human capital Disaster preparedness in schools & colleges	Entire country which faces hurricanes every year

The process of CDBP involves undertaking a needs survey of the villages as the initial step. These needs survey is based on the past experiences of the village when it faced a cyclone or when it had floods. This is ascertained with village meetings and discussion with different sections of the community including women. It is followed by community coming together to articulate its own strengths and weaknesses with respect to a disaster situation. Within this process, the community identifies threats and needs during a disaster e.g. cyclone, and plans a disaster management plan in response to these. The plan includes:

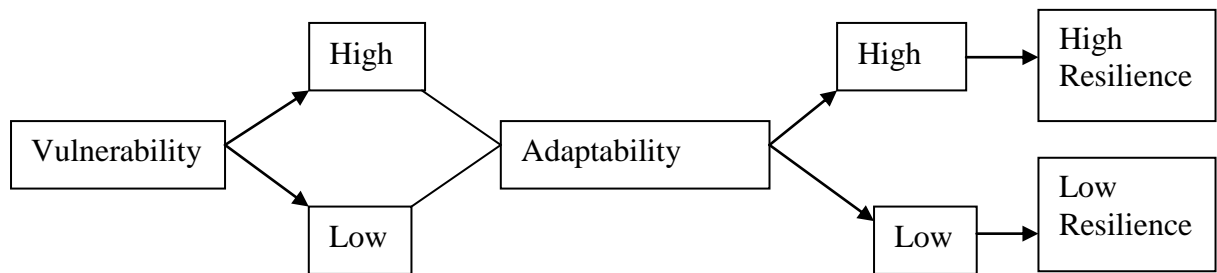
- Developing an area map,
- Identifying vulnerable areas and families,
- Discussing the past history of disasters,
- Developing contingency actions, and
- Forming key action groups.

This leads to preparation of community contingency plan and the task force. To develop the village contingency plan, the villagers come together and make a map of the village. On this village map, they then list the vulnerable population e.g. population with disability. They mark village assets such as boats, fishing crafts, etc. Community infrastructure, including shelters to be used in times of emergency, drinking water facilities, etc. also finds their way into this contingency map. The community then identifies the specific weather hazards it faces during a cyclone, such as winds, heavy rains, floods, mudslides and so on. This helps it determine what is at risk during these weather patterns – cattle and livestock, valuable family documents, houses and weak structures, livelihood assets such as boats, nets, stores of dry fish, pump sets, looms, standing crops, water bodies and so on. They also mark evacuation routes. These are useful for marking safe evacuation routes that will not be disrupted in the case of a cyclone. The community decides which family goes where and by which route to avoid crowding and panic. The community also identifies the existing health and sanitation facilities that can be used in the event of a cyclone. A very important aspect is the mobilization of village level contingency funds to be used in the case of a cyclone. The

village task force generally consists of Cyclone warning group, Shelter management group, Evacuation and rescue group, First aid and medical group, Sanitation group, Relief group and Patrolling group. It also calls for multi stakeholder participation, awareness and training in the entire process right from the community level to the block/taluka/tehsil to the state level encompassing community representatives in form of people, NGO, CBOs, VOs, government officials, corporate, educational institutions, health personnel etc. The main Herculean task however is integrating disaster preparedness into developmental planning. CBDP or CBDM provides a wide scope for such integration since it's a down up approach. Disaster risk reduction calls for collaborative action and commitment by all important stakeholders- the government, NGOs, communities, media and the academic community. Disaster preparedness helps reduce risk only when it is adapted in to daily lives consciously and consistently. CBDP is an effective tool for ensuring this kind of integration at the community level

Vulnerability and Climate Change Adaptation

Picking up this thread, looking at the field of Climate Change impacts and initiatives, apart from the initiatives being taken at the global platform mainly in terms of carbon rate emissions and a boost to green technology and renewable energy, it is at the community level, at the grass root that not only the coping capacity in terms of disaster risk reduction that is the key, it's the adaptability that makes the main difference. Adaptability helps build the resilience of a community, a household or an individual. The need however is establishing multi stakeholder platforms for adaptation that should be linked to national platforms for disaster risk reduction which have, in many cases, been shown to form an important mechanism to ensure a multi-stakeholder dialogue and a multidisciplinary approach. A key factor is the concept of **Vulnerability or Exposure**. Vulnerability assessment is seen as an essential element in risk assessment. Second is the **Sensitivity**, third is **Adaptive Capacity**. The combination of the three would say whether a particular community is vulnerable or resilient.



As shown in the figure, whether the vulnerability is high or low, if adaptability is low, it will result in low resilience but if the adaptability is high, it will result in higher resilience in the long run. This is because adaptability brings about a change in attitude based on transformational learning.

Based on the discussion so far, the present study takes into consider the following factors also:

Exposure in term of in terms of identified hazards, history of disasters, damage, loss of lives, damage/loss of personal property, damage /loss of livelihood tools and short term and long term impact.

Community vulnerabilities, vulnerable groups or population, warning and forecasting systems, traditional knowledge, depletion of resources, changes in coastal area, major changes in living after change and disaster preparedness.

Community resources in term of infrastructure and services related to housing, water, sanitation, health, basic infrastructure, education and skills, amenities, occupations, income groups and legal services.

Community resilience in terms of, risk knowledge, disaster recovery, diversity: in terms of livelihood and resource dependency (coastal and marine), supplementary and alternative livelihoods; knowledge and learning from changes, adaptability: in terms of vision and leadership, demographic changes (migration); and Self Organization: in term of linkages and networks.

This framework is an effective way of understanding the vulnerability or resilience enhancing factors. When two communities are compared, it provides which community is more resilient.

CHAPTER TWO

RESEARCH METHODOLOGY

Outline of the Chapter Research Methodology

Part I

Title of the study

Introduction of the research study

Significance of Study

Objectives

Research Questions

Research Design

Method of Data Collection

Operational Definition

Universe and Population

Sample and Sampling Method

Tools of Data Collection

Reference Period

Treatment of Data

Limitation of the Study

Chapter Scheme

Part II Research Setting

Area and coverage of study

Introduction to the chapter:

A sound research methodology based on practical aspects goes a long way and results in a good approach. The research topic being totally new area in India at the community level, the methodology is based on the experiences of the researcher and familiarity with the methods.

The first part contains the title of the study, significance, objectives, key research questions, research design, etc and the second part of the chapter focuses on the research setting.

Title of the study

Social Vulnerability and Resilience to Climate Change in Gujarat- A Social Work Response to Vulnerable Communities

Introduction of the research study

Climate change is not a myth. Climate change is affecting human life. Irrespective of the cause of climate change whether natural or human induced, the fact remains that nations are suffering due to climate change. The population bomb in India is ticking every day, making it very difficult to meet the needs of the population due to more pressure/stress on natural resources. India is also vulnerable due to its diverse geographical context in terms of long sea coast, mountainous region, massive rivers and desert like conditions. India has strong reason to be concerned. Climate change is projected to impact tropical countries more negatively than temperate ones. As a tropical country, our geography is our destiny. India's 7500 km coastline will be particularly hard-hit by storm surges and sea-level rise displacing millions, flooding low-lying areas, and damaging economic assets and infrastructure. The encroaching salt water will poison fields and make coastal agriculture unviable, deepening the crisis that is already full blown in India's farm sector. Just these impacts alone could severely test India's governance systems and its institutional and social resilience. Unless dealt with effectively they could also quickly turn into political challenges.

For the 700 million people in rural India who are dependent on the most climate-sensitive sectors for their livelihoods - agriculture, forests and fisheries - the future brings declining crop yields, degraded lands, water shortages and ill health. It also brings confusion and helplessness as people lose their traditional capacity to 'read' the weather and adjust accordingly.

When the rains do not come and when the natural world does not behave as it should, societies which have survived by observing the world and adapting to it lose essential coping skills. Gujarat has a long history of climate related hazards in form of droughts, cyclones and floods. Of late incidences of sea

level rise are also reported from many places like Udvada, coastal settlement along Jamnagar coast; etc. The entire coastline of Saurashtra and Kutch is susceptible to cyclones and storm surges. Due to climate change, the frequency of such hazards is increasing (data available with GSDMA). There is an increase in temperature and the year 2010 was one of the hottest year in the entire history so far where temperatures were as high as 48-49 degree Celsius. Thus in view of this, there is a need to identify communities which are more vulnerable in terms of climate change so that these communities can be taken care of on priority basis. There is a need to understand their resilience in form of adaptability so that grass root communities can survive with minimal outside help. Presently there is very little work done at National and State level to identify vulnerable communities to prioritize implementation of programmes except the DRM (Disaster Risk Management) exercise which was taken up. The need of the hour is to develop indicators for assessing vulnerability and resilience at the community level so that each community understands its vulnerability and resilience to meet the demands of climate change. This would help the people in identifying their needs for development and ultimately their resilience. This would enable developmental workers to plan programmes according to the community's priorities and work towards community resilience. Researches so far has been focusing on technical, geographical and social vulnerability. Programmes have been designed to reduce the vulnerability and increase economic, technical and geographical resilience but very less research has been carried out to tackle the issues of social vulnerability and resilience. Researchers today agree that unless the social vulnerability issue is tackled, the impact of technical resilience or economic resilience will not be able to have the optimum effect.

Conceptual Framework: Studies of vulnerability and resilience have multiplied with the growing realization that societal response, particularly societal capacity to adapt to climate change impacts, determines both the severity of impacts and the costs of adaptation. The definition and focus of such studies come from other research communities, including research in impacts of climate change (emphasizing physical impacts), natural hazards and disasters (the hazards themselves plus societal preparation and

response/recovery), and sustainability (societal conditions and decisions about using natural resources). Although research in vulnerability and resilience began by emphasizing vulnerability, the focus has shifted at least in part to resilience as a positive concept that can be more integrated with general development goals.

The present study is based on the theory of resilience in terms of community resilience. Social workers have used this theory with more stress on analysis of vulnerability but there is a growing interest among the professionals to develop the theory further by focusing more on the resilience. This study therefore is based on both the dimensions- vulnerability and resilience.

The three major dimensions are Social Vulnerability, Adaptive Capacity and Social Resilience. Following are the key definitions used for the conceptual framework for the study:

Climate Change:

UNFCCC (United Nations Framework Convention On Climate Change) definition:

A change of climate, which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’.

Extreme Events: (IPCC 2001)

- Higher maximum temperatures and hotter days
- Higher minimum temperatures, fewer cold days and cold waves
- Increased summer drying and associated risk of drought
- Increased tropical cyclone peak wind intensities
- Intensified drought and floods associated with EL Nino events
- Increased Asian Summer Monsoon
- Increased intensity of mild latitude storms

Adaptive capacity (IPCC 2001)

Adaptive capacity is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

(It is important in CC in two ways- in reducing the impacts of the future climate change and in understanding the options for such adaptation to climate changes in face of the fact that Asian region is most vulnerable to climate change impacts due to its vulnerability which is socially differentiated)

Social vulnerability

Social Vulnerability is the exposure of groups or individuals to stress as a result of social and environmental change, where stress refers to unexpected changes and disruption. (W. Neil Adger 98-02)

Social Resilience:

Social resilience is the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change. (W. Neil Adger 2000)

Social Vulnerability and Social Resilience:

Vulnerability determines the extent to which individuals or a community will potentially suffer from climate-related events and resilience is the ability to manage and adapt. It incorporates the notions of self-organization and the ability to learn, cope, and maintain future options. Rather than a concern about how to stop, change or minimize impacts, resilience is the ability to manage and adapt to change.

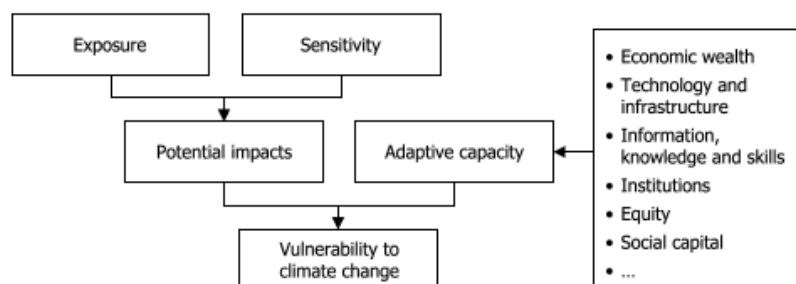


Figure 1: Graphical representation of the conceptualisation of vulnerability to climate change in the IPCC Third Assessment Report.

Significance of Study

Social indicators provide a means of measuring social characteristics to provide decision-makers with an effective and influential tool. The review of literature carried out so far reveals that the theory of social indicators in terms of vulnerability, resilience and adaptive capacity to climate change is largely based upon the quantitative indicators. The emerging challenges of integrating disaster management and climate change into development needs more research based on the qualitative dimensions of social vulnerability and social resilience. Though for assessing the overall vulnerability and resilience of the community, region or nation needs a multidisciplinary approach, the contribution of social indicators is of immense importance to complex issues of climate change. It calls for more research especially from people involved in sociology and social work. Contribution in the field of qualitative social indicators will enable social scientists, researchers and practitioners to have more tailor made approaches to make communities more resilient to climate change taking into consideration their perceptions. It is the inherent vulnerability of the communities which needs to be dealt with using adaptive capacity. Moreover, the present study also proposes to suggest toolkit for practitioners to make communities more resilient.

Purpose:

The purpose of the study is to develop social vulnerability and social resilience indicators based on community's perceptions for developing

community specific vulnerability and resilience index and suggest toolkit for making communities more resilient to climate change.

Objectives

1. To understand community's perceptions regarding social vulnerability and social resilience to extreme events/Sea Level Rise and develop indicators.
2. To understand how social vulnerability intensifies the vulnerability of the community when exposed to extreme events/Sea Level Rise
3. To understand how adaptation measures of the community increases the social resilience of the community and decreases the social vulnerability of a community to extreme events and climate change
4. To develop community specific social vulnerability and social resilience indicators for developing Social Vulnerability Index (SVI) and Social Resilience Index (SRI)

Research Design

The research design is exploratory in nature since the study undertaken will try to explore different indicators involving community people and social scientists and researchers. Different dimensions of social vulnerability and social resilience will be explored using different tools and methods.

Methods of Data Collection:

Both qualitative and quantitative methods are used for the research. It was ensured that the two methods supplemented and complimented each other. An indicator that was used in qualitative method was also tested in the quantitative method so that there was no ambiguity in data collection.

The entire qualitative data was collected by the researcher and help for taken from the two emulators who were trained by the researcher on field for quantitative data collection.

Universe and Population

The universe consist of two coastal districts of Gujarat (Valsad and Junagadh) where incidence of Sea Level Rise/Coastal erosion has been noted and also extreme weather conditions are prevailing like cyclones, floods and droughts. These areas are also susceptible to Tsunami. All the families of fishermen residing on coastline of the two villages will be the universe of the study.

Sample and Sampling Method

The sampling is Purposive in nature. Moreover sampling procedure is as under

1. Community: Horizontal spectrum (various groups) considered for sampling.
2. Key Informants from community
3. Key Informants at District level/Taluka level – Collector, DMO
4. Groups of Men, Women, Youth and Elderly from the two communities
5. Households (10%) of the selected community through systematic random sampling

Inclusion Criteria

1. Coastal Community which has already experienced extreme events/ Sea Level Rise
2. Community residents in the age group of 15+
3. Old Men & Young Men, Old Women & Young Women, Youth & Children
4. Village level functionaries like PRI member(s)
5. Functionaries of CSO/NGOs/CBOs working in the community

Exclusion Criteria

1. Coastal Community which has not experienced extreme events/Sea Level Rise
2. Community residents who have now settled down in other part of the village/other villages/towns/cities
3. Community Residents below 15yrs

Sample Size:

1. One community (a village or community within village) in each selected district. A total of 2 fishermen communities
2. Minimum 10 Key Informants from each village (5 members, 5 others including CBO/NGO/Others)
3. Focus Group Discussions (5- 6 per village)
4. 10% of the affected household of these two communities

Tools of Data Collection:

The tools were first used for pilot study in both the communities and then were modified accordingly.

1. Focus Group Discussions : Observation Guide
2. Transect Walk/Seasonal Calendar: Personally with village volunteers
3. Key Informant Interviews : Interview Guide
4. Household level Interview : Interview Schedule

The household tool is based upon a similar tool adapted in Building Social Resilience into human marine communities in and around MPA (Marine Protection Area) used by Nadia P. Abesamis, Colleen Corrigan, Mark Drew, Stuart Campbell, Giselle Samonte in the project MPA Networks Learning Partnership, Global Conservation Program, USAID, September 2006. The group had designed the tool based on the social resilience principles and variable from folke et al 2003. This tool was used as a guideline to develop the present one used in the study as per requirement and was tested in a pilot bases in both the communities.

Reference Period:

The major data was collected from the study area during the period of April 2010 to September 2010 in both the communities.

Treatment of Data

The data collected at the household level was quantitative in nature. A comparative analysis of the quantitative data analysis was carried out and

single variate tables were computed. The qualitative data from the FGDs was analyzed in form of transcripts and grouped together under common sectors. Similarly, the data from transect walk was analyzed according to the important sectors and important observations were noted as points. The qualitative data in form of qualitative interviews of key informants was analyzed and grouped as per the emerging important sectors.

Limitation of the Study

1. The major limitation of the study is that social vulnerability or social resilience by itself alone cannot measure the vulnerability or resilience of a community. A multi disciplinary approach is needed.
2. Due to constrain of financial resources and time, the study is restricted to two communities of two villages of two districts of Gujarat only.
3. No specific studies have been carried out exclusively for social vulnerability and social resilience in Indian as well as in Gujarat and hence the researcher had to depend on researches carried out by other countries for disaster risk reduction and climate change in developed and developing countries.
4. Dependency on Gujarat State Disaster Management Authority (GSDMA) and Department of Climate Change, Gandhinagar for finalizing the selection of communities acted as constrain.

Chapter Scheme

The thesis will be presented in form of the following chapters:

1. Introduction
2. Review of Literature
3. Research Methodology
4. Data Analysis and Interpretation
5. Findings, Discussion and Recommendations
6. Bibliography
7. Annexure

Some Research Experience:

Since the topic of the study is new one, the researcher had some totally different experiences while undertaking the data collection. In spite trying to contact department of climate change, the researcher could not get an appointment. Moreover there is neither a website of the department nor any material available for the downloading. Thus what is functioning of the department etc could not be known except from the newspapers. GSDMA (Gujarat State Disaster Management Authority) was approached and the researcher had a meeting with Dr. Ranjeet Banerjee (CEO) and he informed that GSDMA is not involved in climate change activities. Thus there was a clear lack of coordination between the two organizations. At the district level and the taluka level also, people were nearly unaware about the functioning of the department of climate change. Mamlatdar, Taluka Development Officer and other functionaries were totally unaware about the issue of climate change but they knew about disasters and the DRM activity. The Non government organizations on the contrary knew some things since their organizations were undertaking planning of one project or the other which took into consideration issues of climate change. Thus the researcher had to indirectly ask questions pertaining to climate change for seeking information.

Apart from this, people at all levels tried to help the researcher in whatever way they could. They were inquisitive about the topic and wanted to know more about it. They expressed their interest in the topic and shared their observations once they knew what climate change is. The response of both the community people was amazing. They shared about their lives and their community and offered good hospitality. The leaders have expressed their interest in willingness to help any other researcher who would take up such researches in their community.

Part II Research Setting

India

Gujarat

Junagadh District

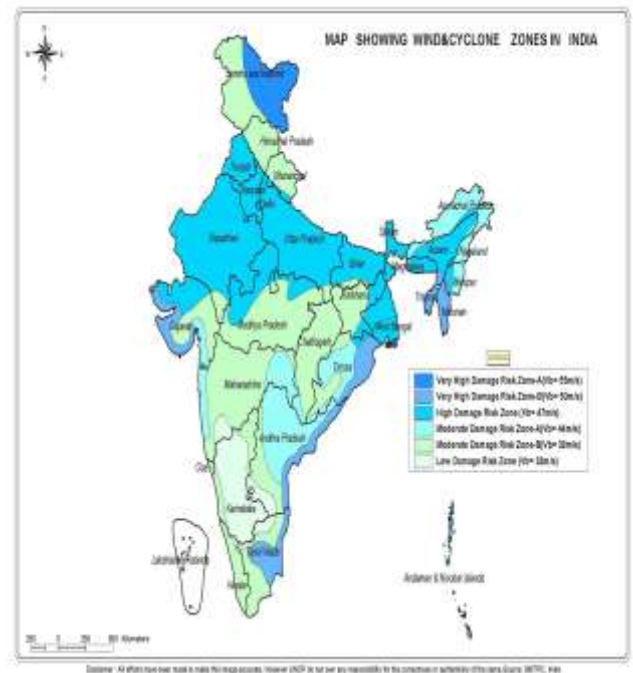
Valsad District

Madhavadi

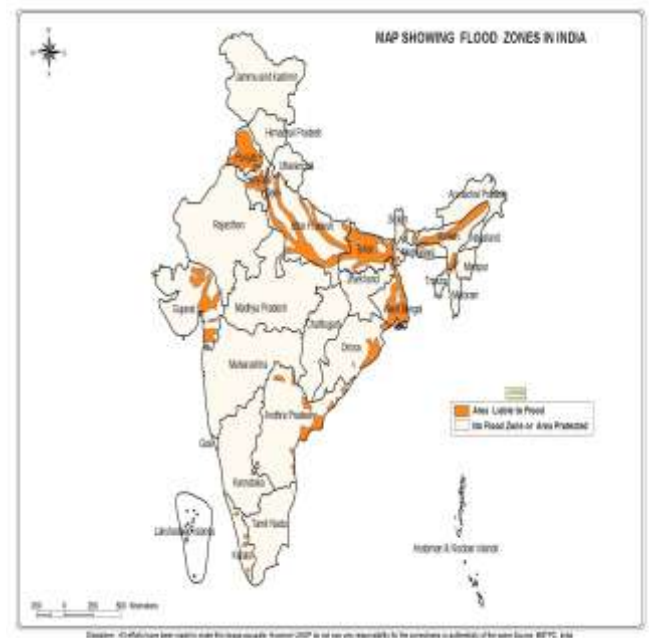
Umarsadi

Hazard Profile of India:

As seen in the cyclone hazard map of India, Gujarat state shoreline falls under the second most sensitive zone especially the eastern coastline



As seen in the flood zone hazard map of India, Gujarat state, especially the eastern parts are prone to flood zone hazards. This also includes the selected Valsad Taluka in south Gujarat.



Gujarat is a state in western India. It has an area of 75,686 sq mi (196,030 km²) with a coastline of 1,600 km, most of which lies on the Kathiawar peninsula, and a population in excess of 60 million. The state is bordered by Rajasthan to the north, Maharashtra to the south, Madhya Pradesh to the east, and the Arabian Sea as well as the Pakistan province of Sindh on the west. Its capital city is Gandhinagar, while its largest city is Ahmedabad. It is one of the most industrialized states of India, and has a per capita GDP above the national average.

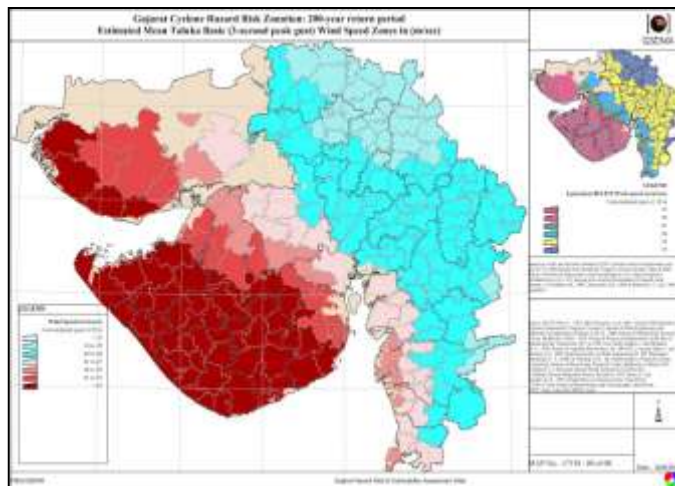


Demographic Profile of Gujarat (2001 Census)

Estimated Population	6.03 Crores
Actual Population	60,383,628
Population Growth	19.17%
Area km ²	196,024
Area mi ²	75,685
Density/km ²	308
Density/mi ²	798
Male	31,482,282
Female	28,901,346
Sex Ratio	918
Percentage of total Population	4.99%
Literacy	79.31
Male Literacy	87.23
Female Literacy	70.73
Total Literate	41,948,677
Male Literate	23,995,500
Female Literate	17,953,177

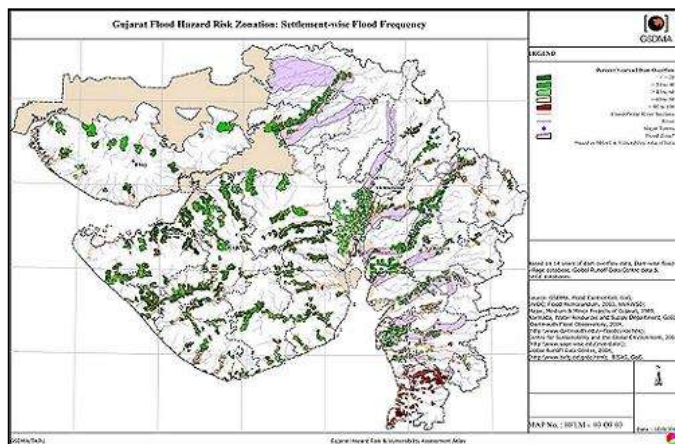
Hazard risk profile of Gujarat State:

Cyclone Hazard Risk:



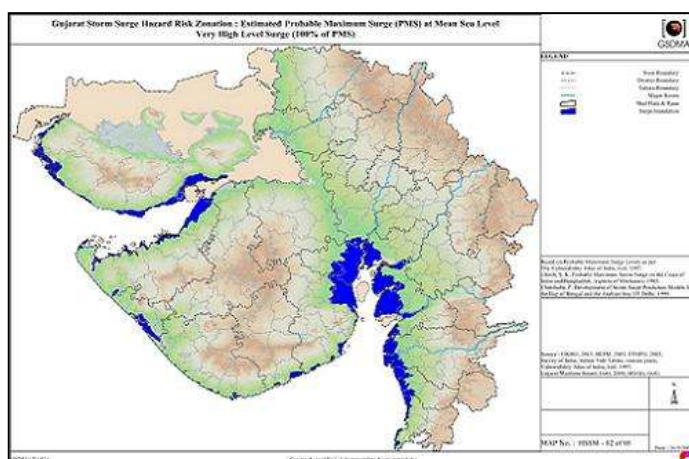
The hazard risk profile of Gujarat indicates that the entire eastern coastline of the state right from Kotesware in Kutch till around Bhavnagar coast including Junagadh district, the entire coastal area falls under high intensity cyclone hazard zone. The sea coast from Khambhat to Umargam area falls under the mediate zone..

Flood Hazard Risk:



As seen from the flood hazard risk map of Gujarat, both the selected communities are prone to flood hazard risk in Junagadh and Valsad district respectively.

Storm Surge Hazard Risk :



As depicted in the storm surge hazard risk map of Gujarat, both, Umarsadi in Valsad and Madhvad in Junagadh district fall under high storm surge zone in Gujarat.

Valsad District

Geographical location	72.73° to 73° East (Longitude) 20.07° to 21.05° North (Latitude)
Area :	2,939 sq. km
District headquarter :	Valsad
Population :	1,410,553 (As per Census 2001)
Population density :	423 persons per sq. km
Sex ratio :	920 Females per 1000 Males
Literacy rate :	69.41%
Airport:	Surat
Nearest port :	Hazira
Major Industrial	7 Industrial Estates and Port based park



Junagadh District

Geographical location	69.40° to 71.05 ° East (Longitude) 20.44 ° to 21.40 ° North (Latitude)
Area :	8,846 sq. km
District headquarter :	Junagadh
Population :	24,48,173 (As per 2001 Census)
Population density :	277 persons per sq. km.
Sex ratio :	955 Females per 1000 Males
Literacy rate :	68.35%
Nearest Airport :	Keshod
Nearest port :	Veraval port
Major Industrial	6 Industrial estates, Integrated Textile Park.



Vellan- Kotada- Madhvad Village:

The village is around 15 kms from the taluka head quarters at Kodinar. Kodinar is an important taluka of Jamnagar district. The village lies on the sea shore of the Arabian Sea. Once, it had a jetty of its own which over the years was rendered non functional. On one side is the Sodham Wetland and the Sodhan Check Dam is within the village. There is mangroves plantation as we enter the village. It is well connected by road. Though the village is one, the people have already applied for a separate Panchayat at Madhvad. Madhvad is 3 kms away from vellan.

For the research purpose, Madhavad with its 700 households was selected as a community. Madhavad has the entire infrastructure necessary for a community. The major ones being, a prathana mandir, overhead tank, public toilets (sauchalaya), primary school, Aanganwadi, electricity, water facility etc. The community is a fishermen community all of whom belong to the Kharvas.

Being a part of the Gir forest –Sodham wet land – coastal ecological system, the community is very unique. It has witnessed many climatic hazards in form of floods and cyclones and storm surges.

Umarsadi Macchiwad- Mangelwad- Desaiwad:

Umarsadi is situated in Pardi Taluka of Valsad district of Gujarat State. It is situated on the Arabian Sea. The village is well connected by road. There is a railway station at Pardi which is around 6 kms from the village. Though the village is one, Umarsadi macchiwadi has already applied for a separate Panchayat. It is surrounded by Par river on the right hand side and in the north is the Arabian sea.

For the research purpose, Umarsadi Macchiwad with its 1000 households was selected as a community. The entire community belongs to fishermen and they all are Machimars. The community has all the necessary infrastructure for functioning in form of drinking water supply of the Panchayat, overhead tanks, Aanganwadis, public toilets, primary school, electricity, laxmi narayan temple, prathana mandir, jetty, etc.

The community is part of the Vaghai forest range- coastal ecology-Valsad-Vapi Industrial area. Thus on one hand it has coastal ecology and on the other hand, there is industrialization in the vicinity.

It is situated in the moderate cyclone zone and high flood and storm surge zones. The community has witnessed many cyclones and flooding in the surrounding areas. Coastal erosion is too high in the area along with industrial pollution.

CHAPTER THREE

REVIEW OF LITERATURE

Review of Literature

Introduction

Review and Assessment of Literature

Introduction:

Research on Social Vulnerability and Resilience to Climate Change is a very rare topic of research in India. The researcher has contacted many academic institutions and libraries and found out that this topic has not been touched upon. There are many researches on disaster management but very few on climate changes. Most of the researches on climate change are in the field of environment sciences but almost none on social sciences especially social work.

Hence the researcher has tried to do justice to the topic by first highlighting on the resilience theory in social work practice. Social work has always focused on vulnerability in terms of individuals, groups and communities and the resilience factor for a long time had been on back front but slowly, this factor is coming to the forefront. The review focuses on the paradigm shift to the strengths perspective from late 1990s onwards in social work.

This chapter then focuses on the use of social indicators as used by people from different fields for research purpose and how they are important for the society and development. It tries to capture the developmental history regarding the social indicators. Since climate change is closely related to natural hazards and disasters in case of extreme events, the researcher has tried to highlight the use of indicators for hazard, disasters, climate change and vulnerability. The review further focuses on social vulnerability and development of social vulnerability index and Social Vulnerability Maps.

It then focuses on Social Vulnerability and Resilience in the context of climate changes and provides some case studies to support the entire review of literature.

The review tries to do justice to the topic of research in the best possible manner.

Thus this chapter contains theoretical inputs made by various scholars as well as researchers done on the above mentioned aspect or efforts undertaken by them to develop vulnerability and social indicators and index

Social Work and Resilience Theory

Social work's commitment, as a profession, to resilience and strengths has a confusing history. At face value one may think social work has always thought and worked within a resilience framework, even if it was without calling it by that name. Generally speaking, social work's origins included a commitment to developing client strengths. Social work as a professional community led to an alliance with psychoanalysis with its pathogenic worldview focusing on client's vulnerability. Only more recently, with the emergence of the ecological perspective, has social work begun to reclaim its strengths-based roots. Social work's first roots lie in the Charity Organization Society and the Settlement House Society at the end of the nineteenth century. Industrialization at that time resulted in greater levels of social pathology than seen before – unemployment, child abuse, homelessness, poverty. Workers in form of friendly visitors and case workers had to develop innovative ways to meet these challenges. Gradually, family and community oriented interventions evolved. The workers from the Charity Organization Society, a religious organization, attributed social problems to individual-level moral deficits. Poverty was attributed to drunkenness, intemperance, ignorance, and lack of moral will. Change was to come about not through provision of monetary assistance but through persuasion and friendly influence. By contrast, the workers from the Settlement House Movement emphasized environmental factors as causative of social pathology. They believed that resources such as housing, sanitation, education, neighborly assistance, and enriched social interactions would enable people to move beyond the limits of their situations.

This saw the emergence of community work. This focus removed the view of individuals as dysfunctional, but simply transferred the deficit and pathology oriented perspective to the community level. It cannot be said that either of these approaches was based in some conception of resilience or strengths.

In the first decades of the twentieth century social work began a process of professionalizing. Mary Richmond advocated a more empirical, rational or scientific approach to helping, rather than a moral or intuitive approach. Increasing attention was paid to defining the problems in people's lives so that a rational, rather than a moralistic, strategy of intervention could be pursued. In Richmond's work the individual perspective continues to dominate, but she advocated the need to assess both pathology and strengths or resources.

The psychosocial casework models of Hamilton and Hollis in the 1950s and 1960s attempted, through the incorporation of the person-in-environment concept to promote an approach to social work that (1) focused on both individual and environmental problems and (2) focused on both weaknesses or deficits and strengths. Perlman's problem-solving model of casework initiated the movement of social work towards a greater appreciation of strengths and resilience. He was able to teach the use of strengths in helping clients solve problems. The concept of coping itself implied a strengths potential when defined as a person's conscious, volitional effort to deal with himself and his problem in their interdependence.

Social work theories and models which have evolved over the past few decades tend to provide a greater opportunity for the incorporation of a strengths or resilience perspective: Germain and Gitterman's life model, Shulman's interactional model, Middleman and Goldberg's structural model and Pincus and Minahan's systems model. These models all integrate the person and environment components of social work interest, and provide a more holistic and system oriented explanation for human functioning.

Recent models and theories of social work practice, such as the strengths perspective and the narrative approaches support a resilience framework.

The Strengths Perspective

The strengths perspective is a new paradigm for social work theory and practice, in which the focus is on the strengths and capacities of clients, rather than the problems of clients. Strengths can be described as follows (McQuaide & Ehrenreich, 1997): **The capacity to cope with difficulties, to**

maintain functioning in the face of stress, to bounce back in the face of significant trauma, to use external challenges as a stimulus for growth, and to use social supports as a source of resilience. The list of strengths is lengthy. Saleebey (1997) has identified several groups of strengths, including: What people have learned about themselves, others and their world, ... personal qualities, traits, and virtues that people possess, ... what people know about the world around them, ... the talents that people have, ... cultural and personal stories and lore, ... pride, ... [and] the community.

Clearly, a great deal of further work is required of social workers to explore and integrate resilience theory into the profession. Given the history of social work, it is likely that such integration will be appropriate but conflictual.

Social Indicators

Social indicators have been in use since the Roman Empire when it was used for the administrative and policy making purposes. It was in 1960's that the social indicators research and its use gained momentum in United States and United Kingdom. The whole two decades of 1960 and 1970 saw emergence of use of social indicators by experts from social sciences.

In Europe, in the 1960s a "social indicator movement" was initiated. While in the 1960s social indicators were primarily developed to assess societies economic growth, social indicators are nowadays adopted in a broader sense and are also related to the assessment of technologies or the assessment of political strategies, especially in reference to sustainable decision making strategies. For this, various surveys on indicators were carried out.

In United States, one of the most famous is the U.S.'s Index of Leading Economic Indicators, a composite of ten economic variables used to estimate future economic activity. There is a rich tradition within the social and environmental sciences on the development of indicators beginning in the 1940s with economic indicators. Social indicators were more prominent in the 1960s and 1970s, followed by environmental indicators. The 1990s witnessed more emphasis on the development of indicators for environmental

sustainability as well as for vulnerability. A special report states 394 studies carried out for social indicators during 1960 to 1999 in U.S.

In India, so far, it's the HDI which is being used by majority. India is yet to come out with its own social indicators at local, regional or national level. Much sporadic work has been done in India especially in terms of developmental or sustainability at community level or project levels.

Vulnerability Indicators:

The 1990s witnessed more emphasis on the development of indicators for environmental sustainability as well as for vulnerability.. The use of indicators and indices to measure attributes of interest for a system continues to gain momentum. With hazards vulnerability, issues such as social networks trust in the government, and institutional capacity and disaster readiness, which are difficult to quantitatively measure, are evident. The result is that vulnerability indices are limited in the scale of analysis (geographic unit and timeframe). There are further limitations in the comparability between various indices because each uses a different set of variables, geography, or approach to the construction of the index. Because of these problems, vulnerability indices are better cast as descriptions of existing and anticipated conditions rather than as predictive tools. In this regard, vulnerability indices can guide policy development on vulnerability reduction at national and sub-national scales, and serve as a means of measuring progress towards that specific goal

Hazards, Disasters, Climate Change and Vulnerability Indicators

Research continues on the development of quantitative indicators of climate variability and adaptation to climate-related hazards at multiple scales of analysis. Indicators for vulnerability and adaptation to climate change and climate variability face many of the same challenges as other vulnerability indices

The development of indicators is still in its infancy. One of the issues is how to incorporate hazard or disaster vulnerability indicators into climate change vulnerability assessments. For example, Brooks and Adger (2003) argue for the inclusion of natural disaster risks, particularly climate-related disasters in assessing vulnerability to climate change and variability. Using data on the number of fatalities and individuals affected by climate-related disasters to construct global climate risk indicators, they provide information on individuals who will be better able to adapt and deal with the long term impacts of climate change and variability, what we refer to **as resilience**.

O'Brien et al. (2004) used the IPCC definition of vulnerability, which includes the elements of exposure, sensitivity, and adaptive capacity to map vulnerability of agriculture in India to both climate change and globalization at a sub-national level. Comprised of three sets of biophysical, social, and technological indicators, they used a combination of mapping techniques and local case studies to identify the high-vulnerability districts of Jhalawar, Anantapur, and Chitradurga(Carried out by TERI). Like O'Brien et al. (2004), Deressa et al. (2008) also examined vulnerability to climate change and variability by local farmers based on the IPCC's definition of vulnerability. Using a combination of socioeconomic and biophysical indicators, they developed a vulnerability index and applied it to a case study of seven regions in Ethiopia.

The Livelihood Vulnerability Index developed by Hahn et al. (2009), used several indicators to assess the impacts of climate change and variability among individuals residing in two districts in Mozambique. They use primary data gathered from household surveys in the study area based on the following components: socio-demographic profile, livelihood strategies, social networks, health, food, water, and natural disasters and climate variability. This index weights all indicators equally when assessing those factors that determine sensitivity and exposure to climate change impacts.

The **Dynamic International Vulnerability Assessment (DIVA)** tool developed by Torresan et al. (2008) employ the methodology to assess

vulnerability to climate change and sea level rise along the coast of Venetia, Italy. The majority of indicators that are used are biophysical encompassing dimensions like geomorphology, topography, and vegetation. Because there are so few regional vulnerability assessments of climate change in coastal environments, they perform their analysis at the regional scale, and compare it to the global scale using the same variables.

Moss et al. (2002) developed a **Vulnerability-Resilience Indicator Prototype (VRIP) model** that assessed the ability of different groups to adapt and cope with climate change in 38 different countries. Indicators that reflected sensitivity and coping capacity included a combination of environmental and social factors like food, water, health, environment and economics. The proxies were scaled against global data to get the overall national baseline of vulnerability and resilience for each of the countries. Brenkert and Malone (2005) in an extension of that work applied the **VRIP model to India** for a more in depth analysis of climate change vulnerability. Finally, Sullivan and Meigh (2005) developed a Climate Vulnerability Index comprised of six indicators encompassing resource, access, capacity, use, environment, and geospatial dimensions. They suggest their index has applicability and comparability across various scales of analysis from small island developing nations (SIDs) to the national level. However, there is no theoretical discussion of indicator choice or the specific indicators.

Social Vulnerability (Hazards)

Social vulnerability describes those characteristics of the population that influence the capacity of the community to prepare for, respond to, and recover from hazards and disasters. Social vulnerability interacts with natural processes and the built environment to redistribute the risks and impacts of natural hazards and in this way creates the social burdens of hazards (Cutter et al. 2003). Social vulnerability helps to explain why some communities experience the hazard differently, even though they experience the same level hazard. Unlike biophysical vulnerability or other exposure indicators, social vulnerability is present, independent of the hazard type or threat

source. In other words, social vulnerability is a pre-existing condition or an inherent property of existing communities, irrespective of the natural hazard of interest.

To understand the Race, Class, Gender and other Correlates of Social Vulnerability within the social science and disasters literature, researchers generally focused on those social factors that increase or decrease the impact of specific natural hazard events on the local population. These include socioeconomic status (wealth or poverty); age; special needs populations; gender; and finally, race and ethnicity.

Socioeconomic status influences the ability of individuals and communities to absorb the losses from hazards. In general, people living in poverty are more vulnerable than the wealthy to hazard impacts as they have less money to spend on preventative measures, emergency supplies, and recovery efforts. The losses sustained by the poor are far more devastating in relative terms. Poor people are more likely to live in substandard housing, which can be a major disadvantage when disasters occur and during disasters, are less likely to have access to critical resources and lifelines, such as communications and transportation. Some research suggests that working class families tend to experience long-lasting impacts from disasters (Dash and Morrow 2007).

The influence of race and class has a long history of producing social inequalities. These were highlighted in the differential impact of and response to Hurricane Katrina (Cutter et al. 2006). The impacts associated with it were more related to the underlying socioeconomic inequalities within the affected population rather than the hurricane's intensity. Racial and ethnic minorities are more vulnerable to hazards because minorities are more likely to live in poverty. Discrimination also plays a major role in increasing the vulnerability of racial and ethnic minorities. Ethnic communities are often geographically and economically isolated from jobs, services and institutions. Where minorities are immigrants from non-English-speaking countries, language barriers can greatly increase vulnerability to a disaster and recovery (Peguero 2006; Leong et al. 2007a,b; Trujillo-Pagan 2007).

Gender also affects social vulnerability. Women are more vulnerable than men to disasters, mainly because women— especially single mothers or women headed households — are more likely to live in poverty. Women often suffer the impacts of a disaster disproportionately. For example, women are more likely than men are to hold low-status jobs in the service industry, which often disappear after a disaster strikes (Morrow 2008). Women are also more vulnerable to disasters because of their roles as mothers and caregivers: when disaster is about to strike, their ability to seek safety becomes restricted by their responsibilities to the very young and the very old, both of whom require help and supervision.

Both the young and the elderly may be unable to respond to disasters without outside support. (Smith et al. 2009). Children who lack adequate family support are at a major disadvantage for disaster response. Disruptions created by a disaster can have significant psychological and physical impacts on children (Kar 2009). Generally, the elderly are more likely to lack the necessary physical and economic resources to respond effectively to a disaster. They are more likely to suffer health problems and experience a slower recovery. The elderly also tend to be more reluctant to evacuate their homes in a disaster. In addition to the physical difficulties imposed by evacuation, the elderly become distressed at the prospect of leaving their own homes and living even on a temporary basis, in a group setting (Gladwin and Peacock 1997).

People living with mental or physical disabilities are less able to respond effectively to disasters and require additional assistance in preparing for and recovering from disasters (McGuire et al. 2007). Emergency managers need to target areas with high concentrations of disabled people, particularly in group-living quarters, for early evacuation and other preparatory measures (Morrow 2008).

It is important to note from the discussion above that the proportion of residents characterized by these broad categories is important, but also how

each factor or variable interacts to produce socially vulnerable populations. It is often the intersection of gender, race, class, and family circumstances that most influence the social burdens from natural hazards.

The Social Vulnerability Index

In 2000, Cutter et al. operationalized the Hazards-of-Place model to reveal the vulnerability of populations living inside hazard zones for Georgetown County, South Carolina. To quantify social vulnerability, nine indicators were chosen deductively, based on *a priori* knowledge from the existing literature. These included total population and total housing units (i.e. proxy of people/structures at risk); number of females, number of nonwhite residents, number of people under age 18, and number of people over age 65; mean house value (i.e. proxy for wealth, resilience); and number of mobile homes (i.e. proxy level of structural vulnerability). Indicators were collected for block groups using 1990 US Census Statistics. Rather than using simple percentages to represent indicators, each social variable was standardized by determining a ratio of that variable in each census block to the total value of that variable for the entire county to create a comparative proportion for each variable in each block. To produce an aggregate value for social vulnerability, standardized values were summed for each block. This score was then combined with the aggregate values for biophysical vulnerability (derived from frequency of hazard occurrence) using a GIS. Lacking the reliable theoretical or statistical evidence needed to assign weights, all indicators had the same relative importance (equal weight) within the GIS.

Chakraborty et al. (2005) used those methods developed by Cutter et al. (2000) to develop the **Social Vulnerability for Evacuation Assistance Index (SVEAI)** for block groups in Hillsborough County Florida. SVEAI used ten indicators, similar to those chosen by Cutter et al. (2000) with some minor changes to reflect those populations that may have special evacuations needs (i.e. disabled) and those who have differential access to evacuation resources inside their home (i.e. no telephone or vehicle). Rather than simply summing the standardized variables, values were averaged yielding aggregate

vulnerability normalized between zero and one. In further contrast from Cutter et al.'s (2000) metric, Chakraborty et al. presented four alternative approaches for grouping the variables to calculate social vulnerability for evacuation and for examining the spatial distribution of each approach within the study area. These characteristics are listed below, along with the number of variables associated with each approach: Approach 1: Population and structure (three variables); Approach 2: Differential access to resources (three variables); Approach 3: Special evacuation needs (four variables); and Approach 4: All three characteristics (all 10 variables). Each approach addresses a specific dimension of evacuation assistance need that can be examined and visualized independently, a process that recognizes the different issues that local emergency managers face in developing evacuation plans. Using the methods of Cutter et al. 2000, SVEAI was combined with a geophysical risk index (hurricane risk and flooding). The resultant values indicate overall evacuation assistance need.

In 2003, Cutter et al. developed the **Social Vulnerability Index (SoVI)**. Based on the social dimensions of the Pressure and Release and Hazards-of-Place models. SoVI is a multidimensional, scale dependent, spatially reliant algorithm for quantifying the relative socio-economic and demographic quality of a place as a means of understanding vulnerability. Using an inductive factor analytic approach, 42 socioeconomic variables (derived from US Census and County Data Books) reduced to 11 statistically independent factors, which accounted for about 76 percent of the variance at the county level for the entire United States. These factors were aggregated using a simple additive model to compute a summary score (i.e. the SoVI score) (Cutter et al. 2003). Again, no *a priori* weights were assigned during any point of aggregation. Those factors that contribute to the overall score often are different for each county, underscoring the interactive nature of social vulnerability—some components increase vulnerability while others reduce or moderate the SoVI score. SoVI attempted to uncover places having an uneven capacity for preparedness and response; places where resources might be used most effectively to reduce the pre-existing vulnerability). Unlike previous indices, SoVI is designed as a stand-alone indicator. This is concurrent with the

accepted theoretical understanding that social vulnerability is independent of hazard type. Zones of differential exposure to any or all hazards combine with SoVI to create place vulnerability (Burton and Cutter 2008).

A common critique of comparative statistical research, particularly those focused on national level analyses, is that it fails to capture the sub-national spatial and social differentiation of vulnerability and local conditions that mediate the capacity to adapt.

Social Vulnerability and Resilience in the Context of Climate Change

Vulnerability assessment has become a noteworthy subject in the field of applied global change (McCarthy et al. 2001). The acknowledgement of a probable increase in the frequency and intensity of hazard events such as hurricane storm surge, flooding, and the potential exacerbation caused by sea level rise has yielded an increased interest in pre-hazard planning and emergency preparedness for climate related hazards (Adger et al. 2004). Most of these studies focus on the physical dimensions of climate hazards answering more the “What, Where and When” of climate hazards, rather than the “Who and Why”. Earlier assessments of the human dimensions of climate impacts focused more on specific impacts in developing countries, such as food scarcity (Bohle et al., 1994). SoVI and variants of it now are beginning to appear to quantify local-scale social vulnerability to climate variability impacts.

Vincent’s (2004) index of **Social vulnerability to climate change in Africa (SVA)** uses the conceptual implementation of the global climate change community’s alignment of social vulnerability with adaptive capacity (Adger 2006; Gallopín 2006; Klein et al. 2003). The SVA concentrates, then, on social vulnerability to climate change, particularly water availability. The framework unites concepts of social vulnerability, coping range, and adaptive capacity. SVA uses 9 indicators as a proxy for social vulnerability ranging from amount of population in poverty to the presence of household and community telephones.

The Predictive Indicators of Vulnerability Index (PIV) (Adger et al. 2004) focuses on vulnerability to climate variability and climate change. The PIV rests on the conceptual framework that risk (outcome) is a function of both biophysical and social vulnerability. The PIV's goal is to identify driving factors of **social vulnerability and adaptive capacity** (Adger et al. 2004). The PIV consults hazard fatalities to conclude on driving vulnerability factors. The PIV aggregates climate-related mortality from the EM-DAT database per decade from 1971 to 2000, and then standardizes hazard mortality by population size. The PIV subsequently reduced a collection of 45 social vulnerability variables to a final set of eleven indicators based on correlations with decadal hazard mortality. To arrive at a final PIV score, the authors simply average the eleven indicators of social vulnerability without imposing weights (Adger et al. 2004). While the PIV's aggregation structure is simple, its approach to normalizing indicators differs significantly from most indices. The PIV normalizes indicators by grouping them into quintiles and assigns scores ranging from one to five to each quintile. It adjusts for the direction of an indicator by equating the top quintile of a vulnerability-increasing indicator with a score of five whereas the top quintile of a vulnerability-reducing indicator receives a score of one. Thus, the higher the aggregated PIV score, the smaller a country's adaptive capacity to climate change and the greater its vulnerability. The Index of Predictive Indicators of Vulnerability (PIV) mimics development-oriented indices such as the Human Development Index (HDI) rather than social vulnerability.

Case Study 1

Title:

Urban Governance for Adaptation: Assessing Climate Change Resilience in Ten Asian Cities

Source:

Urban Governance for Adaptation: Assessing Climate Change Resilience in Ten Asian Cities

Thomas Tanner, Tom Mitchell, Emily Polack and Bruce Guenther

IDS Working Paper 315

First published by the Institute of Development Studies in January 2009

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ISSN 1353 6141 ISBN 978 1 85864 559 X

Assessment framework:

(1) decentralization and autonomy, (2) accountability and transparency, (3) responsiveness and flexibility, (4) participation and inclusion and (5) experience and support.

Method:

Assessment with the help of survey

Table 3.3 Summary of climate resilient governance indicators

City	Decentralisation and autonomy	Transparency and accountability	Responsiveness and flexibility	Participation and inclusion	Experience and support
Bangkok	<ul style="list-style-type: none"> – decentralised municipal authority – overlapping functions and poor coordination between governments – financial decentralisation and autonomy – local responsibility for flood control 	<ul style="list-style-type: none"> – access to information legislation – little oversight by citizens due to bureaucratic procedures 	<ul style="list-style-type: none"> – improvements in responsiveness to flood management – planning in response to climate change mitigation 	<ul style="list-style-type: none"> – low levels of participation among marginalised groups – public consultation on urban planning – top-down decision-making 	<ul style="list-style-type: none"> – experience in flood management, disease control and early warning systems – active civil society
Chennai	<ul style="list-style-type: none"> – decentralised municipal authority – conflict between national, state and city governments – increased autonomy has had mixed results 	<ul style="list-style-type: none"> – access to information legislation 	<ul style="list-style-type: none"> – responsive disaster management – poor city planning capabilities – poor coordination between departments 	<ul style="list-style-type: none"> – large budget allocations for slum dwellers – public consultation on urban planning but lack of representation for the lower class 	<ul style="list-style-type: none"> – membership in associations relevant to climate change – active civil society
Chittagong	<ul style="list-style-type: none"> – decentralised departments and agencies responsible for local service delivery – city disaster management committee – lack of financial autonomy 	<ul style="list-style-type: none"> – lack of transparency and access to information 	<ul style="list-style-type: none"> – clear lines of responsibility in disaster management – poor enforcement of land use policies 	<ul style="list-style-type: none"> – increasing involvement of stakeholders in decision-making 	<ul style="list-style-type: none"> – experience in disaster management – little experience in prevention and preparedness
Cochin	<ul style="list-style-type: none"> – decentralised municipal authority – state level disaster management but no municipal organisation 	<ul style="list-style-type: none"> – improving accountability but little transparency – access to information legislation 	<ul style="list-style-type: none"> – no direct municipal role in disaster management 	<ul style="list-style-type: none"> – inclusive and participatory decision-making including participatory budgeting 	<ul style="list-style-type: none"> – lack of institutions and infrastructure to deal with climate hazards
Da Nang	<ul style="list-style-type: none"> – ‘separate planning city’ controlled by central governing party – local disaster management – lack of financial autonomy and capacity 	<ul style="list-style-type: none"> – transparent delivery of public services 	<ul style="list-style-type: none"> – evidence of collaboration for environmental planning 	<ul style="list-style-type: none"> – lack of participatory decision-making 	<ul style="list-style-type: none"> – some experience in disaster risk reduction through integrated coastal management
Dalian	<ul style="list-style-type: none"> – ‘separate planning city’ controlled by central governing party 	<ul style="list-style-type: none"> – lagging access to information in comparison to other Chinese cities 	<ul style="list-style-type: none"> – responsive disaster management planning – investment in flood management – presence of Emergency Management Office 	<ul style="list-style-type: none"> – no specific agency responsible for implementing adaptation 	<ul style="list-style-type: none"> – experience in dealing with extreme weather events
Hangzhou	<ul style="list-style-type: none"> – ‘separate planning city’ controlled by central governing party – financial autonomy – no municipal authority for dealing with adaptation 	<ul style="list-style-type: none"> – access to information legislation 	<ul style="list-style-type: none"> – investment in flood management – presence of Emergency Management Office 	<ul style="list-style-type: none"> – limited public participation in decision-making 	<ul style="list-style-type: none"> – good practices in early warning systems and emergency planning
Ho Chi Minh	<ul style="list-style-type: none"> – highly centralised urban planning – decentralised disaster management – lack of financial autonomy 	<ul style="list-style-type: none"> – lack of transparency and access to information 	<ul style="list-style-type: none"> – reactive disaster management – lack of capacity and coordination limit responsiveness 	<ul style="list-style-type: none"> – lack of participatory decision-making 	<ul style="list-style-type: none"> – experience in dealing with storms and flooding
Ningbo	<ul style="list-style-type: none"> – ‘separate planning city’ controlled by central governing party – financial autonomy 	<ul style="list-style-type: none"> – access to information legislation 	<ul style="list-style-type: none"> – investment in flood management – presence of Emergency Management Office 	<ul style="list-style-type: none"> – limited public participation in decision-making and planning 	<ul style="list-style-type: none"> – good practices in early warning systems – large financial investment in water conservation and flood management
Surat	<ul style="list-style-type: none"> – decentralised municipal authorities 	<ul style="list-style-type: none"> – access to information legislation 	<ul style="list-style-type: none"> – responsive to growing informal settlements 	<ul style="list-style-type: none"> – broad stakeholder consultations in urban planning 	<ul style="list-style-type: none"> – experience with previous disaster situations

Case Study: 2

Title:

Social Vulnerability to Climate Change and Extremes in Coastal Vietnam

Source:

Neil Adger

World Development Vol. 27, No. 2, pp. 249±269, 1999

Ó 1999 Elsevier Science Ltd

Printed in Great Britain

0305-750X/99 \$

Assessment framework:

Table 2: Collective and individual vulnerability to climate change: determinants and indicators

Type of vulnerability	Causes in relation to climate variability	Indicators of vulnerability	Causes and indicators of vulnerability to climate change
Individual vulnerability	Relative and absolute poverty; entitlement failure in the face of extreme events.	Poverty indices; distribution and proportion of income dependent on risky resources; expected potential resource losses.	<i>Causes:</i> change in occurrence of extreme events; involuntary adaptations including migration. <i>Indicators:</i> changes in probability of extreme events; thresholds in physical (topographical, climatic) parameters.
Collective vulnerability	Absolute levels of infrastructure, market development; institutional and political factors -insurance and formal and informal social security.	GDP per capita; relative inequality; qualitative indicators of institutional arrangements.	<i>Causes:</i> change in hazardous zone area leading to real economic costs of public interventions. <i>Indicators:</i> change in proportion of population vulnerable.

Method:

Quantitative household survey, Qualitative household survey, KII with district officials and secondary data for Xuan Thuy District of Vietnam

Findings:

In general the population exhibits resilience through its use of available natural resources, but the liberalization process has had, at best, an ambivalent impact on vulnerability as a whole by undermining some institutional practices which acted as security and coping mechanisms in times of stress. The causes of social vulnerability are the characteristics of the climatic threat; the political economy context in which the institutions of decision-making, primarily the state in all its manifestations, attempts to minimize or manage threat for the benefit of society but also the benefit of the institutions themselves; and the economic structure and cultural context of adaptation at the individual level. By addressing

Vulnerability in a comprehensive manner current populations are enabled to address today's climatic extremes and other threats and are better equipped to cope with future uncertainties.

Case Study: 3**Title:**

Building Social Resilience into human marine communities in and around MPA (Marine Protection Area)

Source:

Nadia P. Abesamis, Colleen Corrigan, Mark Drew, Stuart Campbell, Giselle Samonte, MPA Networks Learning Partnership, Global Conservation Program, USAID, September 2006

Assessment framework:

The case studies at community level covered terrestrial or marine ecosystems in the US, Caribbean, Europe, Africa, Southeast Asia and Melanesia. (also see exhibit based on social resilience principles and variable from folke et al 2003)

Method:

Working groups for various sub topics were formed. For this particular section, intense review of literature, case studies with the help of various tools like focus groups, survey research, socio economic impacts, rapid assessment, Participatory Coastal Resource Assessment, Ethnography, Contingent Valuation, Predictive modeling, Content Analysis, Cost Benefit Analysis , Comparative Research, Historical Research, Secondary Research Analysis and Case Study Method.

RESILIENCE PRINCIPLE	VARIABLE	REFERENCE	CASE STUDY
Learning to live with change and uncertainty (adaptability)	Vision and leadership	Christie et al. 2003b	Supportive and committed local leadership enhanced the community-based coastal resources management in San Salvador Island, Philippines Over reliance on a small group of leaders can however result in "burn-out" and the narrowing of community participation
		Olsson et al. 2004b	A key leader played an instrumental role in directing change and transforming governance in southern Sweden that led to the adaptive co-management of a wetland landscape
		Adger et al. 2005	Strong leadership confined the impact of Hurricane Andrew to manageable portions in Florida
		Cinner et al. 2005a; McClanahan et al. 2006	Village leaders in Papua New Guinea had the authority and autonomy to develop and adapt harvesting rules in MPAs to reflect ecological and social conditions
	Multi-level social networks and building social capital	Brown et al. 2001 as cited in Adger 2001	When linkages between civil society and the central government were strengthened in an MPA community in Tobago, novel institutional arrangements such as co-management emerged
		Olsson et al. 2004b	A broad social network was assembled from several key organizations at different levels in society to support the management of wetland ecosystems in Kristianstad, Sweden
		Cinner et al. 2005a	For communities in Indonesia and Papua New Guinea, high social capital brought about by a high degree of group interaction likely facilitated the high compliance with periodic closures (<i>taboos</i>)
		Harkes and Novaczek (manuscript)	Strong bonds between traditional and formal institutions in Indonesia make traditional fisheries management and seasonal closures (<i>sasi laut</i>) highly resilient
	Demographic changes	Adger et al. 2002	In Nam Dinh Province, Vietnam, migration and its associated remittance income to the communities increased investments in

			<p>business and new enterprises and reduced pressure on the coastal resources, e.g. mangroves</p> <p>However remittance income also increased economic inequality among households, limiting access of poorer members of the community to coastal resources and encouraging greater risk of unsustainable exploitation</p>
		Cinner 2005; Cinner et al. 2005a	Low or negligible migration contributed to the effectiveness of customary marine tenures and periodic closures in certain villages in Indonesia and Papua New Guinea
		Cinner et al. 2005a; McClanahan et al. 2006	Relatively small population size was related to strong and effective traditional management systems (customary marine tenure and taboos) in Indonesia and Papua New Guinea
Nurturing diversity for reorganization and renewal (diversity)	Diversity of livelihood	Luttrell 2003	Livelihood diversification was a form of adaptation for people in Nam Hai and Da Rang Communes, Vietnam in response to changes in property rights and tenure over mangrove forests
		Adger et al. 2005	Reduced livelihood options and loss of traditional income sources due to already degraded ecosystems in parts of Indonesia reduced the potential for rapid economic recovery after the 2004 Asian tsunami
		Marschke and Berkes 2006	Fishing communities in Kompong Phluk, Cambodia adapted during periods of resource decline by building a portfolio of livelihood options – diversifying their fishing activities (specialization in different gears) and operating small businesses
	Resource use and dependency	Adger 2000	<p>In Quang Ninh Province, Vietnam, high dependence of communities on mangroves for their livelihood led to low resilience at the household level: when the resource was converted to private mariculture areas, reduction in income was significant</p> <p>At the community level, loss of part of the mangrove resource also led to increased conflicts over remaining resources</p>
Combining different types of knowledge for learning (learning & knowledge)	Traditional and local knowledge systems	McCay 1978 as cited in Davidson-Hunt and Berkes	In Fogo Island, Newfoundland, fisherfolk perceptions of codfish population cycles across time and space provided them with the means to formulate adaptive strategies, e.g. maintaining several

		2000	fishing spots, using a variety of gear, and livelihood diversification
		Olsson et al. 2004a	Cree and Inuit communities of James Bay, Canada documented changes in their environment (changing sea-ice patterns, distribution of sea mammals, damage to eelgrass) based on tradition ecological knowledge, combined these into a regional picture and used it as baseline for management in the face of additional hydroelectric projects
		Cinner et al. 2005a	Local decision makers in Indonesian and PNG villages used their understanding of social-ecological systems to interpret threshold levels of social or ecological indicators used to implement reef closures
	Transformational learning	Olsson et al. 2004b	The change of policy of the Municipality of Kristianstad initiated transformational learning and collective action among stakeholders for the management of their wetlands
	Collaborative planning & participation	Tompkins and Adger 2004	In response to declining conditions of Buccoo Reef in Trinidad and Tobago, management enhanced ecological and social resilience by including stakeholders in a learning-driven and iterative decision-making process, with stakeholder preferences elicited and fed into a multi-criteria analysis model
		Granek and Brown 2005	Community members in Mohéli, Comoros Islands were included in the processes of park boundary delineation and guideline creation, and were responsible for coordinating monitoring and enforcement within the marine park
		Lebel et al. 2006	The Great Barrier Reef Marine Park Authority in Australia initiated an ambitious consultancy and public participation exercise with stakeholders to assist with plans for enhancing the level of protection of reef resources
Creating opportunity for self-organization (self-organization)	Multilevel polycentric governance and accountability	Toengkagie 2002	Management of Bunaken National Park improved with the creation of the Multistakeholder Management Advisory Board that included villagers, private tourism sector, environmental NGOs, academe and government officials at the city, district and province levels
		Christie 2004	Insertion of central government agency control over a community-based MPA in Balicasag Island, Philippines undermined

			community support (loss of social resilience)
		Alcala and Russ 2006	30 years of experience in community-based marine protected areas in the Philippines has shown that, at least for this country, one must initially devolve decision-making power to the community and then spend enormous amounts of effort, time and money in large-scale integrated coastal management programs that integrate up again at the national level
	Conflict resolution mechanisms	Christie 2004	For two MPAs in the Philippines, there were no formal conflict resolution mechanisms in place thus interpersonal and inter-stakeholder conflicts ensued. Initial successes of the MPAs and social networks in general were eroded by these conflicts.
		Marschke and Berkes 2006	A local resource management committee in Koh Sralao, Cambodia stopped local fishers from destroying confiscated fishing gear, and instead encouraged non-violent conflict resolution strategies such as negotiation and paint-marking crab traps to discourage gear theft
	Capacity	Christie et al. 2003b	Capacity-building of key community members on sustainable resource management supported the co-management regime setup in San Salvador Island, Philippines
	Monitoring and feedback loops	GBRMPA Strategic Plan	A comprehensive monitoring and evaluation program for the Great Barrier Reef Marine Park aims to ensure public participation, establish mechanisms for data exchange, and encourage stakeholders to review the efficiency and effectiveness of management

Case Study: 4

Title:

A Household Social Vulnerability Index (HSVI) for Evaluating Adaptation Projects in Developing Countries

Source:

Katharine Vincent and Tracy Cull

Kulima Integrated Development Solutions (Pty) Ltd, Johannesburg, 2010

Assessment framework:

A theoretically-derived index of household level social vulnerability to climate change, based on the multiple dimensions of vulnerability identified in the sustainable livelihoods framework (based on access to natural, human, physical, financial and social capital) was developed. The index was formed from the weighted aggregation of 5 composite sub-indices, themselves formed from one or more indicators- Human Capital, Physical Capital, Financial Capital, Social Capital and Natural Capital (the weighted average of five composite sub-indices: financial capital (20%); human capital (20%); social capital (20%); natural capital (20%); and physical capital (20%))

Method:

Household Level Social Vulnerability to Climate Change tool was used in Maangani, South Africa.

Household number	Vulnerability Index	Vulnerability Rank	Human capital					Physical capital	Financial capital			Social capital			natural capital			
			Dependency ratio	working population dependent population	rank dependency ratio	illness	rank illness	House category	rank house	livestock assets	transposed livestock so 1 = most vuln	rank livestock	Social capital- contacts	rank social capital- contacts	Social capital- groups	rank social capital- groups	dependence on farming	rank farming

Result:

The index has been presented with indicators and weightings as appropriate to one village in Limpopo province, South Africa, the theoretical nature of the index means that it is appropriate for modification and use in other rural

settings. This fills an important policy and practical need in terms of the growing field of climate change adaptation. Since the effectiveness of adaptations are only realized after exposure to the hazard in question, development agencies, funders and NGOs need a way of both targeting their interventions, and then monitoring and evaluating their success. By using the HSVI to rank households at the beginning of the intervention, the most vulnerable can be targeted. And then reapplying it during the intervention and afterwards shows how the relative vulnerability of targeted households changes relative to others in the location.

Case Study: 5

Title:

Exposed Social vulnerability and climate change in the US Southeast

Source:

Oxfam America Report
Oxfam America Headquarters
226 Causeway Street, 5th Floor
Boston, MA 02114-2206
(800) 77-OXFAM

Assessment framework:

The application of SoVI to climate change-related hazards was developed by Dr. Susan Cutter and Dr. Christopher Emrich at the Hazards and Vulnerability Research Institute at the University of South Carolina. The SoVI statistically examines the underlying social and demographic characteristics of the population and how they impact certain segments of the population in disabling ways when it comes to climate change-related hazards. The research uses

Method:

SoVI provides a way to measure the difference in social vulnerability across states and regions within states. The SoVI uses 32 variables to define the

multiple dimensions of vulnerability —called components—and then adds them up to arrive at a single reference point to measure vulnerability. Eight components account for most of the variation in social vulnerability in the study: wealth, age, race, gender, ethnicity, rural farm populations, special needs populations, and employment status.

Result:

The result includes a series of layered maps that depict social and climate change-related hazard vulnerability. The maps assist in identifying hotspots in the US Southeast, which are at significant risk in the face of four particular climate change-related hazards: drought, flooding, hurricane force winds, and sea-level rise. The specific region of focus is the 13-state region of the US Southeast: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia. Roughly 80 percent of all US counties that experience persistent poverty (defined as a county in which at least 20 percent of the population experiences poverty for three decades or more) lie in this region.

Case Study: 6

Title:

Climate Change Adaptation in India

Source:

Gorakhpur Environmental Action Group, Gorakhpur, UP, India, 2008

Assessment framework:

The study was carried out in 7 UNDAF states in India (Bihar, Chattishgarh, Jharkhand, Orissa, Madhya Pradesh, Rajasthan and Utter Pradesh). It was the Human Development Index (HDI) that was the basis of most of the findings of the seven states. The study focused on the impacts of climate change, adaptation and disaster risk reduction based on vulnerabilities and resilience, the National Scenario and the state level situations in the 7 states. The study identified substantial research gaps and identified many research needs. The study also identified many possible actions, experiments and demonstrations

Method:

Desk review and consultation with stakeholders for current initiatives and programmes in the seven states by various agencies including government was used.

Result:

The study brings out the following:

1. Due to climate change, the vulnerability of the poor people increases due to dependence on natural resources for their livelihood due to depletion of natural, social, financial, physical and human asset.
2. Usually Disaster Risk Reduction and adaptation focuses on the hard resilience in terms of structures but more importance needs to be given to the softer resilience in terms of skills, processes, institutions, social systems, policies and programmes. This depends on factors like flexibility, diversification, ability to learn from events, mobility, education, risk pooling, convertible assets etc.
3. The seven states have various programmes going on with focus on poverty elevation yet large portion of population are deprived of their benefits.
4. There is serious lack of vulnerability mapping in the states for planning subsequent disaster risk reduction or climate change adaptation programmes.
5. Impetus to research - Core areas of scientific and multidisciplinary research.
6. Need to develop climate change vulnerability –adaptation framework at National, State and local level.
7. Development of national adaptation framework
8. Developing multi and inter ministerial coordination
9. Upgrading the National Disaster Management Authority to deal with climate change
10. Developing regional level climate adaptation model with inter linkages of rural and urban areas.

- 11.State department's capacity building in coming up with state level climate change adaptation plans
- 12.Integrating adaptation interventions with existing programmes and policies
- 13.Redefining role of NGOs in increasing the adaptive capacity of the local communities

Case Study: 7

Title:

Study of changing flood and drought patterns and documentation of community coping practices in Assam

Source:

<http://www.aaranyak.org/Programmes/WCP.htm>

Assessment framework:

The Water Climate and Hazard Programme (WATCH) of AARANYAK Programme has been conceived to carry out intensive scientific study of the key issues related to water and climate of the region(North east- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura) including the human and societal dimensions of these issues. Designed initially for a period of five years (2001-2005) the WATCH programme covered activities like Comprehensive assessment of eco-systems of important river basins of the region and assessment of environmental impacts of ongoing and proposed water resources projects such as large river dams. To study the adaptation of people and communities was one of the three objectives of the study.

Method:

Case studies of different communities were done and multi layered hazard maps especially of flood and droughts were used.

Result:

Studying response to water stresses, coping mechanism and adaptation strategies that communities have practised traditionally and have improvised or developed to adjust to changing water environment in recent times yielded information and knowledge about adaptation practices necessitated by climate change impacts in the local context. In addition to the knowledge and practices systems of communities that have evolved from within the community structure, external interventions by non-Government and Government agencies such as information and knowledge input, introduction of new technology and best practices methods in water management, agriculture, disaster preparedness etc. also lead to new adaptation techniques or influence the existing ones to make them more innovative.

Case Study: 8**Title:**

Assessing Local Adaptation Strategies to Climate Induced Water Stress and Hazards in the Greater Himalayan Region: A Case Study in the Eastern Assam Flood Plains of the Brahmaputra Basin in India

Source:

International Centre for Integrated Mountain Development (ICIMOD), Kathmandu

Assessment framework:

The study was carried out between July 2008 and September 2009 in five highly hazard-prone villages of Lakhimpur and Dhemaji districts of Assam. study mainly explores the ways and means through which the local communities of the study sites have so far coped with and adapted to changing nature of climate and water induced hazards like floods, flash floods, sand casting, river bank erosion, rainstorms etc. This study looks into community coping practices from the perspective of climate change adaptation.

Method:

Case studies of different communities were done and multi layered hazard maps especially of flood and droughts were used.

Result:

‘Adaptation’ as a means of dealing with impacts of climate change has gained extra-ordinary importance worldwide. Regions like northeast India located downstream of the Himalayan water flux, possessing delicate ecosystems rich in biodiversity as well as ethnic, linguistic and cultural diversity need special planning, policies and action programmes to empower the vulnerable communities so that people can acquire or strengthen the adaptation skills and capacities to deal with impending effects of a changing climate. Such steps must be supplemented with change in the present development paradigm to make the pursuit of development more environment and people friendly.

Thus the review of literature captures the various indicators development by different practitioners.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

Data analysis and interpretation:

Introduction

Quantitative Data Analysis

Qualitative Data Analysis

Introduction:

Social Vulnerability and Resilience to climate change being a relatively new area of research, the researcher used qualitative and well as quantitative method of data collection. Data analysis is a very important part of any research.

The present chapter is divided into two major parts. The Part 1 is the quantitative aspect of the present research for which an interview schedule is used and data is collected from one adult member of the household from the two communities. Part II consist of analysis of data gathered by using qualitative tools like focus group discussions, transect walk and key informant interviews from the key informants like formal and informal leaders, NGO representative, functionaries etc . These parts are further divided into various sections:

Part I

The first part contains ten sections. The **Section I** contain questions related to the demographic details of the respondents like sex, caste, marital status, age, education, occupation, role position of the respondents with respect to household head, residential status, type of house, facilities available at the household level, type of family and family size.

It also contains information related to family pattern in terms of gender wise distribution of the family members, marital status of the family members, occupation of the family members and migration status of family member.

The same section also has questions related to the household in terms of ability to save money, types of saving, perception of household related to economic status of the family as compared to other families in the community, perception regarding adequacy of income, debts /loans, the reason for taking debt/loans, the source of taking loan, ability to repay loan and migration status of the household members depicting economic status of the family.

The section further presents data on the health status of the members, accessibility to health services, problems faced in taking care of the special needs members etc.

The **Section II** contains data on exposure of the household to hazards related to climate and their impacts. This is explored in terms of climate hazards, intensity and the damage. Climate related hazards like cyclones, storm surge, coastal erosion, salinity etc and are also explored along with intensity.

Section III talks about the affiliation of the households with groups and subgroups. It probes into the kind of activities that are carried out by the various groups in the community that the household is affiliated with. These act as bonding and bridging social capitals.

Section IV interrogates into the kinds of amenities that the household has in normal times and times of emergency.

Section V talks about the resource dependency of the households on coastal and marine resource for household consumption and for generating income in terms of related goods and services. It explores how people use coral reefs, mangroves and other resources in form of goods and services.

Section VI explores the sources of livelihood at the household level for consumption and for business. It also talks about the role of the members who are involved in livelihood activities. It also encapsulates whether the household has any supplementary and alternative livelihoods at the household level. It also inquires into the possible threats and opportunities, knowledge and capacity for the same.

Section VII explores the impacts of any climate related hazards witnessed by the household, the frequency of these hazards, sensitivity, negative impact on the household in terms of damages and difficulty in coping up with hazards. The sum total of all these adds to the over all vulnerability.

Section VIII probes into from where the households gain information related to climate hazards and how is it used by the household. If they do not utilize why do they not utilize it. It also probes into whether they have access to any other information they seek and what are the barriers to accessing this information. The section further probes the quality and effectiveness of formal and informal networks supporting climate hazard reduction and adaptations and how do they benefit the households.

Section IX deals with perception of the households regarding the ability of the community to organize by learning, planning and making necessary changes to cope with climate change related impacts.

Section X deals with the attitude of the household towards governance and leadership

Part II

The Part II contains three sections of the qualitative data analyzed by the researcher.

Section I contains the information captured by way of transect walk.

Section II captures the focus groups discussions carried out in the selected communities. These groups are of elderly men, young men, elderly women, young women, occupational groups and community leaders. The FGDs explores the basic history of the village/community, community resources in term of infrastructure and services related to housing, water, sanitation, health, basic infrastructure, education and skills, amenities, occupations, income groups and legal services. It takes into consideration vulnerable groups in terms of elderly, widows, single headed households, orphans, children, differently able people or any special need group as identified by the community. It also captures community vulnerabilities in terms of identified hazards, history of disasters, damage, loss of lives, causes, warning and forecasting systems, traditional knowledge, depletion of resources, changes in

coastal area, major changes in living after change and disaster preparedness. The concluding part contains information about community resilience in terms of, risk knowledge, disaster recovery, diversity : in terms of livelihood and resource dependency(coastal and marine), supplementary and alternative livelihoods; knowledge and learning from changes, adaptability : in terms of vision and leadership, demographic changes(migration); and Self Organization : in term of linkages and networks.

Section III captures the key informant interviews. It contains information about the history of village in term of community and its ecology, the infrastructure facilities available in the village in terms of Housing, Health, Education, Water, Electricity, Drainage, Communication and legal services. It further probes into the kind of family and family networks, the major occupations of the community, whether there are any sudden or gradual change observed in the occupation of the community members, the economic status of the community, the indebttness status of the households in general, the major reasons for the same and status of migration observed in the community. It also probes into the health status of community people, specific health problems observed amongst the people and the health services available. It captures the presence of any persons with special needs in the community. It probes the climate related hazards identified by the community and the loss/damage due to such events. It inquires into the social networks and their role in carrying out activities. In furthers probes into the livelihoods and possible alternative and supplementary livelihoods, resource dependency in term of good and services on coastal and marine resources. The section than deals with the hazards and their impact, sources of information related to climate hazards, networks supporting climate hazard reduction and adaptation and quality and effectiveness of such networks. The section continues with perception of the households regarding the ability of the community to organize for planning, learning and making necessary changes to cope with climate related impacts and also its attitude towards governance and leadership.

SECTION I

DEMOGRAPHIC PROFILE

Table No: 1: Table depicting sex wise distribution of respondents

Sex		Area		Total
		Umarsadi	Madhavad	
Male	Frequency	62	56	118
	% within Sex	52.5%	47.5%	100.0%
	% within Area	62.0%	80.0%	69.4%
Female	Frequency	38	14	52
	% within Sex	73.1%	26.9%	100.0%
	% within Area	38.0%	20.0%	30.6%
Total	Frequency	100	70	170
	% within Sex	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

The above table reflects that over all, 58.8% of the respondents are male. The figure is high 80% in case of Madhavad while in Umarsadi its 62.0%. It reflects that there are more male respondents than female connoting a male dominant community.

Table No: 2: Table depicting caste wise distribution of respondents

Caste		Area		Total
		Umarsadi	Madhavad	
Hindu Machi	Frequency	99	2	101
	% within Caste	98.0%	2.0%	100.0%
	% within Area	99.0%	2.9%	59.4%
Hindu Kharva	Frequency	0	68	68
	% within Caste	.0%	100.0%	100.0%
	% within Area	.0%	97.1%	40.0%
Hindu Patel	Frequency	1	0	1
	% within Caste	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Caste	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

It is inferred from the table that while Umarsadi is dominated by the Hindu Machi caste amounting to 99%, it is the Kharvas who dominate Madhavad with 97.1%. It is also inferred that all 170 respondents are Hindus. All the respondents belong to general category.

Table No: 3: Table showing marital status of the respondents

Marital Status		Area		Total
		Umarsadi	Madhvad	
Married	Frequency	90	66	156
	% within Marital Status	57.7%	42.3%	100.0%
	% within Area	90.0%	94.3%	91.8%
Unmarried	Frequency	5	4	9
	% within Marital Status	55.6%	44.4%	100.0%
	% within Area	5.0%	5.7%	5.3%
Widow	Frequency	5	0	5
	% within Marital Status	100.0%	.0%	100.0%
	% within Area	5.0%	.0%	2.9%
Total	Frequency	100	70	170
	% within Marital Status	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the table, 90% of the respondents from Umarsadi are married while 94.3% of the respondents from Madhvad are married. 5% of the respondents from Umarsadi are widows.

Table No: 4: Table showing age wise distribution of the respondents:

Age		Area		Total
		Umarsadi	Madhvad	
25-40 Yrs.	Count	47	40	87
	% within Area	47.0%	57.1%	51.2%
41-55 Yrs.	Count	44	24	68
	% within Area	44.0%	34.3%	40.0%
>=56 Yrs.	Count	9	6	15
	% within Area	9.0%	8.6%	8.8%
Total	Count	100	70	170
	% within Area	100.0%	100.0%	100.0%

57.0% of the respondents from Madhvad fall in the age group of 25 to 40 years as compared to 47.0% from Umarsadi. In the age group of 41-55 years, there are 44.0% of the respondents from Umarsadi and 34.3% from Madhvad. Very few percentage of respondents are above the age of 55.

Table No: 5: Table showing education wise distribution of the respondents

Education		Area		Total
		Umarsadi	Madhvad	
Primary	Frequency	18	19	37
	% within Educational level of the respondent	48.6%	51.4%	100.0%
	% within Area	18.0%	27.1%	21.8%
Secondary	Frequency	35	31	66
	% within Educational level of the respondent	53.0%	47.0%	100.0%
	% within Area	35.0%	44.3%	38.8%
Higher secondary	Frequency	8	7	15
	% within Educational level of the respondent	53.3%	46.7%	100.0%
	% within Area	8.0%	10.0%	8.8%
ITI/PTC	Frequency	4	8	12
	% within Educational level of the respondent	33.3%	66.7%	100.0%
	% within Area	4.0%	11.4%	7.1%
Graduate	Frequency	31	3	34
	% within Educational level of the respondent	91.2%	8.8%	100.0%
	% within Area	31.0%	4.3%	20.0%
Post Graduate	Frequency	4	2	6
	% within Educational level of the respondent	66.7%	33.3%	100.0%
	% within Area	4.0%	2.9%	3.5%
Total	Frequency	100	70	170
	% within Educational level of the respondent	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

The educational level of the respondents is note worthy. In case of Madhvad, 4.3% of the respondents are graduates and 2.9% of the respondents are post graduates while in case of Umarsadi, this is 31% and 4%. None of the respondents are illiterate.

Table No: 6: Table showing Occupation wise distribution of respondents

Occupation		Area		Total
		Umarsadi	Madhavad	
Machimar/Fishing	Count	21	44	65
	% within Area	21.0%	62.9%	38.2%
Household	Count	13	6	19
	% within Area	13.0%	8.6%	11.2%
Business	Count	15	2	17
	% within Area	15.0%	2.9%	10.0%
Seamen	Count	14	0	14
	% within Area	14.0%	.0%	8.2%
Service	Count	30	0	30
	% within Area	30.0%	.0%	17.6%
Labour	Count	0	14	14
	% within Area	.0%	20.0%	8.2%
Unemployed	Count	3	0	3
	% within Area	3.0%	.0%	1.8%
Other	Count	2	0	2
	% within Area	2.0%	.0%	1.2%
NR	Count	2	4	6
	% within Area	2.0%	5.7%	3.5%
Total	Count	100	70	170
	% within Area	100.0%	100.0%	100.0%

Regarding the occupation of the respondents, it can be depicted from the above table that 62.9% of the respondents in case of Madhavad are Fishermen as compared to 21.0% in Umarsadi. 30.0% of respondents in case of Umarsadi are dependent on service sector as compared to Nil in case of Madhavad. 15.0% of the respondents are engaged in business in Umarsadi while only 2.9% of the respondents from Madhavad are engaged in business.

Table No: 7 : Table showing roles position of the respondents with respect to household head

Role Position of the Respondent with respect to household head		Area		Total
		Umarsadi	Madhvad	
Self	Frequency	79	55	134
	% within Role Position of the Respondent with respect to household head	59.0%	41.0%	100.0%
	% within Area	79.0%	78.6%	78.8%
Daughter in law	Frequency	6	11	17
	% within Role Position of the Respondent with respect to household head	35.3%	64.7%	100.0%
	% within Area	6.0%	15.7%	10.0%
Son	Frequency	6	0	6
	% within Role Position of the Respondent with respect to household head	100.0%	.0%	100.0%
	% within Area	6.0%	.0%	3.5%
Wife	Frequency	9	4	13
	% within Role Position of the Respondent with respect to household head	69.2%	30.8%	100.0%
	% within Area	9.0%	5.7%	7.6%
Total	Frequency	100	70	170
	% within Role Position of the Respondent with respect to household head	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

In both the communities the respondents are house hold heads which account for more than 75% of the total respondents with 79% in case of Umarsadi and 78.6% in case of Madhvad.

Table No: 8: Table showing residential status of the household in the community

Resident of the community since		Area		Total
		Umarsadi	Madhvad	
From beginning	Frequency	96	70	166
	% within Resident of the community since :	57.8%	42.2%	100.0%
	% within Area	96.0%	100.0%	97.6%
NR	Frequency	4	0	4
	% within Resident of the community since :	100.0%	.0%	100.0%
	% within Area	4.0%	.0%	2.4%
Total	Frequency	100	70	170
	% within Resident of the community since :	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the table, all the respondents in Madhavad are residents of the community since the beginning of their lives as compared to 96% in case of Umarsadi. Thus this indicated continuity of domicile in the community.

Table No: 9: Table showing type of house of the respondent

Type of house		Area		Total
		Umarsadi	Madhavad	
Pucca	Frequency	65	24	89
	% within Type of house	73.0%	27.0%	100.0%
	% within Area	65.0%	34.3%	52.4%
Semi pucca	Frequency	26	13	39
	% within Type of house	66.7%	33.3%	100.0%
	% within Area	26.0%	18.6%	22.9%
Kutcha	Frequency	7	27	34
	% within Type of house	20.6%	79.4%	100.0%
	% within Area	7.0%	38.6%	20.0%
Thatched	Frequency	0	1	1
	% within Type of house	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
Other	Frequency	2	5	7
	% within Type of house	28.6%	71.4%	100.0%
	% within Area	2.0%	7.1%	4.1%
Total	Frequency	100	70	170
	% within Type of house	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, while 65% of the houses in Umarsadi are Pucca houses, the percentage is 34.3% in case of Madhavad. In contrast to this, 38.6% of the houses in Madhavad are Kutcha as compared to 7% in Umarsadi. Percentage of semi pucca houses are more in Umarsadi than in Madhavad.

Table No: 10: Table showing the facilities available at the household level of the respondents

Facilities at the Household level		Area		Total
		Umarsadi	Madhavad	
Courtyard	Frequency	85	3	88
	% within \$Q4	96.6%	3.4%	
	% within Area	85.0%	4.3%	
latrines	Frequency	66	15	81
	% within \$Q4	81.5%	18.5%	
	% within Area	66.0%	21.4%	
Bathrooms	Frequency	86	35	121
	% within \$Q4	71.1%	28.9%	
	% within Area	86.0%	50.0%	
Ventilation	Frequency	65	11	76
	% within \$Q4	85.5%	14.5%	
	% within Area	65.0%	15.7%	
Separate Kitchen	Frequency	83	18	101
	% within \$Q4	82.2%	17.8%	
	% within Area	83.0%	25.7%	
Store Room	Frequency	1	1	2
	% within \$Q4	50.0%	50.0%	
	% within Area	1.0%	1.4%	
No facilities	Frequency	14	24	38
	% within \$Q4	36.8%	63.2%	
	% within Area	14.0%	34.3%	
Total	Frequency	100	70	170

As regards the facilities available in the houses, 66.0% of the houses in Umarsadi have latrines which are only 21.4% in case of Madhavad. In case of bathrooms, 86% of the houses in Umarsadi as compared to 50% in case of Madhavad have them. 65% of the houses in Umarsadi as compared to 15.7% in case of Madhavad have ventilation, in case of separate kitchen this is 83% in case of Umarsadi as compared to 25.7% in case of Madhavad. 34.3% of the houses in Madhavad have no facilities conveying one room houses. Thus, it is clear that basic facilities and housing is better in Umarsadi than in Madhavad

Table No: 11: Table showing type of family of the respondents

Type of Family		Area		Total
		Umarsadi	Madhavad	
Joint	Frequency	35	24	59
	% within Type of Family	59.3%	40.7%	100.0%
	% within Area	35.0%	34.3%	34.7%
Nuclear	Frequency	65	46	111
	% within Type of Family	58.6%	41.4%	100.0%
	% within Area	65.0%	65.7%	65.3%
Total	Frequency	100	70	170
	% within Type of Family	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, prevalence of nuclear families is seen in both the communities with 65% of the families in Umarsadi and 65.7% of the families in Madhavad having nuclear families. Generally fishermen communities have more incidences of joint family as part of their traditional lifestyles.

Table No: 12: Table showing family size of the respondents

Family Size		Area		Total
		Umarsadi	Madhavad	
1-4 Members	Frequency	58	17	75
	% within Family Size	77.3%	22.7%	100.0%
	% within Area	58.0%	24.3%	44.1%
5-7 members	Frequency	41	37	78
	% within Family Size	52.6%	47.4%	100.0%
	% within Area	41.0%	52.9%	45.9%
8-12 Members	Frequency	1	16	17
	% within Family Size	5.9%	94.1%	100.0%
	% within Area	1.0%	22.9%	10.0%
Total	Frequency	100	70	170
	% within Family Size	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As regards the size of the families, the table shows that 22.9% of the families in Madhavad are large families with 8-12 members as compared to 1% families in Umarsadi. 52% of the families in Madhavad have 5-7 members as compared to 41.0% in Umarsadi. Thus Madhavad has larger families than Umarsadi depicting a traditional pattern.

Table No: 13: Table showing Gender wise distribution of the family members of the respondents

N=170

Gender of family members		Area		Total
		Umarsadi	Madhvad	
Male	Frequency	222	210	432
	% within gender	51.4%	48.6%	
	% within Area	222.0%	300.0%	
Female	Frequency	215	207	422
	% within gender	50.9%	49.1%	
	% within Area	215.0%	295.7%	
Total	Frequency	100	70	170

As seen in the above table there is no significance difference between the gender of family members of both the communities.

Table No: 14: Table showing marital status of the family members of the respondents

N=170

Marital status of family members		Area		Total
		Umarsadi	Madhvad	
Married	Frequency	234	202	436
	% within marital status	53.7%	46.3%	
	% within Area	234.0%	288.6%	
Unmarried	Frequency	202	216	418
	% within marital status	48.3%	51.7%	
	% within Area	202.0%	308.6%	
Any other	Frequency	0	2	2
	% within marital status	.0%	100.0%	
	% within Area	.0%	2.9%	
Total	Frequency	100	70	170

As depicted from the above table, there is not much difference between the marital status of family members in both the communities

Table No: 15: Table showing educational level of the family members of the respondent

N=170

Educational level of family members		Area		Total
		Umarsadi	Madhvad	
KG	Frequency	16	0	16
	% within \$Q6e	100.0%	.0%	
	% within Area	16.0%	.0%	
Primary	Frequency	117	173	290
	% within \$Q6e	40.3%	59.7%	
	% within Area	117.0%	247.1%	
Secondary	Frequency	119	25	144
	% within \$Q6e	82.6%	17.4%	
	% within Area	119.0%	35.7%	
Higher secondary	Frequency	74	0	74
	% within \$Q6e	100.0%	.0%	
	% within Area	74.0%	.0%	
ITI/PTC	Frequency	13	0	13
	% within \$Q6e	100.0%	.0%	
	% within Area	13.0%	.0%	
Graduate	Frequency	79	0	79
	% within \$Q6e	100.0%	.0%	
	% within Area	79.0%	.0%	
Post Graduate	Frequency	7	4	11
	% within \$Q6e	63.6%	36.4%	
	% within Area	7.0%	5.7%	
NA	Frequency	13	12	13
	% within \$Q6e			
	% within Area			
Total	Frequency	100	70	170

As depicted from the above table, the family members in Umarsadi are more educated as compared to Madhvad. This is especially so in case of higher education

Table No: 16: Table showing occupation of the family members of the respondents

Occupation		Area		Total
		Umarsadi	Madhvad	
Household	Count	19	47	66
	% within Area	19.0%	67.1%	
Service	Count	61	2	63
	% within Area	61.0%	2.9%	
Unemployed	Count	1	0	1
	% within Area	1.0%	.0%	
Seamen	Count	39	1	40
	% within Area	39.0%	1.4%	
fishermen	Count	15	12	27
	% within Area	15.0%	17.1%	
Business	Count	25	2	27
	% within Area	25.0%	2.9%	
Other	Count	10	5	160
	% within Area	10.0%	5.6%	
NR	Count	6	1	7
	% within Area	6.0%	1.4%	
Total	Count	100	70	170

As depicted from the above table, 67.1% of the household members are engaged in household work while in Umarsadi, it is 19.0% of the household members. 61.0% of the household members in Umarsadi are engaged in service sector while only 2.9% are engaged in this sector in Madhvad. 39.0% of the household members in Umarsadi are engaged as seamen while no such case is seen in Madhvad. 25.0% of the household members are engaged in Business in Umarsadi with only 2.9% in case of Madhvad.

Table No: 17: Table showing migration status of the family members of the respondent

N=170

Migration of family members for livelihood		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	15	145	160
	% within Migration of family members for livelihood	9.4%	90.6%	
	% within Area	15.0%	207.1%	
No	Frequency	119	271	390
	% within Migration of family members for livelihood	30.5%	69.5%	
	% within Area	119.0%	387.1%	
NR	Frequency	10	0	10
	% within Migration of family members for livelihood	100.0%	.0%	
	% within Area	10.0%	.0%	
Total	Frequency	100	70	170

As depicted from the above table, 145 family members migrate seasonally for livelihood in Madhavad while only 15 members migrate for livelihood in case of Umarsadi. The main reason being unavailability of livelihood resources in the near vicinity.

Table No: 18: Table showing ability of the household for monthly savings:

Ability of the household to save money monthly		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	72	21	93
	% within Is the household able to save money monthly? Ability of the household to save money monthly	77.4%	22.6%	100.0%
	% within Area	72.0%	30.0%	54.7%
No	Frequency	28	49	77
	% within Ability of the household to save money monthly	36.4%	63.6%	100.0%
	% within Area	28.0%	70.0%	45.3%
Total	Frequency	100	70	170
	% within Ability of the household to save money monthly	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the ability of the household to have monthly savings, it is found that 70% of the respondents in Madhavad are not able to save as compared to 28% in Umarsadi. Respondent in Umarsadi are saving more monthly in comparison with the respondents from Madhavad.

Table No: 19: Table showing types of saving at the household level

Cross Tabulation				
Type of savings		Area		Total
		Umarsadi	Madhavad	
Cash at household	Frequency	67	1	68
	% within savings	98.5%	1.5%	
	% within Area	93.1%	4.8%	
Saving accounts in bank	Frequency	4	15	19
	% within savings	21.1%	78.9%	
	% within Area	5.6%	71.4%	
Gold and Silver	Frequency	1	2	3
	% within savings	33.3%	66.7%	
	% within Area	1.4%	9.5%	
Business	Frequency	1	8	9
	% within savings	11.1%	88.9%	
	% within Area	1.4%	38.1%	
Any other	Frequency	0	2	2
	% within savings	.0%	100.0%	
	% within Area	.0%	9.5%	
Total	Frequency	72	21	93

As depicted from the table, 93.1% of the households save money in form of cash at home in Umarsadi as compared to 71.4% opting for saving accounts in bank in case of Madhavad. Unlike other fishing communities, they do not invest much in gold and silver.

Table No: 20: Table showing perception of the respondent regarding economic status of the household as compared to other families in the community

Economic status of the household compared to other families in the community		Area		Total
		Umarsadi	Madhvad	
Below Average	Frequency	9	6	15
	% within comparison	60.0%	40.0%	100.0%
	% within Area	9.0%	8.6%	8.8%
Average	Frequency	34	24	58
	% within Comparison	58.6%	41.4%	100.0%
	% within Area	34.0%	34.3%	34.1%
Above average	Frequency	50	3	53
	% within comparison	94.3%	5.7%	100.0%
	% within Area	50.0%	4.3%	31.2%
NR	Frequency	7	37	44
	% within Comparison	15.9%	84.1%	100.0%
	% within Area	7.0%	52.9%	25.9%
Total	Frequency	100	70	170
	% within comparison	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

50% of the respondents in Umarsadi rate the economic status of their households as compared to other families of the community to be above average as compared to 34.3% respondents in Madhvad stating that the economic status of their household is average as compared to economic status of others families in the community. 52.9% of the respondents in Madhvad did not respond

Table No: 21: Table showing perception of the respondent regarding adequacy of income of the household

Adequacy of income		Area		Total
		Umarsadi	Madhvad	
Usually not enough to cover important household expenses	Frequency	8	28	36
	% within Usually not enough to cover important household expenses	22.2%	77.8%	
	% within Area	8.0%	40.0%	
Just enough to cover important household expenses	Frequency	15	31	46
	% within Just enough to cover important household expenses	15.6%	84.4%	
	% within Area	15.0%	44.3%	
Usually have some left after important household expenses	Frequency	75	10	85
	% within Usually have some left after important household expenses	88.2%	11.8%	
	% within Area	75.0%	14.3%	
NR	Frequency	7	1	8
	% within NR	87.5%	12.5%	
	% within Area	7.0%	1.4%	
Total	Frequency	100	70	170

As seen from the above table, 40.0% of the respondents in Madhvad feel that usually the income of the household is not enough to cover important household expenses and 44.3% of the respondents in the same community state that their income is just enough to cover important household expenses. 75.0% of the respondents in Umarsadi state that their income is adequate and usually they have some left after important household expenses. Thus respondents in Umarsadi have adequate income.

Table No: 22: Table showing whether the household of the respondent takes debt/loans

Household takes any debt/loan		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	40	46	86
	% within household takes any debt	46.5%	53.5%	100.0%
	% within Area	40.0%	65.7%	50.6%
No	Frequency	60	24	84
	% within household takes any debt	71.4%	28.6%	100.0%
	% within Area	60.0%	34.3%	49.4%
Total	Frequency	100	70	170
	% within household takes any debt	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

65.7% of the respondents in case of Madhvad take debts as compared to 40% of the respondents in Umarsadi. This also indicates that Madhvad is more dependent on loans than Umarsadi.

Table No: 23: Table showing the reasons for taking debt by the household of the respondent

N=86

Reasons for taking debt for the household		Area		Total
		Umarsadi	Madhvad	
For Household expenses	Frequency	9	44	53
	% within reason	17.0%	83.0%	
	% within Area	22.5%	95.7%	
For Marriage	Frequency	32	38	70
	% within reason	45.7%	54.3%	
	% within Area	80.0%	82.6%	
Religious purpose	Frequency	2	39	41
	% within reason	4.9%	95.1%	
	% within Area	5.0%	84.8%	
For basic necessities	Frequency	3	40	43
	% within reason	7.0%	93.0%	
	% within Area	7.5%	87.0%	
Building house or renovation	Frequency	27	4	31
	% within reason	87.1%	12.9%	
	% within Area	67.5%	8.7%	
Others	Frequency	4	20	24
	% within reason	16.7%	83.3%	
	% within Area	10.0%	43.5%	
Total	Frequency	40	46	86

Stating the main reasons for taking debt of the 40 and 46 respondents who take debts in Umarsadi and Madhavad respectively, 95.7% of the respondents in Madhavad stated that they take debts to meet the household expenses while 80.0% of the households in Umarsadi take debts for marriage as compared to 82.6% of the respondents. 87% of the respondents in Madhavad also take debt for basic necessities. 67.5% of the households in Umarsadi take debt for building house or renovation. 84.8% of the households in Madhavad take the debt for religious purpose also.

Table No: 24: Table showing the source of debt/loan by the household of the respondents

Source of debt/loans		Area		Total
		Umarsadi	Madhavad	
Bank	Frequency	29	5	34
	% within Source of debt/loans	85.3%	14.7%	
	% within Area	72.5%	10.9%	
Money lender from the village	Frequency	0	4	4
	% within Source of debt/loans	.0%	100.0%	
	% within Area	.0%	8.7%	
From relatives	Frequency	40	23	63
	% within Source of debt/loans	63.5%	36.5%	
	% within Area	100.0%	50.0%	
Community organizations	Frequency	0	18	18
	% within Source of debt/loans	.0%	100.0%	
	% within Area	.0%	39.1%	
Others	Frequency	0	6	6
	% within Source of debt/loans	.0%	100.0%	
	% within Area	.0%	13.0%	
Total	Frequency	40	46	86

Regarding the source of debts/loans, 72.5% of the people in Umarsadi take loans from the bank as compared to 50% in case of Madhavad who resort to taking loan from relatives. Surprisingly 63.5% of the respondents from Umarsadi admitted that they take loan from relatives as compared to 36.5% in Madhavad. Madhavad also has mechanism of taking loans from community organizations in form of their samaj.

Table No: 25: Table showing whether the household of the respondent is able to repay debt

Ability of the household to repay debt /loan		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	10	41	51
	% within Ability of the household to repay debt /loan	19.6%	80.4%	100.0%
	% within Area	25.0%	89.1%	59.3%
No	Frequency	29	5	34
	% within Is the household able to repay debt? Ability of the household to repay debt /loan	85.3%	14.7%	100.0%
	% within Area	72.5%	10.9%	39.5%
NR	Frequency	1	0	1
	% within Ability of the household to repay debt /loan	100.0%	.0%	100.0%
	% within Area	2.5%	.0%	1.2%
Total	Frequency	40	46	86
	% Ability of the household to repay debt /loan	46.5%	53.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the repayment of loans, 89.1% of the households in Madhavad are able to repay the loans while 72.5% of the households in Umarsadi are not able to repay the debts they take.

Migration status of the family members of the respondents

There is no in migration at the household level in both communities.

Table No: 26: Table showing out Migration Status of the household members of the respondents

N=170

Migration of family members livelihood		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	15	145	160
	% within out migration	9.4%	90.6%	
	% within Area	15.0%	207.1%	
No	Frequency	119	271	390
	% within out migration	30.5%	69.5%	
	% within Area	119.0%	387.1%	
NR	Frequency	10	0	10
	% within out migration	100.0%	.0%	
	% within Area	10.0%	.0%	
Total	Frequency	100	70	170

As seen from the above table out of the total 160 family members who migrate, 145 family members in case of Madhavad migrate on seasonal basis for livelihood purpose as compared to 15 members in case of Umarsadi.

SECTION II

EXPOSURE TO CLIMATE HAZARDS BY THE HOUSEHOLDS

Table No: 27 : Table showing exposure of the household of the respondent to storm surge climate hazard

Climate Hazard_Storm surge		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	97	1	98
	% within Climate Hazards_Storm surge	99.0%	1.0%	100.0%
	% within Area	97.0%	1.4%	57.6%
No	Frequency	3	69	72
	% within Climate Hazards_Storm surge	4.2%	95.8%	100.0%
	% within Area	3.0%	98.6%	42.4%
Total	Frequency	100	70	170
	% within Climate Hazards_Storm surge	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As shown in the above table, 97% of the households in Umarsadi have been exposed to climate related hazard of storm surge as compared to 1.4% at Madhvad. 98.6% of the respondents have no exposure to storm surge in Mahdvad.

Table No: 28 : Table showing intensity experienced by the household of the respondent to storm surge climate hazard

Intensity of Storm Surge		Area		Total
		Umarsadi	Madhvad	
High	Frequency	58	0	58
	% within Intensity of Storm Surge	100.0%	.0%	100.0%
	% within Area	58.0%	.0%	34.1%
Medium	Frequency	20	1	21
	% within Intensity of Storm Surge	95.2%	4.8%	100.0%
	% within Area	20.0%	1.4%	12.4%
Low	Frequency	19	0	19
	% within Intensity of Storm Surge	100.0%	.0%	100.0%
	% within Area	19.0%	.0%	11.2%
NA	Frequency	3	69	72
	% within Intensity of Storm Surge	4.2%	95.8%	100.0%
	% within Area	3.0%	98.6%	42.4%
Total	Frequency	100	70	170
	% within Intensity of Storm Surge	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

58% of the households in Umarsadi have rated the intensity of storm surge to be high while in Madhvad, they have rated it as Medium.

Table No: 29: Table showing exposure of the household of the respondent to coastal erosion climate hazard

Climate Hazard_Coastal erosion		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	96	18	114
	% within Climate Hazards_Coastal erosion	84.2%	15.8%	100.0%
	% within Area	96.0%	25.7%	67.1%
No	Frequency	4	52	56
	% within Climate Hazards_Coastal erosion	7.1%	92.9%	100.0%
	% within Area	4.0%	74.3%	32.9%
Total	Frequency	100	70	170
	% within Climate Hazards_Coastal erosion	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

96.0% of the respondents in Umarsadi state that their households have been exposed to Coastal erosion as a climate related hazard as against 25.7% of the households in Madhvad. This connotes that Umarsadi is more vulnerable as compared to Madhvad in term of coastal erosion.

Table No: 30 : Table showing intensity experienced by the household of the respondent to coastal erosion climate hazard

Intensity experienced by the household to Coastal Erosion climate hazard		Area		Total
		Umarsadi	Madhvad	
High	Frequency	54	3	57
	% within Intensity of Coastal Erosion	94.7%	5.3%	100.0%
	% within Area	54.0%	4.3%	33.5%
Medium	Frequency	32	15	47
	% within Intensity of Coastal Erosion	68.1%	31.9%	100.0%
	% within Area	32.0%	21.4%	27.6%
Low	Frequency	10	0	10
	% within Intensity of Coastal Erosion	100.0%	.0%	100.0%
	% within Area	10.0%	.0%	5.9%
NA	Frequency	4	52	56
	% within Intensity of Coastal Erosion	7.1%	92.9%	100.0%
	% within Area	4.0%	74.3%	32.9%
Total	Frequency	100	70	170
	% within Intensity of Coastal Erosion	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

54% of the respondents in Umarsadi have stated that the intensity of coastal erosion as a climate hazard as experienced by the household to be high as compared to 21.4% of the respondents stating it to be medium in Madhvad

Table No: 31 : Table showing exposure of the household of the respondent to Cyclone climate hazard

Climate Hazard_Cyclone		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	87	70	157
	% within Climate Hazards_Cyclone	55.4%	44.6%	100.0%
	% within Area	87.0%	100.0%	92.4%
No	Frequency	13	0	13
	% within Climate Hazards_Cyclone	100.0%	.0%	100.0%
	% within Area	13.0%	.0%	7.6%
Total	Frequency	100	70	170
	% within Climate Hazards_Cyclone	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

All respondents in Madhvad stated that their households have been exposed to cyclone climate hazard as compared to 87% of the respondents in Umarsadi area.

Table No: 32 : Table showing intensity experienced by the household of the respondent to cyclone climate hazard

Intensity of Cyclone		Area		Total
		Umarsadi	Madhvad	
High	Frequency	19	2	21
	% within Intensity of Cyclone	90.5%	9.5%	100.0%
	% within Area	19.0%	2.9%	12.4%
Medium	Frequency	7	68	75
	% within Intensity of Cyclone	9.3%	90.7%	100.0%
	% within Area	7.0%	97.1%	44.1%
Low	Frequency	61	0	61
	% within Intensity ofCyclone	100.0%	.0%	100.0%
	% within Area	61.0%	.0%	35.9%
NA	Frequency	13	0	13
	% within Intensity of Cyclone	100.0%	.0%	100.0%
	% within Area	13.0%	.0%	7.6%
Total	Frequency	100	70	170
	% within Intensity of Cyclone	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 61% of the respondents have rated cyclones to be of low intensity in Umarsadi while 97.1% of the respondents in Madhvad stated it to be of medium intensity.

Table No: 33 : Table showing exposure of the household of the respondent to Flood climate hazard

Climate Hazard_Flood		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	1	53	54
	% within Climate Hazard_Flood	1.9%	98.1%	100.0%
	% within Area	1.0%	75.7%	31.8%
No	Frequency	99	17	116
	% within Climate Hazard_Flood	85.3%	14.7%	100.0%
	% within Area	99.0%	24.3%	68.2%
Total	Frequency	100	70	170
	% within Climate Hazard_Flood	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

75.7% of the respondents from Madhavad stated that their households have been exposed to flood related climate hazard as compared to 99% of the respondents from Umarsadi stating that their households have not been exposed to flood related climate hazard.

Table No: 34 : Table showing intensity experienced by the household of the respondent of Flood climate hazard

Intensity of Flood		Area		Total
		Umarsadi	Madhavad	
High	Frequency	0	32	32
	% within Intensity of Flood	.0%	100.0%	100.0%
	% within Area	.0%	45.7%	18.8%
Medium	Frequency	0	21	21
	% within Intensity of Flood	.0%	100.0%	100.0%
	% within Area	.0%	30.0%	12.4%
Low	Frequency	1	0	1
	% within Intensity of Flood	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
NA	Frequency	99	17	116
	% within Intensity of Flood	85.3%	14.7%	100.0%
	% within Area	99.0%	24.3%	68.2%
Total	Frequency	100	70	170
	% within Intensity of Flood	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

The above table reflects that 45.7% of the respondents in Madhavad have rated the intensity of the flood as experienced by the household to be of High and 30% of them rate it as medium. This almost makes 75.7% of the respondents in the area. In case of Umarsadi, 99% of the respondents have stated it to be non applicable and the one who experienced it stated that intensity was low.

Table No: 35 : Table showing exposure of the household of the respondent to Salinity climate hazard

Climate Hazard_Salinity		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	16	70	86
	% within Climate Hazard_Salinity	18.6%	81.4%	100.0%
	% within Area	16.0%	100.0%	50.6%
No	Frequency	84	0	84
	% within Climate Hazard_Salinity	100.0%	.0%	100.0%
	% within Area	84.0%	.0%	49.4%
Total	Frequency	100	70	170
	% within Climate Hazard_Salinity	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

With regards to exposure of the households to salinity climate hazard, all the households in Madhvad have stated that they have been exposed to this hazard as compared to 16% of the households in case of Umarsadi.

Table No: 36 : Table showing intensity experienced by the household of the respondent to Salinity climate hazard

Intensity of Salinity		Area		Total
		Umarsadi	Madhvad	
High	Frequency	3	46	49
	% within Intensity of Salinity	6.1%	93.9%	100.0%
	% within Area	3.0%	65.7%	28.8%
Medium	Frequency	5	24	29
	% within Intensity of Salinity	17.2%	82.8%	100.0%
	% within Area	5.0%	34.3%	17.1%
Low	Frequency	8	0	8
	% within Intensity of Salinity	100.0%	.0%	100.0%
	% within Area	8.0%	.0%	4.7%
NA	Frequency	84	0	84
	% within Intensity of Salinity	100.0%	.0%	100.0%
	% within Area	84.0%	.0%	49.4%
Total	Frequency	100	70	170
	% within Intensity of Salinity	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the intensity of the salinity, 65.7% of the households state in Madhvad state that it's high as compared to 3.0% in Umarsadi. None of the respondents in Madhvad state it to be low as compared to 8% in Umarsadi stating that it is low.

Table No: 37 : Table showing exposure of the household of the respondent to depletion of mangrove cover as climate hazard

Climate Hazard -depletion of mangroves		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	11	11
	% within Climate Hazard_ depletion of mangroves	.0%	100.0%	100.0%
	% within Area	.0%	15.7%	6.5%
No	Frequency	100	59	159
	% within Climate Hazard_ depletion of mangroves	62.9%	37.1%	100.0%
	% within Area	100.0%	84.3%	93.5%
Total	Frequency	100	70	170
	% within Climate Hazard_ depletion of mangroves	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As observed from the above table, 15.7% of the households in Madhavad state that there has been depletion of mangrove covers in the area. No such exposure has been felt in case of Umarsadi.

Table No: 38 : Table showing intensity experienced by the household of the respondent to depletion of mangrove cover as climate hazard

Intensity of mangrove depletion		Area		Total
		Umarsadi	Madhavad	
High	Frequency	0	7	7
	% within Intensity of mangrove depletion	.0%	100.0%	100.0%
	% within Area	.0%	10.0%	4.1%
Medium	Frequency	0	4	4
	% within Intensity of mangrove depletion	.0%	100.0%	100.0%
	% within Area	.0%	5.7%	2.4%
NA	Frequency	100	59	159
	% within Intensity of mangrove depletion	62.9%	37.1%	100.0%
	% within Area	100.0%	84.3%	93.5%
Total	Frequency	100	70	170
	% within Intensity of mangrove depletion	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

10% of the respondents state that the intensity of depletion of mangroves is high while 5.7% say its low in Madhavad area. No such incidence is reported from Umarsadi area.

SECTION III

**SOCIAL CAPITAL IN FORM OF
FORMAL AND INFORMAL
NETWORKS**

Social Capital

Social capital in form of formal and informal capital is present in both the communities. These are especially in form of the fishermen community network known as Samaj by the local community. Another one is the presence of Swadhyay Parivar in both the communities since past two generations. People are connected to their Samaj right from their births as membership is based on birth. Once a baby is born, he/she is considered as member of the community. All the adults of the community become members of the samaj and hence their affiliation is since adulthood for working. In Madhvad, it is known as Kharva Samaj which in turn is affiliated with its network at the regional and national level. It acts as a strong support system and helps in governance of the community. They have their own social rules and regulations which are binding to the members. Regarding its activities, these networks apart from monitoring and implementing social rules and regulations, are also active during emergencies like death in a family, loss of income/livelihood, natural disasters, theft etc. These networks are the back bone of the community and thus they act as a strong support to the communities. There are regular meeting of the samaj and an annual meeting at the regional level for discussing and planning.

Religious group in form of Swadhyay parivar is present in both the communities. The members are engaged in different activities like krushi mandir, matsyagandha (tartu mandir), bhav feri, relief work during emergencies etc. They also conduct youth kendras and women kendras for the development of the community on regular basis. More than 75% of the households in both the communities are members of swadhyay parivar. In Madhvad, there is another group which is follower of Ram Dev Pir baba but apart from religious activities in form of prayers and religious functions, it is not involved in any other activities. In Umarsadi, there are followers of a cult from Dakor which is affiliated to the laxminarayan temple. They also run mandals especially mahila mandals which carry out activities like bhajans, prayers etc. These mandals also help their members in times of need.

There are three self help groups in Madhavad formed by the DRDA (District Rural Development Agency) they are recently formed groups and are in their infancy stage. They are presently involved in saving – credit activities. Each group has around 20 members who are all women. Similar kinds of self help groups are also there in Umarsadi and they are around 6-8 years old. They are also involved in saving credit activities and lending of loans. There are around 8-10 such groups which are functional.

Occupational groups in form of boat association are found to be there in both the communities. The main function of this association is to look after the various benefits the fishermen get under the various programmes of the fisheries department. These groups are also actively engaged during the cyclones in both the communities. In Umarsadi, there is a Seamen's association which caters to the need of seamen in the community. There are around 600+ members. The group basically helps the seamen in getting education, work permits, provide accommodation and lodging facilities at Mumbai etc. One important activity of this group is to offer monetary help to the needy people.

SECTION IV

**AMENITIES IN TIMES OF
NORMALCY AND EMERGENCY**

Table No: 39 : Table showing source of drinking water at the household level

Amenities _Drinking water		Area		Total
		Umarsadi	Madhvad	
Borewell	Frequency	54	1	55
	% within Amenities _Drinking water	98.2%	1.8%	
	% within Area	54.0%	1.4%	
Handpump	Frequency	39	3	42
	% within Amenities _Drinking water	92.9%	7.1%	
	% within Area	39.0%	4.3%	
Tap water	Frequency	6	41	47
	% within Amenities _Drinking water	12.8%	87.2%	
	% within Area	6.0%	58.6%	
Well	Frequency	2	14	16
	% within Amenities _Drinking water	12.5%	87.5%	
	% within Area	2.0%	20.0%	
Tanker	Frequency	0	11	11
	% within Amenities _Drinking water	.0%	100.0%	
	% within Area	.0%	15.7%	
NR	Frequency	2	8	10
	% within Amenities _Drinking water	20.0%	80.0%	
	% within Area	2.0%	11.4%	
Total	Frequency	100	70	170

As depicted from the above table under stress free conditions, 54.0% and 39.0% of the households have Borewell and Handpump as major source of drinking water in Umarsadi as compared to 58.6% , 20.0% and 15.7% households have Tap water, Well and Tanker as major source of drinking water in Madhvad. People in Umarsadi have better drinking facilities

Table No: 40 : Table showing source of Electricity at the household level

Amenities _Electricity		Area		Total
		Umarsadi	Madh vad	
GEB	Frequency	96	44	140
	% within Amenities _Electricity	68.6%	31.4%	100.0%
	% within Area	96.0%	62.9%	82.4%
NA	Frequency	4	26	30
	% within Amenities _Electricity	13.3%	86.7%	100.0%
	% within Area	4.0%	37.1%	17.6%
Total	Frequency	100	70	170
	% within Amenities _Electricity	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding source of power (electricity) under stress free conditions, 96.0% of the households in Umarsadi and 62.9 % of the households in Madh vad depend on government power supply. It is to be noted that 37.1% of the households in Madh vad have no electricity as compared to 4% in case of Umarsadi.

Table No: 41 : Table showing Health Care Services utilized at the household level

Amenities- Health Care services		Area		Total
		Umarsadi	Madh vad	
Private	Frequency	94	65	159
	% within \$q16a4	59.1%	40.9%	
	% within Area	94.0%	92.9%	
Government	Frequency	5	22	27
	% within \$q16a4	18.5%	81.5%	
	% within Area	5.0%	31.4%	
NR	Frequency	5	5	10
	% within \$q16a4	50.0%	50.0%	
	% within Area	5.0%	7.1%	
Total	Frequency	100	70	170

Under stress free conditions (Normal conditions), 94% of the respondents go to private health care service providers in Umarsadi for their health care needs and 92.9% of the respondent households also go to private health care service providers in Madh vad. In contrast to this, 31.4% of the households opt for government health care service providers in Madh vad while only 5.0% of the households from Umarsadi avail government facilities.

Table No: 42 : Table showing source of communication utilized at the household level

N=170

Amenities_ Communication		Area		Total
		Umarsadi	Madhavad	
Phone	Frequency	35	13	48
	% within Amenities_ Communication	72.9%	27.1%	
	% within Area	35.0%	18.6%	
Mobile	Frequency	58	17	75
	% within Amenities_ Communication	77.3%	22.7%	
	% within Area	58.0%	24.3%	
T.V	Frequency	31	45	76
	% within Amenities_ Communication	40.8%	59.2%	
	% within Area	31.0%	64.3%	
Radio	Frequency	6	40	46
	% within Amenities_ Communication	13.0%	87.0%	
	% within Area	6.0%	57.1%	
Boat Radio	Frequency	0	3	3
	% within Amenities_ Communication	.0%	100.0%	
	% within Area	.0%	4.3%	
NR	Frequency	34	22	56
	% within Amenities_ Communication	60.7%	39.3%	
	% within Area	34.0%	31.4%	
Total	Frequency	100	70	170

Regarding the sources of communication under stress free conditions, households in Umarsadi use Phone and Mobile with 35.0% and 58.0% of households as compared to 18.6% and 24.3% in Madhavad households. 64.3% use TV and 57.1% use Radio in Madhavad as compared to 31.0% and 6.0% in Umarsadi. It is worth noting that 34.0% and 31.4% of the respondent households in Umarsadi and Madhavad have not responded to the question.

Table No: 43 : Table showing source of transportation utilized at the household level

Amenities_ Transportation		Area		Total
		Umarsadi	Madhavad	
Rickshaw	Frequency	44	45	89
	% within Amenities_ Transportation	49.4%	50.6%	
	% within Area	44.0%	64.3%	
Bus	Frequency	35	2	37
	% within Amenities_ Transportation	94.6%	5.4%	
	% within Area	35.0%	2.9%	
Two Wheeler	Frequency	46	0	46
	% within Amenities_ Transportation	100.0%	.0%	
	% within Area	46.0%	.0%	
Car	Frequency	9	0	9
	% within Amenities_ Transportation	100.0%	.0%	
	% within Area	9.0%	.0%	
Train	Frequency	2	0	2
	% within Amenities_ Transportation	100.0%	.0%	
	% within Area	2.0%	.0%	
Others	Frequency	9	24	33
	% within Amenities_ Transportation	27.3%	72.7%	
	% within Area	9.0%	34.3%	
Total	Frequency	100	70	170

As seen from the above table, 62.0% and 34.3% of the households in Madhavad use Rickshaw and other mode of transportation in stress free conditions as compared to 46.0% and 44% of the households in Umarsadi using two wheeler and rickshaw. Households at Umarsadi use all amenities and more number of households has two wheelers and cars.

Table No: 44 : Table showing occupational resources utilized at the household level

Amenities- Occupational Resources		Area		Total
		Umarsadi	Madhvad	
Boat	Frequency	3	12	15
	% within Amenities- Occupational Resources	20.0%	80.0%	100.0%
	% within Area	3.0%	17.1%	8.8%
NA	Frequency	97	58	155
	% within Amenities- Occupational Resources	62.6%	37.4%	100.0%
	% within Area	97.0%	82.9%	91.2%
Total	Frequency	100	70	170
	% within Amenities- Occupational Resources	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, it can be inferred that 17.1% and 3% of the respondents in Madhvad and Umarsadi have stated that under stress free conditions, they use their boats as occupation resources.

Table No: 45 : Table showing source of drinking water in times of stress at the household level

Drinking water in times of stress		Area		Total
		Umarsadi	Madhvad	
Tanker	Frequency	23	54	77
	% within tanker	29.9%	70.1%	
	% within Area	23.0%	77.1%	
Government tap	Frequency	69	4	73
	% within government	94.5%	5.5%	
	% within Area	69.0%	5.7%	
Boring	Frequency	4	0	4
	% within boring	100.0%	.0%	
	% within Area	4.0%	.0%	
Hand pump	Frequency	1	0	1
	% within hand pump	100.0%	.0%	
	% within Area	1.0%	.0%	
Panchayat Tap	Frequency	3	5	8
	% within Panchayat tap	37.5%	62.5%	
	% within Area	3.0%	7.1%	

Other	Frequency	0	4	4
	% within others	.0%	100.0%	
	% within Area	.0%	5.7%	
NA	Frequency	4	7	11
	% within NA	36.4%	63.6%	
	% within Area	4.0%	10.0%	
Total	Frequency	100	70	170

As depicted from the above table, it can be noted that in case of emergency situations, 77.1% of the households in Madhvad and 69.0% households in Umarsadi resort to tankers selling water and Government sources for drinking water facility.

Table No: 46 : Table showing source of electricity in times of stress at the household level

N=170

Amenities in the time of stress -Electricity		Area		Total
		Umarsadi	Madhvad	
Lamp	Frequency	64	42	106
	% within lamp	60.4%	39.6%	
	% within Area	64.0%	60.0%	
Candle	Frequency	55	39	94
	% within candle	58.5%	41.5%	
	% within Area	55.0%	55.7%	
Government	Frequency	30	51	81
	% within government	37.0%	63.0%	
	% within Area	30.0%	72.9%	
Inverter	Frequency	5	0	5
	% within inverter	100.0%	.0%	
	% within Area	5.0%	.0%	
Emergency Light	Frequency	5	1	6
	% within emergency light	83.3%	16.7%	
	% within Area	5.0%	1.4%	
NA	Frequency	3	7	10
	% within NA	30.0%	70.0%	
	% within Area	3.0%	10.0%	
Total	Frequency	100	70	170

As depicted from the above table, in emergency situation, for electricity or power, 72.9%, 55.7% and 60% of the households in Madhavad depend on government sources, candle and lamps as compared to 30%, 55% and 64% in case of Umarsadi. It is worth noting that households in Umarsadi also have facilities like emergency light and inverters.

Table No: 47 : Table showing shelter utilized in times of stress at the household level

N=170

Amenities in the time of stress_Shelter		Area		Total
		Umarsadi	Madhavad	
School	Frequency	62	29	91
	% within school	68.1%	31.9%	
	% within Area	62.0%	41.4%	
Society	Frequency	32	1	33
	% within society	97.0%	3.0%	
	% within Area	32.0%	1.4%	
Thatch	Frequency	1	0	1
	% within thatch	100.0%	.0%	
	% within Area	1.0%	.0%	
Relatives	Frequency	2	21	23
	% within Relatives	8.7%	91.3%	
	% within Area	2.0%	30.0%	
House	Frequency	0	21	21
	% within house	.0%	100.0%	
	% within Area	.0%	30.0%	
Temple	Frequency	0	12	12
	% within Temple	.0%	100.0%	
	% within Area	.0%	17.2%	
NR	Frequency	7	0	17
	% within NR	100.0%	.0%	
	% within Area	7.0%	.0%	
Total	Frequency	100	70	170

In case of emergencies, households in Madhavad, 30% go to relatives or stay in own houses, 41.4% take shelter in School and 17.0 % take shelter in the temple. In Umarsadi, 62.0% go to schools and 32% take shelter in society.

Table No: 48 : Table showing source of Health Care Services in times of stress at the household level

N=170

Amenities in the time of stress_ Health Service Providers		Area		Total
		Umarsadi	Madhvad	
Government	Frequency	84	30	114
	% within Amenities in the time of stress_ Health Service Providers	73.7%	26.3%	
	% within Area	84.0%	42.9%	
Private	Frequency	62	50	112
	% within Amenities in the time of stress_ Health Service Providers	55.4%	44.6%	
	% within Area	62.0%	71.4%	
108	Frequency	2	31	33
	% within Amenities in the time of stress_ Health Service Providers	6.1%	93.9%	
	% within Area	2.0%	44.3%	
Village Doctor	Frequency	8	0	8
	% within Amenities in the time of stress_ Health Service Providers	100.0%	.0%	
	% within Area	8.0%	.0%	
NA	Frequency	5	10	15
	% within Amenities in the time of stress_ Health Service Providers	33.3%	66.7%	
	% within Area	5.0%	14.3%	
Total	Frequency	100	70	170

As seen from the above table, in emergency situations, households in Umarsadi resort to Government as well as private health care providers with 84.0% opting for government health care providers and 62.0% opting for private health care providers. 71.4%, 44.3% and 42.9% households in Madhvad opt for Private, 108 emergency services and government health care providers respectively.

Table No: 49 : Table showing source of Communication in times of stress at the household level

N=170

Amenities in the time of stress_ Communication		Area		Total
		Umarsadi	Madhavad	
Phone	Frequency	31	10	41
	% within Amenities in the time of stress_ Communication	75.6%	24.4%	
	% within Area	31.0%	14.3%	
Mobile	Frequency	61	12	73
	% within Amenities in the time of stress_ Communication	83.6%	16.4%	
	% within Area	61.0%	17.1%	
TV	Frequency	63	39	102
	% within Amenities in the time of stress_ Communication	61.8%	38.2%	
	% within Area	63.0%	55.7%	
Public Address System	Frequency	28	28	56
	% within Amenities in the time of stress_ Communication	50.0%	50.0%	
	% within Area	28.0%	40.0%	
Radio	Frequency	0	34	34
	% within Amenities in the time of stress_ Communication	.0%	100.0%	
	% within Area	.0%	48.6%	
NR	Frequency	33	26	59
	% within Amenities in the time of stress_ Communication	55.9%	44.1%	
	% within Area	33.0%	37.1%	
Total	Frequency	100	70	170

Regarding communication facilities in time of stress, an interesting thing to note is that 33% of households in Umarsadi and 37% of the households in Madhavad have not responded to the question. The major source of communication in Madhavad with 40% of the households responding is Public Address System as compared to 28.0% in Umarsadi. In Umarsadi, major source still remains Phone, Mobile and TV while for Madhavad, its Radio and TV.

Table No: 50 : Table showing use of Transportation in times of stress at the household level

N=170

Amenities in the time of stress_ Transportation		Area		Total
		Umarsadi	Madhvad	
Government	Frequency	64	1	65
	% within Amenities in the time of stress_ Transportation	98.5%	1.5%	
	% within Area	64.0%	1.4%	
Private	Frequency	74	47	121
	% within Amenities in the time of stress_ Transportation	61.2%	38.8%	
	% within Area	74.0%	67.1%	
Car	Frequency	2	0	2
	% within Amenities in the time of stress_ Transportation	100.0%	.0%	
	% within Area	2.0%	.0%	
Other	Frequency	6	0	6
	% within Amenities in the time of stress_ Transportation	100.0%	.0%	
	% within Area	6.0%	.0%	
NR	Frequency	13	22	35
	% within Amenities in the time of stress_ Transportation	37.1%	62.9%	
	% within Area	13.0%	31.4%	
Total	Frequency	100	70	170

As depicted from the above table, 64.0% and 74.0% of the households in Umarsadi use Government and Private transportation in times of emergency while in Madhvad, 67.1% use the private vehicles. It is to be noted that 31.4% of the households in Madhvad have not responded to the question. Madhvad households have less access to government vehicles.

Table No: 51 : Table showing source of Occupational resources in times of stress at the household level

Amenities in the time of stress_ Occupational resources		Area		Total
		Umarsadi	Madhavad	
Boat	Frequency	0	1	1
	% within Amenities in the time of stress_Occupational tool	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
NA	Frequency	100	69	169
	% within Amenities in the time of stress_Occupational tool	59.2%	40.8%	100.0%
	% within Area	100.0%	98.6%	99.4%
Total	Frequency	100	70	170
	% within Amenities in the time of stress_Occupational tool	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As observed from the above table, 1.4% of the total household respondents use boat as occupation resources in times of emergency in Madhavad. Thus most of the households do not go to sea during cyclones and floods.

SECTION V
COASTAL AND MARINE
RESOURCE DEPENDENCY

Table No: 52 : Table showing utilization of Coral Reefs as coastal and marine resources for fishing for household consumption

Utilizing Coral reef for fishing as goods and services		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	48	48
	% within Utilizing Coral reef for fishing as goods and services	.0%	100.0%	100.0%
	% within Area	.0%	68.6%	28.2%
No	Frequency	100	22	3
	% within Utilizing Coral reef for fishing as goods and services	98%	66.7%	100.0%
	% within Area	84.2%	18.8%	1.8%
Total	Frequency	100	70	170
	% within Utilizing Coral reef for fishing as goods and services	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, 68.6% of the respondents households in Madhavad utilizes coral reef as coastal and marine resources for fishing in form of goods and services for household consumption. No one from Umarsadi utilizes this.

Table No: 53 : Table showing utilization of Coral Reefs as coastal and marine resources for fishing for Selling

Utilizing Coral reef for fishing as goods and services for selling		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	48	48
	% within Your household is utilizing which of the following coastal and Goods & services_Fish	.0%	100.0%	100.0%
	% within Area	.0%	68.6%	28.2%
No	Frequency	100	22	122
	% within Your household is utilizing which of the following coastal and Goods & services_Fish	82.0%	18.0%	100.0%
	% within Area	100.0%	31.4%	71.8%
Total	Frequency	100	70	170
	% within Your household is utilizing which of the following coastal and Goods & services_Fish	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted in the above table, 68.6% of the respondent households in Madhavad do utilize fishing from coral reef to sell and earn livelihood. It is to be noted that no such activity is found to be in practice in Umarsadi area.

Table No: 54 : Table showing utilization of mangroves as coastal and marine resources in form of wood for household

Goods & Services_Wood for HH use		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	36	36
	% within Goods & Services_Wood for HH use	.0%	100.0%	100.0%
	% within Area	.0%	51.4%	21.2%
No	Frequency	100	34	134
	% within Goods & Services_Wood for HH use	74.6%	25.4%	100.0%
	% within Area	100.0%	48.6%	78.8%
Total	Frequency	100	70	170
	% within Goods & Services_Wood for HH use	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

51.4% of the households in Madhavad do utilize mangroves wood in the households. It is important to note that no such practice is seen in Umarsadi.

Table No: 55 : Table showing utilization of mangroves as coastal and marine resources in form of wood for cooking for household

Goods & Services_Wood for cooking		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	38	38
	% within Goods & Services_Wood for cooking	.0%	100.0%	100.0%
	% within Area	.0%	54.3%	22.4%
No	Frequency	100	32	132
	% within Goods & Services_Wood for cooking	75.8%	24.2%	100.0%
	% within Area	100.0%	45.7%	77.6%
Total	Frequency	100	70	170
	% within Goods & Services_Wood for cooking	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

54.3% of the households in Madhavad use mangrove wood for cooking purpose. No such activity is reported in case of Umarsadi.

Table No: 56 : Table showing utilization of mangroves as coastal and marine resources in form of wood for making coal for household

Goods & Services_ Coal for cooking		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	11	11
	% within Goods & Services_ Coal for cooking	.0%	100.0%	100.0%
	% within Area	.0%	15.7%	6.5%
No	Frequency	100	59	159
	% within Goods & Services_ Coal for cooking	62.9%	37.1%	100.0%
	% within Area	100.0%	84.3%	93.5%
Total	Frequency	100	70	170
	% within Goods & Services_ Coal for cooking	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, it is observed that 15.7% of the respondent households utilize mangroves for making coal which is used for cooking in the households. It is to be noted that no such activity is noted in Umarsadi.

Table No: 57 : Table showing utilization of mangroves as coastal and marine resources for fishing for selling

Goods & Services_ Fishing		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	50	50
	% within Goods & Services_ Fishing	.0%	100.0%	100.0%
	% within Area	.0%	71.4%	29.4%
No	Frequency	100	20	120
	% within Goods & Services_ Fishing	83.3%	16.7%	100.0%
	% within Area	100.0%	28.6%	70.6%
Total	Frequency	100	70	170
	% within Goods & Services_ Fishing	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

The above table depicts that 71.4% of the respondent households utilize coastal and marine resource of mangroves for fishing which they sell. No such activity is found to be there in case of Umarsadi,

SECTION VI: SOURCES OF LIVELIHOOD

Table No: 58 : Table showing fishing as a main source of livelihood for household use

Livelihood source_HH consumption_Fishing		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	23	57	80
	% within Livelihood source_HH consumption_Fishing	28.8%	71.3%	100.0%
	% within Area	23.0%	81.4%	47.1%
No	Frequency	77	13	90
	% within Livelihood source_HH consumption_Fishing	85.6%	14.4%	100.0%
	% within Area	77.0%	18.6%	52.9%
Total	Frequency	100	70	170
	% within Livelihood source_HH consumption_Fishing	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As shown in the table, 71.3% of the respondent households in Madhavad and 23.0% in Umarsadi state that the main source of livelihood for their household use is in form of fishing. It is to be noted that 77% of the households in Umarsadi do not depend on fishing for household use.

Table No: 59 : Table showing Other marine life as a main source of livelihood for household use

Livelihood source_HH consumption_Other marine life		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	0	31	31
	% within Livelihood source_HH consumption_Other marine life	.0%	100.0%	100.0%
	% within Area	.0%	44.3%	18.2%
No	Frequency	100	39	139
	% within Livelihood source_HH consumption_Other marine life	71.9%	28.1%	100.0%
	% within Area	100.0%	55.7%	81.8%
Total	Frequency	100	70	170
	% within Livelihood source_HH consumption_Other marine life	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, 44.3% of the households in Madhavad depend on other marine life in form of crabs, lobsters and shells for household purpose as main source of livelihood. It is to be noted that no such activity is reported in case of Umarsadi.

Table No: 60 : Table showing income from Job as a main source of livelihood for household

Livelihood source_HH consumption_Income from service/job		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	54	1	55
	% within Livelihood source_HH consumption_Income from service/job	98.2%	1.8%	100.0%
	% within Area	54.0%	1.4%	32.4%
No	Frequency	46	69	115
	% within Livelihood source_HH consumption_Income from service/job	40.0%	60.0%	100.0%
	% within Area	46.0%	98.6%	67.6%
Total	Frequency	100	70	170
	% within Livelihood source_HH consumption_Income from service/job	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, 54% of the respondent households in Umarsadi and only 1.4% of the households in Madhavad are engaged in service/job as the major source of income for household consumption. Rest of the respondents from Madhavad are not dependent on job.

Table No: 61 : Table showing business as a main source of livelihood for household use

Livelihood source_HH consumption_Business		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	10	40	50
	% within Livelihood source_HH consumption_Business	20.0%	80.0%	100.0%
	% within Area	10.0%	57.1%	29.4%
No	Frequency	90	30	120
	% within Livelihood source_HH consumption_Business	75.0%	25.0%	100.0%
	% within Area	90.0%	42.9%	70.6%
Total	Frequency	100	70	170
	% within Livelihood source_HH consumption_Business	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 10% of the households in Umarsadi and 57.1% of the households in Madhavad are engaged in business as a main source of livelihood for their subsistence

Table No: 62 : Table showing Pension as a main source of livelihood for household use

Livelihood source_HH consumption_Pension		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	2	1	3
	% within Livelihood source_HH consumption_Pension	66.7%	33.3%	100.0%
	% within Area	2.0%	1.4%	1.8%
No	Frequency	98	69	167
	% within Livelihood source_HH consumption_Pension	58.7%	41.3%	100.0%
	% within Area	98.0%	98.6%	98.2%
Total	Frequency	100	70	170
	% within Livelihood source_HH consumption_Pension	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted in the above table, 2.0% of the households in Umarsadi and 1.4 % of the households in Madhvad have pension as their main source of livelihood for household consumption.

Table No: 63 : Table showing other sources as a main source of livelihood for household use

Livelihood source_HH consumption_Other ...		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	31	1	32
	% within Livelihood source_HH consumption_Other ...	96.9%	3.1%	100.0%
	% within Area	31.0%	1.4%	18.8%
No	Frequency	69	69	138
	% within Livelihood source_HH consumption_Other ...	50.0%	50.0%	100.0%
	% within Area	69.0%	98.6%	81.2%
Total	Frequency	100	70	170
	% within Livelihood source_HH consumption_Other ...	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding other sources as main source of livelihood for household use, 31.0%of the households from Umarsadi and 1.4% of the households from Madhvad have opted for this suggestive of engagement in other occupations like driving auto, bus etc.

Table No: 64 : Table showing fishing as a main source of livelihood for business use

For business purpose_Fishing		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	19	1	20
	% within For business purpose_Fishing	95.0%	5.0%	100.0%
	% within Area	19.0%	1.4%	11.8%
No	Frequency	81	69	150
	% within For business purpose_Fishing	54.0%	46.0%	100.0%
	% within Area	81.0%	98.6%	88.2%
Total	Frequency	100	70	170
	% within For business purpose_Fishing	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Only 19.0% of the households in Umarsadi and 1.4% of the households in Madhavad are engaged in fishing as a main source of livelihood for business use only.

Table No: 65 : Table showing other marine life as a main source of livelihood for business use

For business purpose_Other marine life		Area		Total
		Umarsadi	Madhavad	
No	Frequency	100	70	170
	% within For business purpose_Other marine life	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%
Total	Frequency	100	70	170
	% within For business purpose_Other marine life	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

None of the households in the two communities depend on other marine life as main source of livelihood for business use.

Table No: 66 : Table showing animal husbandry as a main source of livelihood for business use

For business purpose_Animal husbandry		Area		Total
		Umarsadi	Madhavad	
No	Frequency	100	70	170
	% within For business purpose_Animal husbandry	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%
Total	Frequency	100	70	170
	% within For business purpose_Animal husbandry	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

It is to be noted that no respondent household is involved in animal husbandry as main source of livelihood for business use.

Table No: 67 : Table showing Handicraft as a main source of livelihood for business use

For business purpose_Handicraft		Area		Total
		Umarsadi	Madhavad	
Yes	Frequency	1	0	1
	% within For business purpose_Handicraft	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
No	Frequency	99	70	169
	% within For business purpose_Handicraft	58.6%	41.4%	100.0%
	% within Area	99.0%	100.0%	99.4%
Total	Frequency	100	70	170
	% within For business purpose_Handicraft	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Only 1.0% of the household in Umarsadi is involved in Handicrafts as the main source of livelihood for business use. No such activity is reported in Madhavad area.

Table No: 68 : Table showing Income from service as a main source of livelihood for business use

For business purpose_Income from service/job		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	42	0	42
	% within For business purpose_Income from service/job	100.0%	.0%	100.0%
	% within Area	42.0%	.0%	24.7%
No	Frequency	58	70	128
	% within For business purpose_Income from service/job	45.3%	54.7%	100.0%
	% within Area	58.0%	100.0%	75.3%
Total	Frequency	100	70	170
	% within For business purpose_Income from service/job	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 42% of the respondent households in Umarsadi are involved in major source of livelihood for business purpose in form of income from service. No such activity is seen in Madhvad area.

Table No: 69 : Table showing money from relatives as a main source of livelihood for business use

For business purpose_Money from relatives		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	1	0	1
	% within For business purpose_Money from relatives	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
No	Frequency	99	70	169
	% within For business purpose_Money from relatives	58.6%	41.4%	100.0%
	% within Area	99.0%	100.0%	99.4%
Total	Frequency	100	70	170
	% within For business purpose_Money from relatives	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

1.0% of the respondent household is involved in using money from relatives as main source of livelihood for business use.

Table No: 70 : Table showing others as a main source of livelihood for business use

For business purpose_other		Area		Total
		Umarsadi	Madhvad	
Yes	Frequency	29	0	29
	% within For business purpose_other	100.0%	.0%	100.0%
	% within Area	29.0%	.0%	17.1%
No	Frequency	71	70	141
	% within For business purpose_other	50.4%	49.6%	100.0%
	% within Area	71.0%	100.0%	82.9%
Total	Frequency	100	70	170
	% within For business purpose_other	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

29.0% of the respondent households in Umarsadi depend on other sources as main source of livelihood in form of Seamen for business use. It is to be noted that no such activity is reported from Madhvad.

Table No: 71 : Table showing number and role of family members engaged in livelihood - Fishing

Family members involved in _Fishing		Area		Total
		Umarsadi	Madhvad	
Self/ head of the family	Frequency	17	27	44
	% within Family members involved in _Fishing	38.6%	61.4%	100.0%
	% within Area	17.0%	38.6%	25.9%
Wife	Frequency	2	15	17
	% within Family members involved in _Fishing	11.8%	88.2%	100.0%
	% within Area	2.0%	21.4%	10.0%
Son	Frequency	1	7	8
	% within Family members involved in _Fishing	12.5%	87.5%	100.0%
	% within Area	1.0%	10.0%	4.7%
Daughter in law	Frequency	0	5	5
	% within Family members involved in _Fishing	.0%	100.0%	100.0%
	% within Area	.0%	7.1%	2.9%
Grand Daughter	Frequency	0	1	1
	% within Family members involved in _Fishing	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%

Mother	Frequency	1	0	1
	% within Family members involved in _Fishing	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Husband	Frequency	0	6	6
	% within Family members involved in _Fishing	.0%	100.0%	100.0%
	% within Area	.0%	8.6%	3.5%
Father in law	Frequency	1	0	1
	% within Family members involved in _Fishing	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
NA	Frequency	78	9	87
	% within Family members involved in _Fishing	89.7%	10.3%	100.0%
	% within Area	78.0%	12.9%	51.2%
Total	Frequency	100	70	170
	% within Family members involved in _Fishing	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, 38.6% of the respondent households in Madhavad as compared to 17.0% in Umarsadi state that it is the household head who is engaged in fishing for livelihood. 21.4% and 2.0% of the households in Madhavad and Umarsadi respectively have engagement of wives in the same livelihood. Only 12.9% of the households in Madhavad and 78.0% of the households in Umarsadi are not engaged in fishing for livelihood. It is to be noted that in case of Madhavad, second generation in form of daughter in law, sons, daughters etc are also involved in fishing unlike Umarsadi.

Table No: 72 : Table showing number and role of family members engaged in livelihood – Other marine life

Role of family members engaged in livelihood in form of other marine life		Area		Total
		Umarsadi	Madhvad	
Wife	Frequency	3	11	14
	Role of family members engaged in livelihood in form of other marine life	21.4%	78.6%	
	% within Area	3.0%	15.7%	
Son	Frequency	0	20	20
	Role of family members engaged in livelihood in form of other marine life	.0%	100.0%	
	% within Area	.0%	28.6%	
Daughter in law	Frequency	0	1	1
	Role of family members engaged in livelihood in form of other marine life	.0%	100.0%	
	% within Area	.0%	1.4%	
Daughter	Frequency	0	1	1
	Role of family members engaged in livelihood in form of other marine life	.0%	100.0%	
	% within Area	.0%	1.4%	
Husband	Frequency	2	0	2
	Role of family members engaged in livelihood in form of other marine life	100.0%	.0%	
	% within Area	2.0%	.0%	
Sister in law (nanand)	Frequency	0	1	1
	Role of family members engaged in livelihood in form of other marine life	.0%	100.0%	
	% within Area	.0%	1.4%	
Brother in law (diyar)	Frequency	0	1	1
	Role of family members engaged in livelihood in form of other marine life	.0%	100.0%	
	% within Area	.0%	1.4%	
NA	Frequency	95	44	139
	Role of family members engaged in livelihood in form of other marine life	68.3%	31.7%	
	% within Area	95.0%	62.9%	
Total	Frequency	100	70	170

As pertaining to role of family members engaged in livelihood from other marine lives like crabs, prawns and shells, 15.7% of the households in Madhvad have the wives engaged in this while 28.6% are in form of sons. Thus absence of engagement of the household heads is noted in this case in both the communities.

Table No: 73 : Table showing number and role of family members engaged in livelihood – Handicraft

Role of Family members engaged in livelihood in form of handicrafts		Area		Total
		Umarsadi	Madhavad	
Wife	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of handicrafts	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
NA	Frequency	99	70	169
	% within Role of Family members engaged in livelihood in form of handicrafts	58.6%	41.4%	100.0%
	% within Area	99.0%	100.0%	99.4%
Total	Frequency	100	70	170
	% within Role of Family members engaged in livelihood in form of handicrafts	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, only one person in form of wife of a respondent household is engaged in livelihood in form of handicraft in Umarsadi. No such activity is reported in Madhavad.

Table No: 74 : Table showing number and role of family members engaged in livelihood – Service sector

Role of Family members engaged in livelihood in form of service/job		Area		Total
		Umarsadi	Madhavad	
Self/ head of the family	Frequency	30	1	31
	% within Role of Family members engaged in livelihood in form of service/job	96.8%	3.2%	
	% within Area	30.0%	1.4%	
Wife	Frequency	14	0	14
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	14.0%	.0%	
Son	Frequency	14	2	16
	% within Role of Family members engaged in livelihood in form of service/job	87.5%	12.5%	
	% within Area	14.0%	2.9%	
Daughter in law	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	1.0%	.0%	

Daughter	Frequency	2	0	2
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	2.0%	.0%	
Father	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	1.0%	.0%	
Mother	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	1.0%	.0%	
Husband	Frequency	5	0	5
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	5.0%	.0%	
Sister	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	1.0%	.0%	
Brother	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of service/job	100.0%	.0%	
	% within Area	1.0%	.0%	
NA	Frequency	49	69	118
	% within Role of Family members engaged in livelihood in form of service/job	41.5%	58.5%	
	% within Area	49.0%	98.6%	
Total	Frequency	100	70	170

As regards the engagement in service sector, it is noted that this is negligible in case of Madhavad with only three members engaged in this activity as against in Umarsadi where 30.0% are in form of household heads, 14.0 % in form of wives and sons. It is to be noted that daughters, daughter in laws, sisters etc are also engaged in this sector in Umarsadi.

Table No: 75 : Table showing number and role of family members engaged in livelihood – Business

Role of Family members engaged in livelihood in form of business		Area		Total
		Umarsadi	Madhvad	
Self/ head of the family	Frequency	6	1	7
	% within Role of Family members engaged in livelihood in form of business	85.7%	14.3%	100.0%
	% within Area	6.0%	1.4%	4.1%
Son	Frequency	2	0	2
	% within Role of Family members engaged in livelihood in form of business	100.0%	.0%	100.0%
	% within Area	2.0%	.0%	1.2%
Mother	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of business	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Husband	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of business	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
NA	Frequency	90	69	159
	% within Role of Family members engaged in livelihood in form of business	56.6%	43.4%	100.0%
	% within Area	90.0%	98.6%	93.5%
Total	Frequency	100	70	170
	% within Role of Family members engaged in livelihood in form of business	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, members engaged in livelihood in form of business like shop, auto rickshaw etc in Umarsadi are found to be head of the family amounting to 6.0% and sons (2.0%) followed by mothers and husbands amounting to 1.0% each. In contrast, in Madhvad, this percentage is 1.4% in form of head of the family.

Table No: 76 : Table showing number and role of family members engaged in livelihood – others

Role of Family members engaged in livelihood in form of other occupations		Area		Total
		Umarsadi	Madhavad	
Self/ head of the family	Frequency	0	6	6
	% within Role of Family members engaged in livelihood in form of other occupations	.0%	100.0%	100.0%
	% within Area	.0%	8.6%	3.5%
Son	Frequency	1	1	2
	% within Role of Family members engaged in livelihood in form of other occupations	50.0%	50.0%	100.0%
	% within Area	1.0%	1.4%	1.2%
NA	Frequency	99	63	162
	% within Role of Family members engaged in livelihood in form of other occupations	61.1%	38.9%	100.0%
	% within Area	99.0%	90.0%	95.3%
Total	Frequency	100	70	170
	% within Role of Family members engaged in livelihood in form of other occupations	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 8.6% of the household heads and 1.4% of the sons are engaged in livelihood in form of other occupations in Madhavad as compared to 1.0% sons engaged in Umarsadi.

Table No: 77 : Table showing number and role of family members engaged in livelihood – Seaman

Role of Family members engaged in livelihood in form of seaman		Area		Total
		Umarsadi	Madhvad	
Self/ head of the family	Frequency	17	0	17
	% within Role of Family members engaged in livelihood in form of seaman	100.0%	.0%	
	% within Area	17.0%	.0%	
Son	Frequency	11	0	11
	% within Role of Family members engaged in livelihood in form of seaman	100.0%	.0%	
	% within Area	11.0%	.0%	
Father	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of seaman	100.0%	.0%	
	% within Area	1.0%	.0%	
Husband	Frequency	8	0	8
	% within Role of Family members engaged in livelihood in form of seaman	100.0%	.0%	
	% within Area	8.0%	.0%	
Father in law	Frequency	1	0	1
	% within Role of Family members engaged in livelihood in form of seaman	100.0%	.0%	
	% within Area	1.0%	.0%	
NA	Frequency	67	68	135
	% within Role of Family members engaged in livelihood in form of seaman	49.6%	50.4%	
	% within Area	67.0%	97.1%	
Total	Frequency	100	70	170

As seen from the above table, 17.0% of the household heads, 11.0% of the sons, 8.0% of the husbands, and 1.0% of father and father in law each in Umarsadi are engaged in livelihood in form of seaman while no such occupational engagement is found to be there in Madhvad.

SECTION VII

VULNERABILITY TO HAZARDS AT THE HOUSEHOLD LEVEL

Table No : 78 : Table showing frequency of cyclones witnessed by the households

Frequency of cyclones as witnessed by households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	74	7	81
	% within Frequency of cyclones as witnessed by households	91.4%	8.6%	100.0%
	% within Area	77.1%	10.1%	49.1%
Medium	Frequency	18	40	58
	% within Frequency of cyclones as witnessed by households	31.0%	69.0%	100.0%
	% within Area	18.8%	58.0%	35.2%
High	Frequency	4	22	26
	% within Frequency of cyclones as witnessed by households	15.4%	84.6%	100.0%
	% within Area	4.2%	31.9%	15.8%
Total	Frequency	96	69	165
	% within Frequency of cyclones as witnessed by households	58.2%	41.8%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the frequency of cyclones witnessed by the households, 31.9% of the households in Madhvad as compared to 4.2% in Umarsadi state this to be high. 58.0% of them in Madhvad report this to be medium while 77.1% of them in Umarsadi state that the frequency is low. 5 respondents have not responded.

Table No : 79 : Table showing sensitivity of the households towards impact of cyclones witnessed by the households

Sensitivity of households towards impact of cyclones as witnessed by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	72	27	99
	% within Sensitivity of households towards impact of cyclones as witnessed by the households	72.7%	27.3%	100.0%
	% within Area	75.0%	39.1%	60.0%
Medium	Frequency	20	38	58
	% within Sensitivity of households towards impact of cyclones as witnessed by the households	34.5%	65.5%	100.0%
	% within Area	20.8%	55.1%	35.2%
High	Frequency	4	4	8
	% within Sensitivity of households towards impact of cyclones as witnessed by the households	50.0%	50.0%	100.0%
	% within Area	4.2%	5.8%	4.8%

Total	Frequency	96	69	165
	% within Sensitivity of households towards impact of cyclones as witnessed by the households	58.2%	41.8%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the table, sensitivity of the households towards cyclones, 75.0% of the households in Umarsadi rate it as low and 20.8% rate it as medium as against 39.1% of them in Madhvad rating it as low and 55.1% of them rating it as medium. 5 respondents did not respond.

Table No : 80 : Table showing negative impact of cyclones witnessed by the households

Negative impact of cyclones as witnessed by households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	64	26	90
	% within Negative impact of cyclones as witnessed by households	71.1%	28.9%	100.0%
	% within Area	66.7%	37.7%	54.5%
Medium	Frequency	28	37	65
	% within Negative impact of cyclones as witnessed by households	43.1%	56.9%	100.0%
	% within Area	29.2%	53.6%	39.4%
High	Frequency	4	6	10
	% within Negative impact of cyclones as witnessed by households	40.0%	60.0%	100.0%
	% within Area	4.2%	8.7%	6.1%
Total	Frequency	96	69	165
	% within Negative impact of cyclones as witnessed by households	58.2%	41.8%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the negative impact of cyclones (in term of damage) as witnessed by the households, 66.7% of the households in Umarsadi as compared to 37.7% in Madhvad rate it as low. 53.6% of the households in Madhvad as compared to 29.2% in Umarsadi rate it as medium. 5 respondents did not respond.

Table No: 81: Table showing difficulty in coping with impact of cyclones witnessed by the households

Difficulty of coping with Impact of cyclones witnessed by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	69	27	96
	% within Difficulty of coping with Impact of cyclones witnessed by the households	71.9%	28.1%	100.0%
	% within Area	71.9%	39.1%	58.2%
Medium	Frequency	26	14	40
	% within Difficulty of coping with Impact of cyclones witnessed by the households	65.0%	35.0%	100.0%
	% within Area	27.1%	20.3%	24.2%
High	Frequency	1	28	29
	% within Difficulty of coping with Impact of cyclones witnessed by the households	3.4%	96.6%	100.0%
	% within Area	1.0%	40.6%	17.6%
Total	Frequency	96	69	165
	% within Difficulty of coping with Impact of cyclones witnessed by the households	58.2%	41.8%	100.0%
	% within Area	100.0%	100.0%	100.0%

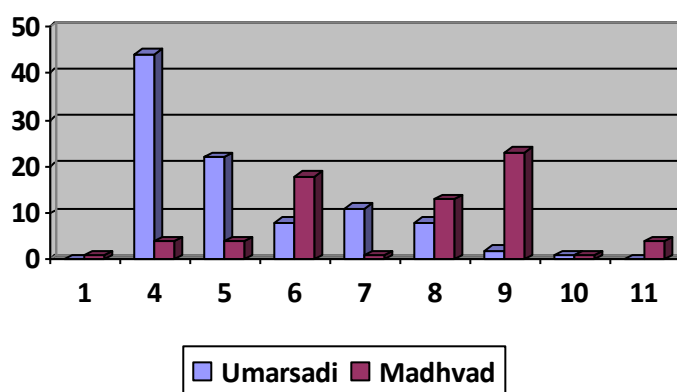
As seen in the above table, 71.9% of the households in Umarsadi as compared to 39.1% in Madhvad rate difficulty in coping with impact of cyclones witnessed by the households to be low while 27.1% and 20.3% rate it to be medium in Umarsadi and Madhvad. It is to be noted that 40.6% of the households in Madhvad have rated it to be high. Thus households in Madhvad find it more difficult to cope up with impacts of cyclone. This is so due to the intensity of the cyclones in the area.

Table No: 82: Table showing total vulnerability rating for cyclones witnessed by the households

Total Vulnerability Rating		Area		Total
		Umarsadi	Madhvad	
1	Frequency	0	1	1
	% within Total Vulnerability Rating_Cyclone	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
4	Frequency	44	4	48
	% within Total Vulnerability Rating_Cyclone	91.7%	8.3%	100.0%
	% within Area	45.8%	5.8%	29.1%

5	Frequency	22	4	26
	% within Total Vulnerability Rating_Cyclone	84.6%	15.4%	100.0%
	% within Area	22.9%	5.8%	15.8%
6	Frequency	8	18	26
	% within Total Vulnerability Rating_Cyclone	30.8%	69.2%	100.0%
	% within Area	8.3%	26.1%	15.8%
7	Frequency	11	1	12
	% within Total Vulnerability Rating_Cyclone	91.7%	8.3%	100.0%
	% within Area	11.5%	1.4%	7.3%
8	Frequency	8	13	21
	% within Total Vulnerability Rating_Cyclone	38.1%	61.9%	100.0%
	% within Area	8.3%	18.8%	12.7%
9	Frequency	2	23	25
	% within Total Vulnerability Rating_Cyclone	8.0%	92.0%	100.0%
	% within Area	2.1%	33.3%	15.2%
10	Frequency	1	1	2
	% within Total Vulnerability Rating_Cyclone	50.0%	50.0%	100.0%
	% within Area	1.0%	1.4%	1.2%
11	Frequency	0	4	4
	% within Total Vulnerability Rating_Cyclone	.0%	100.0%	100.0%
	% within Area	.0%	5.8%	2.4%
Total	Frequency	96	69	165
	% within Total Vulnerability Rating_Cyclone	58.2%	41.8%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Cyclone



As seen from the above table and graph, while the total vulnerability to cyclones is low in Umarsadi, it is high in case of Madhvad. The sum total of frequency, sensitivity, negative impact and difficulty in coping gives an idea about the total vulnerability rating. Thus Madhvad is more vulnerable than Umarsadi based on the total vulnerability rating

Table No: 83 : Table showing frequency of coastal erosion witnessed by the households

Frequency of Coastal erosion witnessed by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	19	10	29
	% within Frequency of Coastal erosion witnessed by the households	65.5%	34.5%	100.0%
	% within Area	19.8%	27.8%	22.0%
Medium	Frequency	23	8	31
	% within Frequency of Coastal erosion witnessed by the households	74.2%	25.8%	100.0%
	% within Area	24.0%	22.2%	23.5%
High	Frequency	54	18	72
	% within Frequency of Coastal erosion witnessed by the households	75.0%	25.0%	100.0%
	% within Area	56.3%	50.0%	54.5%
Total	Frequency	96	36	132
	% within Frequency of Coastal erosion witnessed by the households	72.7%	27.3%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the frequency of coastal erosion, 56.3% of the households in Umarsadi and 50.0% of the households in Madhvad have rated this to be high. Coastal erosion is a major hazard identified by both the communities. 28 respondents did not respond as it is not applicable to them

Table No: 84: Table showing sensitivity of the households to coastal erosion

Sensitivity of the household to coastal erosion		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	23	18	41
	% within Sensitivity of the household to coastal erosion	56.1%	43.9%	100.0%
	% within Area	24.0%	50.0%	31.1%
Medium	Frequency	15	8	23
	% within Sensitivity of the household to coastal erosion	65.2%	34.8%	100.0%
	% within Area	15.6%	22.2%	17.4%
High	Frequency	58	10	68
	% within Sensitivity of the household to coastal erosion	85.3%	14.7%	100.0%
	% within Area	60.4%	27.8%	51.5%
Total	Frequency	96	36	132
	% within Sensitivity of the household to coastal erosion	72.7%	27.3%	100.0%
	% within Area	100.0%	100.0%	100.0%

60.4% of the households in Umarsadi and 27.8% of the households in Madhavad state that the sensitivity of their households to coastal erosion is high. It is to be noted that 50.0% of the households in Madhavad rate this to be low. 28 respondents did not reply as it is not applicable to them

Table No: 85: Table showing Negative impact of coastal erosion on the households

Negative Impact of coastal erosion on households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	20	6	26
	% within Negative Impact of coastal erosion on households	76.9%	23.1%	100.0%
	% within Area	20.8%	16.7%	19.7%
Medium	Frequency	23	29	52
	% within Negative Impact of coastal erosion on households	44.2%	55.8%	100.0%
	% within Area	24.0%	80.6%	39.4%
High	Frequency	53	1	54
	% within Negative Impact of coastal erosion on households	98.1%	1.9%	100.0%
	% within Area	55.2%	2.8%	40.9%
Total	Frequency	96	36	132
	% within Negative Impact of coastal erosion on households	72.7%	27.3%	100.0%
	% within Area	100.0%	100.0%	100.0%

80.6% of the households in Madhavad rate the negative impact of coastal erosion on their households as medium while 55.2% of the households rate it to be high in Umarsadi. 28 respondents did not reply as it is not applicable to them

Table No : 86 : Table showing difficulty in coping with impact of coastal erosion by the households

Difficulty in coping with impact of coastal erosion by the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	21	7	28
	% within Difficulty in coping with impact of coastal erosion by the households	75.0%	25.0%	100.0%
	% within Area	21.9%	19.4%	21.2%
Medium	Frequency	19	28	47
	% within Difficulty in coping with impact of coastal erosion by the households	40.4%	59.6%	100.0%
	% within Area	19.8%	77.8%	35.6%

High	Frequency	56	1	57
	% within Difficulty in coping with impact of coastal erosion by the households	98.2%	1.8%	100.0%
	% within Area	58.3%	2.8%	43.2%
Total	Frequency	96	36	132
	% within Difficulty in coping with impact of coastal erosion by the households	72.7%	27.3%	100.0%
	% within Area	100.0%	100.0%	100.0%

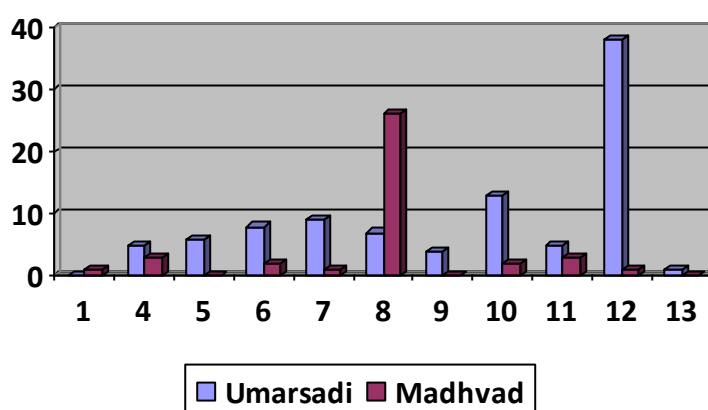
Regarding difficulty in coping with impact of coastal erosion by the households, 77.8% of the respondent households in Madhvad rate this to be medium while 58.3% of the households in Umarsadi rate this to be high. 28 respondents did not respond as it is not applicable to them.

Table No: 87 : Table showing total vulnerability rating of the households to coastal erosion

Total Vulnerability Rating_Coastal erosion		Area		Total
		Umarsadi	Madhvad	
1	Frequency	0	1	1
	% within Total Vulnerability Rating_Coastal erosion	.0%	100.0%	100.0%
	% within Area	.0%	2.8%	.8%
4	Frequency	5	3	8
	% within Total Vulnerability Rating_Coastal erosion	62.5%	37.5%	100.0%
	% within Area	5.2%	8.3%	6.1%
5	Frequency	6	0	6
	% within Total Vulnerability Rating_Coastal erosion	100.0%	.0%	100.0%
	% within Area	6.3%	.0%	4.5%
6	Frequency	8	2	10
	% within Total Vulnerability Rating_Coastal erosion	80.0%	20.0%	100.0%
	% within Area	8.3%	5.6%	7.6%
7	Frequency	9	1	10
	% within Total Vulnerability Rating_Coastal erosion	90.0%	10.0%	100.0%
	% within Area	9.4%	2.8%	7.6%
8	Frequency	7	26	33
	% within Total Vulnerability Rating_Coastal erosion	21.2%	78.8%	100.0%
	% within Area	7.3%	72.2%	25.0%
9	Frequency	4	0	4
	% within Total Vulnerability Rating_Coastal erosion	100.0%	.0%	100.0%
	% within Area	4.2%	.0%	3.0%
10	Frequency	13	2	15
	% within Total Vulnerability Rating_Coastal erosion	86.7%	13.3%	100.0%
	% within Area	13.5%	5.6%	11.4%
11	Frequency	5	0	5
	% within Total Vulnerability Rating_Coastal erosion	100.0%	.0%	100.0%
	% within Area	5.2%	.0%	3.8%

12	Frequency	38	1	39
	% within Total Vulnerability Rating_Coastal erosion	97.4%	2.6%	100.0%
	% within Area	39.6%	2.8%	29.5%
13	Frequency	1	0	1
	% within Total Vulnerability Rating_Coastal erosion	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.8%
Total	Frequency	96	36	132
	% within Total Vulnerability Rating_Coastal erosion	72.7%	27.3%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Costal Erosion



As depicted in the above table and graph, total vulnerability rating for coastal erosion is found to be high in case of Umarsadi than in Madhvad. The sum total of frequency, sensitivity, negative impact and difficulty in coping with the impact of coastal erosion provides the total vulnerability rating. Thus though both the communities are vulnerable, the vulnerability is high in case of Umarsadi. 28 respondents did not reply as it is not applicable to them.

Table No: 88 : Table showing frequency of increase in sea level as witnessed by the households

Frequency rating of increase in sea level by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	30	22	52
	% within Frequency rating of increase in sea level by the households	57.7%	42.3%	100.0%
	% within Area	31.6%	31.4%	31.5%
Medium	Frequency	41	42	83
	% within Frequency rating of increase in sea level by the households	49.4%	50.6%	100.0%
	% within Area	43.2%	60.0%	50.3%
High	Frequency	24	6	30
	% within Frequency rating of increase in sea level by the households	80.0%	20.0%	100.0%
	% within Area	25.3%	8.6%	18.2%
Total	Frequency	95	70	165
	% within Frequency rating of increase in sea level by the households	57.6%	42.4%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen in the above table, 60.0% of the households in Madhvad have rated frequency of increase in sea level to be medium as compared to 43.2% of the households in Umarsadi. 25.3% of the households in Umarsadi have rated this to be high while 31.6% have rated this to be low. 5 respondents did not reply

Table No: 89 : Table showing sensitivity towards increase in sea level by the households

Sensitivity to increase in sea level by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	32	20	52
	% within Sensitivity to increase in sea level by the households	61.5%	38.5%	100.0%
	% within Area	33.7%	28.6%	31.5%
Medium	Frequency	36	18	54
	% within Sensitivity to increase in sea level by the households	66.7%	33.3%	100.0%
	% within Area	37.9%	25.7%	32.7%
High	Frequency	27	32	59
	% within Sensitivity to increase in sea level by the households	45.8%	54.2%	100.0%
	% within Area	28.4%	45.7%	35.8%
Total	Frequency	95	70	165
	% within Sensitivity to increase in sea level by the households	57.6%	42.4%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the table, 45.7% of the households in Madhavad have rated sensitivity to increase in sea level to be high as 37.9% of the households in Umarsadi rating it to be medium. 5 respondents did not reply

Table No : 90 : Table showing negative impact of increase in sea level on the households

Negative impact of increase in sea level on the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	35	57	92
	% within Negative impact of increase in sea level on the households	38.0%	62.0%	100.0%
	% within Area	36.8%	81.4%	55.8%
Medium	Frequency	34	7	41
	% within Negative impact of increase in sea level on the households	82.9%	17.1%	100.0%
	% within Area	35.8%	10.0%	24.8%
High	Frequency	26	6	32
	% within Negative impact of increase in sea level on the households	81.3%	18.8%	100.0%
	% within Area	27.4%	8.6%	19.4%
Total	Frequency	95	70	165
	% within Negative impact of increase in sea level on the households	57.6%	42.4%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the negative impact of increase in sea level on the households, 81.4% of the households in Madhavad have rated it to be low as compared to 36.8% in Umarsadi. 35.8% and 10.0% of the households have rated this to be medium in Umarsadi and Madhavad respectively. 5 respondents did not respond.

Table No : 91 : Table showing difficulty in coping with impact of increase in sea level by the households

Difficulty in coping with impact of increase in sea level by the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	38	35	73
	% within Difficulty in coping with impact of increase in sea level by the households	52.1%	47.9%	100.0%
	% within Area	40.0%	50.0%	44.2%
Medium	Frequency	32	5	37
	% within Difficulty in coping with impact of increase in sea level by the households	86.5%	13.5%	100.0%
	% within Area	33.7%	7.1%	22.4%

High	Frequency	25	30	55
	% within Difficulty in coping with impact of increase in sea level by the households	45.5%	54.5%	100.0%
	% within Area	26.3%	42.9%	33.3%
Total	Frequency	95	70	165
	% within Difficulty in coping with impact of increase in sea level by the households	57.6%	42.4%	100.0%
	% within Area	100.0%	100.0%	100.0%

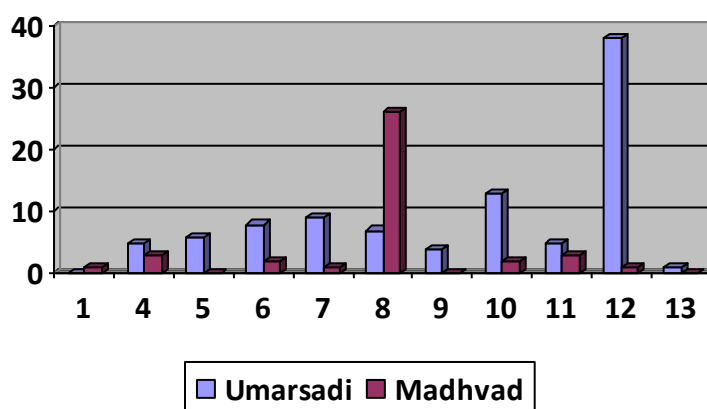
As regards the difficulty in coping with impact of increase in sea level by the households, 42.9% of the households in Madhavad have rated it to be high compared to 40.0% of the households in Umarsadi rating it to be low. It is to be noted that 33.7% of the households in Umarsadi have rated this to be as medium. 5 respondents did not respond.

Table No: 92: Table showing total vulnerability rating of increase in sea level by the households

Total Vulnerability Rating		Area		Total
		Umarsadi	Madhavad	
1	Frequency	0	1	1
	% within Total Vulnerability Rating_Increase in sea water level	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
4	Frequency	4	20	24
	% within Total Vulnerability Rating_Increase in sea water level	16.7%	83.3%	100.0%
	% within Area	4.2%	28.6%	14.5%
5	Frequency	14	3	17
	% within Total Vulnerability Rating_Increase in sea water level	82.4%	17.6%	100.0%
	% within Area	14.7%	4.3%	10.3%
6	Frequency	18	10	28
	% within Total Vulnerability Rating_Increase in sea water level	64.3%	35.7%	100.0%
	% within Area	18.9%	14.3%	17.0%
7	Frequency	21	3	24
	% within Total Vulnerability Rating_Increase in sea water level	87.5%	12.5%	100.0%
	% within Area	22.1%	4.3%	14.5%
8	Frequency	7	5	12
	% within Total Vulnerability Rating_Increase in sea water level	58.3%	41.7%	100.0%
	% within Area	7.4%	7.1%	7.3%
9	Frequency	3	20	23
	% within Total Vulnerability Rating_Increase in sea water level	13.0%	87.0%	100.0%
	% within Area	3.2%	28.6%	13.9%
10	Frequency	12	2	14
	% within Total Vulnerability Rating_Increase in sea water level	85.7%	14.3%	100.0%
	% within Area	12.6%	2.9%	8.5%

11	Frequency	2	0	2
	% within Total Vulnerability Rating_Increase in sea water level	100.0%	.0%	100.0%
	% within Area	2.1%	.0%	1.2%
12	Frequency	14	6	20
	% within Total Vulnerability Rating_Increase in sea water level	70.0%	30.0%	100.0%
	% within Area	14.7%	8.6%	12.1%
Total	Frequency	95	70	165
	% within Total Vulnerability Rating_Increase in sea water level	57.6%	42.4%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Sea Level Rise



As seen in the above table and graph, total vulnerability rating regarding Sea Level Rise is more in case of Umarsadi than in case of Madhvad. The sum total of the frequency, sensitivity, negative impact and difficulty in coping up provides the total vulnerability rating of a hazard. Thus, Umarsadi is more vulnerable to Sea Level Rise than Madhvad.

Table No: 93: Table showing frequency of salty water in farms as witnessed by the households

Frequency of salty water in farms witnessed by the households				
		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	20	28	48
	% within Frequency of salty water in farms by the households	41.7%	58.3%	100.0%
	% within Area	69.0%	50.0%	56.5%
Medium	Frequency	6	16	22
	% within Frequency of salty water in farms by the households	27.3%	72.7%	100.0%
	% within Area	20.7%	28.6%	25.9%

High	Frequency	3	12	15
	% within Frequency of salty water in farms by the households	20.0%	80.0%	100.0%
	% within Area	10.3%	21.4%	17.6%
Total	Frequency	29	56	85
	% within Frequency of salty water in farms by the households	34.1%	65.9%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 69.0% and 50.0% of the households have rated the frequency of salty water in the farms to be low in Umarsadi and Madhavad. This is to be noted that the respondents belong to fishermen community. While 20.7% and 28.6% households in Umarsadi and Madhavad rate it as medium respectively. 21.4% of the households in Madhavad rate this to be high suggestive of salinity ingress. Only 85 respondents have responded.

Table No : 94 : Table showing sensitivity to salty water in farms by the households

Sensitivity to salty water in farms witnessed by the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	22	28	50
	% within Sensitivity to salty water in farms by the households	44.0%	56.0%	100.0%
	% within Area	75.9%	50.0%	58.8%
Medium	Frequency	2	16	18
	% within Sensitivity to salty water in farms by the households	11.1%	88.9%	100.0%
	% within Area	6.9%	28.6%	21.2%
High	Frequency	5	12	17
	% within Sensitivity to salty water in farms by the households	29.4%	70.6%	100.0%
	% within Area	17.2%	21.4%	20.0%
Total	Frequency	29	56	85
	% within Sensitivity to salty water in farms by the households	34.1%	65.9%	100.0%
	% within Area	100.0%	100.0%	100.0%

As observed in the above table, 75.9% and 50.0% of the households in Umarsadi and Madhavad respectively state that the sensitivity to salty water in the farms is low. It is to be noted that 21.4% of the households in Madhavad have rated it to be high and 28.6% stating it to be medium. Only 85 respondents have responded.

Table No : 95 : Table showing negative impact of salty water in farms on the households

Negative impact of salty water in farms on the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	22	16	38
	% within Negative impact of salty water in farms on the households	57.9%	42.1%	100.0%
	% within Area	75.9%	28.6%	44.7%
Medium	Frequency	5	10	15
	% within Negative impact of salty water in farms on the households	33.3%	66.7%	100.0%
	% within Area	17.2%	17.9%	17.6%
High	Frequency	2	30	32
	% within Negative impact of salty water in farms on the households	6.3%	93.8%	100.0%
	% within Area	6.9%	53.6%	37.6%
Total	Frequency	29	56	85
	% within Negative impact of salty water in farms on the households	34.1%	65.9%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, the negative impact of salty water in farms has been rated as low by 75.9% of the households in Umarsadi as against 53.6% of the households in Madhvad rating it to be high. Only 85 respondents have responded and hence values are computed for them only.

Table No: 96 : Table showing difficulty in coping due to salty water in farms by the households

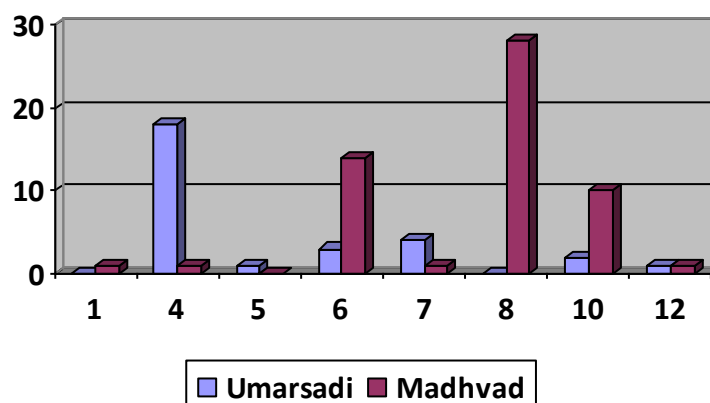
Difficulty in coping due to salty water in farms by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	21	18	39
	% within Difficulty in coping due to salty water in farms by the households	53.8%	46.2%	100.0%
	% within Area	72.4%	32.1%	45.9%
Medium	Frequency	5	9	14
	% within Difficulty in coping due to salty water in farms by the households	35.7%	64.3%	100.0%
	% within Area	17.2%	16.1%	16.5%
High	Frequency	3	29	32
	% within Difficulty in coping due to salty water in farms by the households	9.4%	90.6%	100.0%
	% within Area	10.3%	51.8%	37.6%
Total	Frequency	29	56	85
	% within Difficulty in coping due to salty water in farms by the households	34.1%	65.9%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding difficulty in coping by the households due to salty water in farms, it is rated low by 72.4% and 32.1% of the households in Umarsadi and Madhavad respectively. 51.8% of the households have rated this to be high in Madhavad. Only 85 respondents have responded to the question.

Table No: 97: Table showing total vulnerability rating of salty water in farms as witnessed by the households

Total Vulnerability Rating_Salty water in farms		Area		Total
		Umarsadi	Madhavad	
1	Frequency	0	1	1
	% within Total Vulnerability Rating_Salty water in farms	.0%	100.0%	100.0%
	% within Area	.0%	1.8%	1.2%
4	Frequency	18	1	19
	% within Total Vulnerability Rating_Salty water in farms	94.7%	5.3%	100.0%
	% within Area	62.1%	1.8%	22.4%
5	Frequency	1	0	1
	% within Total Vulnerability Rating_Salty water in farms	100.0%	.0%	100.0%
	% within Area	3.4%	.0%	1.2%
6	Frequency	3	14	17
	% within Total Vulnerability Rating_Salty water in farms	17.6%	82.4%	100.0%
	% within Area	10.3%	25.0%	20.0%
7	Frequency	4	1	5
	% within Total Vulnerability Rating_Salty water in farms	80.0%	20.0%	100.0%
	% within Area	13.8%	1.8%	5.9%
8	Frequency	0	28	28
	% within Total Vulnerability Rating_Salty water in farms	.0%	100.0%	100.0%
	% within Area	.0%	50.0%	32.9%
10	Frequency	2	10	12
	% within Total Vulnerability Rating_Salty water in farms	16.7%	83.3%	100.0%
	% within Area	6.9%	17.9%	14.1%
12	Frequency	1	1	2
	% within Total Vulnerability Rating_Salty water in farms	50.0%	50.0%	100.0%
	% within Area	3.4%	1.8%	2.4%
Total	Frequency	29	56	85
	% within Total Vulnerability Rating_Salty water in farms	34.1%	65.9%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Salty Water in Farms



The sum total of frequency of hazard, sensitivity to hazard, negative impact of hazard and difficulty in coping up with the impact of hazard provides the total vulnerability rating for that hazard. It shows the total vulnerability in terms of hazards. Thus, according to the responses received from the respondents, Madhvad is more vulnerable than Umarsadi based on the total vulnerability rating for salty water in farms as witnessed by the households.

Table No: 98 : Table showing frequency of salty water in wells as witnessed by the households

Frequency of salty water in wells as witnessed by the households		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	29	15	44
	% within Frequency of salty water in wells by the households	65.9%	34.1%	100.0%
	% within Area	30.2%	21.4%	26.5%
Medium	Frequency	26	11	37
	% within Frequency of salty water in wells by the households I	70.3%	29.7%	100.0%
	% within Area	27.1%	15.7%	22.3%
High	Frequency	41	44	85
	% within Frequency of salty water in wells by the households	48.2%	51.8%	100.0%
	% within Area	42.7%	62.9%	51.2%
Total	Frequency	96	70	166
	% within Frequency of salty water in wells by the households	57.8%	42.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

62.9% of the households in Madhvad and 42.7% of the households in Umarsadi state that frequency of salty water in wells is high. 4 respondents did not reply.

Table No : 99 : Table showing sensitivity to salty water in wells as witnessed by the households

Sensitivity to salty water in wells as witnessed by the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	29	0	29
	% within Sensitivity to salty water in wells by the households	100.0%	.0%	100.0%
	% within Area	30.2%	.0%	17.5%
Medium	Frequency	26	13	39
	% within Sensitivity to salty water in wells by the households	66.7%	33.3%	100.0%
	% within Area	27.1%	18.6%	23.5%
High	Frequency	41	57	98
	% within Sensitivity to salty water in wells by the households	41.8%	58.2%	100.0%
	% within Area	42.7%	81.4%	59.0%
Total	Frequency	96	70	166
	% within Sensitivity to salty water in wells by the households	57.8%	42.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 81.4% of the households in Madhavad and 42.7% of the households in Umarsadi state that the sensitivity to salty water in wells is high. 4 respondents did not respond.

Table No: 100: Table showing negative impact of salty water in wells as witnessed by the households

Negative impact of salty water in wells on the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	29	6	35
	% within Negative impact of salty water in wells on the households	82.9%	17.1%	100.0%
	% within Area	30.2%	8.6%	21.1%
Medium	Frequency	25	25	50
	% within Negative impact of salty water in wells on the households	50.0%	50.0%	100.0%
	% within Area	26.0%	35.7%	30.1%
High	Frequency	42	39	81
	% within Negative impact of salty water in wells on the households	51.9%	48.1%	100.0%
	% within Area	43.8%	55.7%	48.8%
Total	Frequency	96	70	166
	% within Negative impact of salty water in wells on the households	57.8%	42.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the negative impact of salty water in wells on the households, 55.7% and 43.8% of the respondent households in Madhavad and Umarsadi have rated this to be high. 26.0% and 35.7% in Umarsadi and Madhavad respectively state it to be medium. 4 respondents did not respond.

Table No: 101 : Table showing difficulty in coping with salty water in wells by the households

Difficulty of coping with Salty water in well by the household		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	32	7	39
	% within Difficulty of coping with Salty water in well by the household	82.1%	17.9%	100.0%
	% within Area	33.3%	10.0%	23.5%
Medium	Frequency	25	27	52
	% within Difficulty of coping with Salty water in well by the household	48.1%	51.9%	100.0%
	% within Area	26.0%	38.6%	31.3%
High	Frequency	39	36	75
	% within Difficulty of coping with Salty water in well by the household	52.0%	48.0%	100.0%
	% within Area	40.6%	51.4%	45.2%
Total	Frequency	96	70	166
	% within Difficulty of coping with Salty water in well by the household	57.8%	42.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

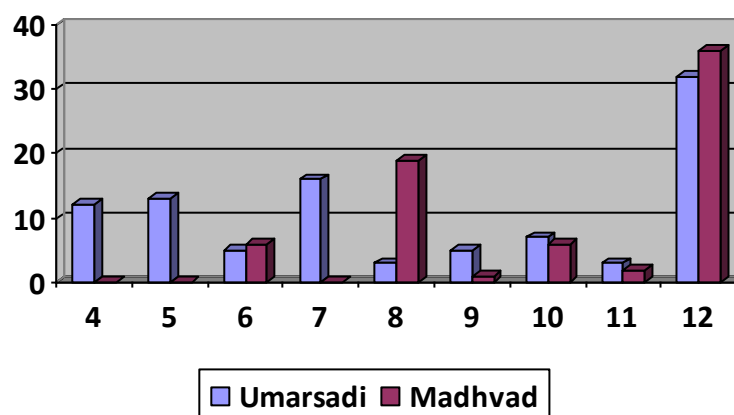
As depicted in the above table, 51.4% and 40.6% of the households in Madhvad and Umarsadi respectively have rated difficulty in coping with salty water in well by the households to be high and 38.6% and 26.0% have rated it to be medium.

Table No: 102 : Table showing total vulnerability rating of salty water in wells as witnessed by the households

Total Vulnerability Rating_Salty water in well		Area		Total
		Umarsadi	Madhvad	
4	Frequency	12	0	12
	% within Total Vulnerability Rating_Salty water in well	100.0%	.0%	100.0%
	% within Area	12.5%	.0%	7.2%
5	Frequency	13	0	13
	% within Total Vulnerability Rating_Salty water in well	100.0%	.0%	100.0%
	% within Area	13.5%	.0%	7.8%
6	Frequency	5	6	11
	% within Total Vulnerability Rating_Salty water in well	45.5%	54.5%	100.0%
	% within Area	5.2%	8.6%	6.6%
7	Frequency	16	0	16
	% within Total Vulnerability Rating_Salty water in well	100.0%	.0%	100.0%
	% within Area	16.7%	.0%	9.6%

8	Frequency	3	19	22
	% within Total Vulnerability Rating_Salty water in well	13.6%	86.4%	100.0%
	% within Area	3.1%	27.1%	13.3%
9	Frequency	5	1	6
	% within Total Vulnerability Rating_Salty water in well	83.3%	16.7%	100.0%
	% within Area	5.2%	1.4%	3.6%
10	Frequency	7	6	13
	% within Total Vulnerability Rating_Salty water in well	53.8%	46.2%	100.0%
	% within Area	7.3%	8.6%	7.8%
11	Frequency	3	2	5
	% within Total Vulnerability Rating_Salty water in well	60.0%	40.0%	100.0%
	% within Area	3.1%	2.9%	3.0%
12	Frequency	32	36	68
	% within Total Vulnerability Rating_Salty water in well	47.1%	52.9%	100.0%
	% within Area	33.3%	51.4%	41.0%
Total	Frequency	96	70	166
	% within Total Vulnerability Rating_Salty water in well	57.8%	42.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Salty Water in Well



The total vulnerability rating of any hazard is computed by adding the sum total of frequency, sensitivity, negative impact and difficulty in coping to that hazard. As seen from the above table and graph, Madhvad shows more vulnerability rating than Umarsadi. Thus households in Madhvad are more vulnerable to the wells becoming salty as it affects their water requirement.

Table No : 103 : Table showing frequency of change in weather as reported by the households

Frequency of change in weather as reported by the households		Area		Total
		Umarsadi	Madh vad	
Low	Frequency	78	31	109
	% within Frequency of change in weather by the households	71.6%	28.4%	100.0%
	% within Area	85.7%	44.3%	67.7%
Medium	Frequency	12	33	45
	% within % within Frequency of change in weather by the households	26.7%	73.3%	100.0%
	% within Area	13.2%	47.1%	28.0%
High	Frequency	1	6	7
	% within Frequency of change in weather by the households	14.3%	85.7%	100.0%
	% within Area	1.1%	8.6%	4.3%
Total	Frequency	91	70	161
	% within Frequency of change in weather by the households	56.5%	43.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 47.1% of the households in Madh vad state that the frequency of change in weather is medium while 85.7% of the households in Umarsadi rate it as low. 9 respondents did not respond.

Table No: 104: Table showing sensitivity to change in weather as reported by the households

Sensitivity to change in weather		Area		Total
		Umarsadi	Madh vad	
Low	Frequency	84	14	98
	% within Sensitivity to change in weather	85.7%	14.3%	100.0%
	% within Area	92.3%	20.0%	60.9%
Medium	Frequency	6	39	45
	% within Sensitivity to change in weather	13.3%	86.7%	100.0%
	% within Area	6.6%	55.7%	28.0%
High	Frequency	1	17	18
	% within Sensitivity to change in weather	5.6%	94.4%	100.0%
	% within Area	1.1%	24.3%	11.2%
Total	Frequency	91	70	161
	% within Sensitivity to change in weather	56.5%	43.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted in the above table, 92.3% of the households in Umarsadi rate sensitivity to change in weather of households to be low while 55.7% of the households in Madh vad rate it to be medium. It is to be noted that 24.3% of the households rate this to be high in case of Madh vad. 9 respondents did not respond.

Table No : 105 : Table showing negative impact of change in weather on the households

Negative Impact of change in weather		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	70	51	121
	% within Negative Impact of change in weather	57.9%	42.1%	100.0%
	% within Area	76.9%	72.9%	75.2%
Medium	Frequency	18	19	37
	% within Negative Impact of change in weather	48.6%	51.4%	100.0%
	% within Area	19.8%	27.1%	23.0%
High	Frequency	3	0	3
	% within Negative Impact of change in weather	100.0%	.0%	100.0%
	% within Area	3.3%	.0%	1.9%
Total	Frequency	91	70	161
	% within Negative Impact of change in weather	56.5%	43.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

As observed from the above table, 76.9% and 72.9% of the households in Umarsadi and Madhavad respectively rate negative impact of change in weather on households to be low. It is to be noted that 27.1% in Madhavad rate this to be medium.

Table No: 106 : Table showing difficulty in coping up with change in weather by the households

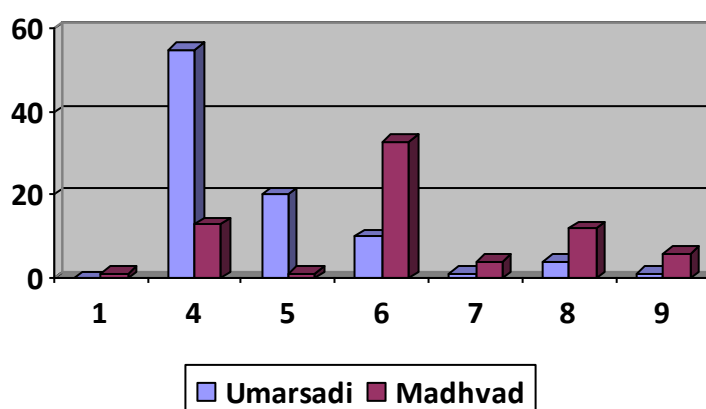
Difficulty in coping with changes in weather by the households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	76	51	127
	% within Difficulty in coping with changes in weather by the households	59.8%	40.2%	100.0%
	% within Area	83.5%	72.9%	78.9%
Medium	Frequency	12	19	31
	% within Difficulty in coping with changes in weather by the households	38.7%	61.3%	100.0%
	% within Area	13.2%	27.1%	19.3%
High	Frequency	3	0	3
	% within Difficulty in coping with changes in weather by the households	100.0%	.0%	100.0%
	% within Area	3.3%	.0%	1.9%
Total	Frequency	91	70	161
	% within Difficulty in coping with changes in weather by the households	56.5%	43.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding difficulty in coping with changes in weather by the households, 83.5% and 72.9% of the households in Umarsadi and Madhavad respectively rate it to be low. 9 respondents did not respond.

Table No : 107 : Table showing total vulnerability rating of impact of change in weather as witnessed by the households

Total Vulnerability Rating_Changes in weather		Area		Total
		Umarsadi	Madhvad	
1	Frequency	0	1	1
	% within Total Vulnerability Rating_Changes in weather	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
4	Frequency	55	13	68
	% within Total Vulnerability Rating_Changes in weather	80.9%	19.1%	100.0%
	% within Area	60.4%	18.6%	42.2%
5	Frequency	20	1	21
	% within Total Vulnerability Rating_Changes in weather	95.2%	4.8%	100.0%
	% within Area	22.0%	1.4%	13.0%
6	Frequency	10	33	43
	% within Total Vulnerability Rating_Changes in weather	23.3%	76.7%	100.0%
	% within Area	11.0%	47.1%	26.7%
7	Frequency	1	4	5
	% within Total Vulnerability Rating_Changes in weather	20.0%	80.0%	100.0%
	% within Area	1.1%	5.7%	3.1%
8	Frequency	4	12	16
	% within Total Vulnerability Rating_Changes in weather	25.0%	75.0%	100.0%
	% within Area	4.4%	17.1%	9.9%
9	Frequency	1	6	7
	% within Total Vulnerability Rating_Changes in weather	14.3%	85.7%	100.0%
	% within Area	1.1%	8.6%	4.3%
Total	Frequency	91	70	161
	% within Total Vulnerability Rating_Changes in weather	56.5%	43.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Changes in Weather



As seen from the above table and graph, the total vulnerability rating of change in weather as witnessed by households is high in case of Madhvad then Umarsadi. Thus Madhvad is more vulnerable than Umarsadi.

Table No : 108 : Table showing frequency of drought faced by the households

Cross Table			
Frequency of drought faced by the households		Area	Total
		Madhvad	
Low	Frequency	21	21
	% within Frequency of drought faced by the households	100.0%	100.0%
	% within Area	80.8%	80.8%
Medium	Frequency	4	4
	% within Frequency_ Frequency of drought faced by the households	100.0%	100.0%
	% within Area	15.4%	15.4%
High	Frequency	1	1
	% within Frequency of drought faced by the households	100.0%	100.0%
	% within Area	3.8%	3.8%
Total	Frequency	26	26
	% within Frequency of drought faced by the households	100.0%	100.0%
	% within Area	100.0%	100.0%

Out of the 26 households who have said that their households have experienced drought, 80.8% of them have rated this to be low in case of Madhvad. No such incidence has been stated from Umarsadi and hence it is not shown in the table. Only 26 respondents have responded to the question as it is applicable to them.

Table No : 109 : Table showing sensitivity of drought rated by the households

Sensitivity of drought rated by the households		Area	Total
		Madhvad	
Low	Frequency	21	21
	% within Sensitivity of drought rated by the households	100.0%	100.0%
	% within Area	80.8%	80.8%
Medium	Frequency	4	4
	% within Sensitivity of drought rated by the households	100.0%	100.0%
	% within Area	15.4%	15.4%

High	Frequency	1	1
	% within Sensitivity of drought rated by the households	100.0%	100.0%
	% within Area	3.8%	3.8%
Total	Frequency	26	26
	% within Sensitivity_	100.0%	100.0%
	% within Area	100.0%	100.0%

Out of the 26 households who have responded, 80.8% of the households in Madhvad have rated the sensitivity of drought to be low. No such incidence is reported from Umarsadi. Only 26 respondents have reported as they have faced the situation.

Table No: 110 : Table showing negative impact of drought on the households

Negative Impact of drought on the households		Area	Total
		Madhvad	
Low	Frequency	24	24
	% within Negative Impact on HH_	100.0%	100.0%
	% within Area	92.3%	92.3%
Medium	Frequency	2	2
	% within Negative Impact on HH_	100.0%	100.0%
	% within Area	7.7%	7.7%
Total	Frequency	26	26
	% within Negative Impact on HH_	100.0%	100.0%
	% within Area	100.0%	100.0%

As observed from the above table, 92.3% of the households from the 26 that responded to the questioning Madhvad have stated that the negative impact of drought on their households is low. Only 26 respondents have respondent since it was applicable to them.

Table No: 111 : Table showing difficulty in coping up with drought as witnessed by the households

Difficulty in coping with drought		Area	Total
		Madhvad	
Low	Frequency	14	14
	% within Difficulty in coping with drought	100.0%	100.0%
	% within Area	53.8%	53.8%
Medium	Frequency	6	6
	% within Difficulty in coping with drought	100.0%	100.0%
	% within Area	23.1%	23.1%
High	Frequency	6	6
	% within Difficulty in coping with drought	100.0%	100.0%
	% within Area	23.1%	23.1%
Total	Frequency	26	26
	% within Difficulty in coping with drought	100.0%	100.0%
	% within Area	100.0%	100.0%

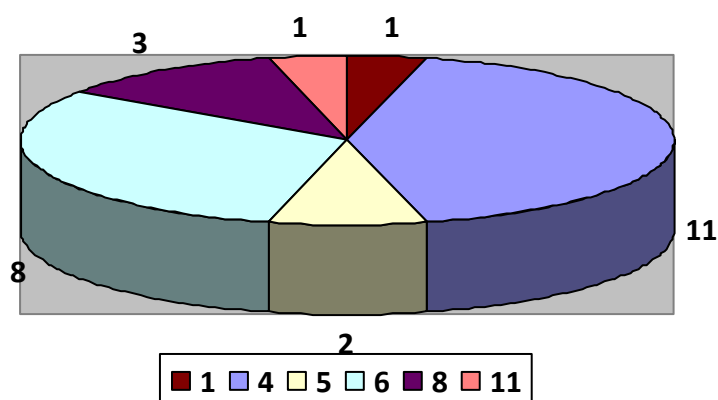
As seen in the above table, 23.1% of the households out of the total 26 who have responded in Madhvad have found difficulty in coping with drought by the households to be medium and high respectively.

Table No: 112: Table showing total vulnerability rating of drought by the households

Total Vulnerability Rating		Area	Total
		Madhvad	
1	Frequency	1	1
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	3.8%	3.8%
4	Frequency	11	11
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	42.3%	42.3%
5	Frequency	2	2
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	7.7%	7.7%
6	Frequency	8	8
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	30.8%	30.8%
8	Frequency	3	3
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	11.5%	11.5%
11	Frequency	1	1
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	3.8%	3.8%

Total	Frequency	26	26
	% within Total Vulnerability Rating_ drought	100.0%	100.0%
	% within Area	100.0%	100.0%

Total Vulnerability Rating_Drought



The total vulnerability rating of drought is medium by most of the respondents as represented in the table and graph.

Table No : 113 : Table showing frequency of floods as rated by the households

Frequency of floods		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	1	23	24
	% within Frequency of Flood	4.2%	95.8%	100.0%
	% within Area	100.0%	33.3%	34.3%
Medium	Frequency	0	13	13
	% within Frequency of Flood	.0%	100.0%	100.0%
	% within Area	.0%	18.8%	18.6%
High	Frequency	0	33	33
	% within Frequency of Flood	.0%	100.0%	100.0%
	% within Area	.0%	47.8%	47.1%
Total	Frequency	1	69	70
	% within Frequency of Flood	1.4%	98.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the frequency of floods, 47.8% of the households have stated it to be high in Madhvad. It is to be noted that in Umarsadi, only 4.2% of the household have stated it to be low. Only 70 respondents for whom it is applicable have responded.

Table No: 114: Table showing sensitivity of floods as rated by the households

Sensitivity to Flood		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	1	23	24
	% within Sensitivity to Flood	4.2%	95.8%	100.0%
	% within Area	100.0%	33.3%	34.3%
Medium	Frequency	0	6	6
	% within Sensitivity to Flood	.0%	100.0%	100.0%
	% within Area	.0%	8.7%	8.6%
High	Frequency	0	40	40
	% within Sensitivity to Flood	.0%	100.0%	100.0%
	% within Area	.0%	58.0%	57.1%
Total	Frequency	1	69	70
	% within Sensitivity to Flood	1.4%	98.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted from the above table, 58.0% of the households in Madhavad out of the total 69, state that there is high sensitivity to floods of their households. Only 70 respondents for whom it is applicable have responded

Table No : 115 : Table showing negative impact of floods as rated by the households

Negative Impact on flood on households		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	0	23	23
	% within Negative Impact on flood on households	.0%	100.0%	100.0%
	% within Area	.0%	33.3%	32.9%
Medium	Frequency	1	17	18
	% within Negative Impact on flood on households	5.6%	94.4%	100.0%
	% within Area	100.0%	24.6%	25.7%
High	Frequency	0	29	29
	% within Negative Impact on flood on households	.0%	100.0%	100.0%
	% within Area	.0%	42.0%	41.4%
Total	Frequency	1	69	70
	% within Negative Impact on flood on households	1.4%	98.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

As per the above table, 42.0% of the households in Madhavad state that the negative impact on flood on their households is high. In case of Umarsadi only one household has responded to the question and has rated it as medium. Only 70 respondents for whom it is applicable have responded

Table No : 116 : Table showing difficulty in coping with impact of floods as rated by the households

Difficulty in coping with impact of floods		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	1	23	24
	% within Difficulty in coping with impact of floods	4.2%	95.8%	100.0%
	% within Area	100.0%	33.3%	34.3%
Medium	Frequency	0	21	21
	% within Difficulty in coping with impact of floods	.0%	100.0%	100.0%
	% within Area	.0%	30.4%	30.0%
High	Frequency	0	25	25
	% within Difficulty in coping with impact of floods	.0%	100.0%	100.0%
	% within Area	.0%	36.2%	35.7%
Total	Frequency	1	69	70
	% within Difficulty in coping with impact of floods	1.4%	98.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

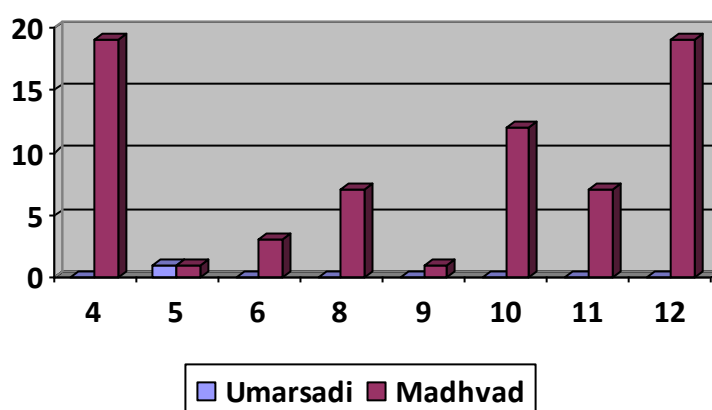
As depicted from the above table, 36.2% of the households state that the difficulty in coping with impact of floods is high in Madhavad while 30.4% state it to be medium. The rest state it to be low.

Table No: 117: Graph showing total vulnerability of floods as rated by the households

Total Vulnerability Rating for Floods		Area		Total
		Umarsadi	Madhavad	
4	Frequency	0	19	19
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	27.5%	27.1%
5	Frequency	1	1	2
	% within Total Vulnerability Rating for Floods	50.0%	50.0%	100.0%
	% within Area	100.0%	1.4%	2.9%
6	Frequency	0	3	3
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	4.3%	4.3%
8	Frequency	0	7	7
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	10.1%	10.0%
9	Frequency	0	1	1
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	1.4%
10	Frequency	0	12	12
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	17.4%	17.1%

11	Frequency	0	7	7
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	10.1%	10.0%
12	Frequency	0	19	19
	% within Total Vulnerability Rating for Floods	.0%	100.0%	100.0%
	% within Area	.0%	27.5%	27.1%
Total	Frequency	1	69	70
	% within Total Vulnerability Rating_Flood Total Vulnerability Rating for Floods	1.4%	98.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Flood



The frequency of hazard, sensitivity, negative impact and difficulty in coping provides the total vulnerability rating of a hazard. As depicted from the table and the graph, it is seen that households in Madhvad have rated the total vulnerability to floods in different way due to the location of their households.

Table No : 118 : Table showing frequency of sea water becoming hot as rated by the households

Frequency of Sea water becoming hot		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	25	0	25
	% within Frequency of Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	92.6%	.0%	53.2%
Medium	Frequency	2	20	22
	% within Frequency of Sea water becoming hot	9.1%	90.9%	100.0%
	% within Area	7.4%	100.0%	46.8%
Total	Frequency	27	20	47
	% within Frequency of Sea water becoming hot	57.4%	42.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

As observed from the above table, 92.6% of the households of the total 27 households who have responded to this question state that the frequency of sea water becoming hot is high in Umarsadi as compared to 90.9% of the 20 households in Madhvad. Only 47 respondents who have experienced the phenomenon have responded

Table No : 119 : Table showing sensitivity to sea water becoming hot as rated by the households

Sensitivity to Sea water becoming hot		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	26	0	26
	% within Sensitivity to Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	96.3%	.0%	55.3%
Medium	Frequency	1	20	21
	% within Sensitivity to Sea water becoming hot	4.8%	95.2%	100.0%
	% within Area	3.7%	100.0%	44.7%
Total	Frequency	27	20	47
	% within Sensitivity to Sea water becoming hot	57.4%	42.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

As shown in the above table, 96.3% of the households of the total 27 households who have responded to the question in Umarsadi state that the sensitivity of the household is low to sea water becoming hot while 95.2% of the households in Madhvad out of the 20 total households state it to be medium. Only 47 respondents who have experienced the phenomenon have responded

Table No: 120: Table showing negative impact of sea water becoming hot as rated by the households

Negative Impact of Sea water becoming hot		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	20	0	20
	% within Negative Impact of Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	76.9%	.0%	43.5%
Medium	Frequency	5	20	25
	% within Negative Impact of Sea water becoming hot	20.0%	80.0%	100.0%
	% within Area	19.2%	100.0%	54.3%
High	Frequency	1	0	1
	% within Negative Impact of Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	3.8%	.0%	2.2%
Total	Frequency	26	20	46
	% within Negative Impact of Sea water becoming hot	56.5%	43.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the negative impact of the sea water becoming hot, out of the 26 households who have responded in Umarsadi, 76.9% state tat it is low as compared to 100% out of 20 households in Madhavad who have responded stating it to be medium. Only 47 respondents who have experienced the phenomenon have responded

Table No : 121 : Table showing difficulty in coping with impact of sea water becoming hot as rated by the households

Difficulty in coping with Sea water becoming hot		Area		Total
		Umarsadi	Madhavad	
Low	Frequency	27	0	27
	% within Difficulty in coping with Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	100.0%	.0%	57.4%
Medium	Frequency	0	20	20
	% within Difficulty in coping with Sea water becoming hot	.0%	100.0%	100.0%
	% within Area	.0%	100.0%	42.6%
Total	Frequency	27	20	47
	% within Difficulty in coping with Sea water becoming hot	57.4%	42.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

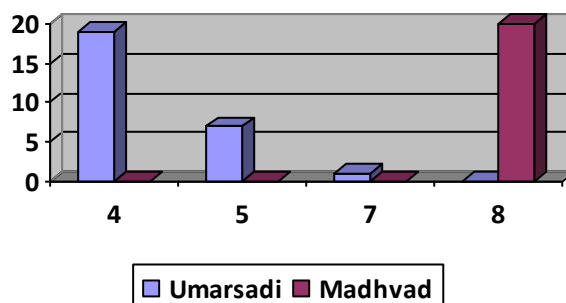
As depicted from the above table, 100% of the households of the total 27 who have responded in Umarsadi state that the difficulty in coping up with impact of sea water becoming hot is low as compared to 100% of the households of the total 20 in Madhavad stating it to be medium. Only 47 respondents who have experienced the phenomenon have responded

Table No: 122: Table showing total vulnerability rating of sea water becoming hot as rated by the households

Total Vulnerability Rating of Sea water becoming hot		Area		Total
		Umarsadi	Madhavad	
4	Frequency	19	0	19
	% within Total Vulnerability Rating of Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	70.4%	.0%	40.4%
5	Frequency	7	0	7
	% within Total Vulnerability Rating of Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	25.9%	.0%	14.9%
7	Frequency	1	0	1
	% within Total Vulnerability Rating of Sea water becoming hot	100.0%	.0%	100.0%
	% within Area	3.7%	.0%	2.1%
8	Frequency	0	20	20
	% within Total Vulnerability Rating of Sea water becoming hot	.0%	100.0%	100.0%
	% within Area	.0%	100.0%	42.6%

Total	Frequency	27	20	47
	% within Total Vulnerability Rating of Sea water becoming hot	57.4%	42.6%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_Sea Water Becoming Hot



As seen from the above table and graph, the total vulnerability as rated by the households is high in case of Madhvad than Umarsadi. This shows that the households in Madhvad are more vulnerable than those in Umarsadi

Table No: 123: Table showing frequency of depletion of mangroves as rated by the households

Frequency of depletion of mangroves		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	71	4	75
	% within Frequency_Other	94.7%	5.3%	100.0%
	% within Area	82.6%	12.9%	64.1%
Medium	Frequency	13	5	18
	% within Frequency_Other	72.2%	27.8%	100.0%
	% within Area	15.1%	16.1%	15.4%
High	Frequency	2	22	24
	% within Frequency_Other	8.3%	91.7%	100.0%
	% within Area	2.3%	71.0%	20.5%
Total	Frequency	86	31	117
	% within Frequency_Other	73.5%	26.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

As seen from the above table, 82.6% of the household respondents in Umarsadi rate depletion of mangroves to be low while 71.0% of the households in Madhvad rate it to be high. This is due to the fact that mangrove cover in Umarsadi is lost since many years and there are hardly any mangroves left which are far off. In case of Madhvad, the depletion is rated high since it is a recent phenomenon in the memory of the respondents.

Table No: 124: Table showing negative impact of depletion of mangroves as rated by the households

Negative Impact of depletion of mangroves		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	61	27	88
	% within Negative Impact on HH_Other	69.3%	30.7%	100.0%
	% within Area	70.9%	87.1%	75.2%
Medium	Frequency	24	4	28
	% within Negative Impact on HH_Other	85.7%	14.3%	100.0%
	% within Area	27.9%	12.9%	23.9%
High	Frequency	1	0	1
	% within Negative Impact on HH_Other	100.0%	.0%	100.0%
	% within Area	1.2%	.0%	.9%
Total	Frequency	86	31	117
	% within Negative Impact on HH_Other	73.5%	26.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

As shown in the above table, the negative impact of depletion of the mangroves is shown to be low with 70.9% of respondents from Umarsadi and 87.1% of respondents from Umarsadi rate it to be low.

Table No: 125: Table showing difficulty in coping with depletion of mangroves as rated by the households

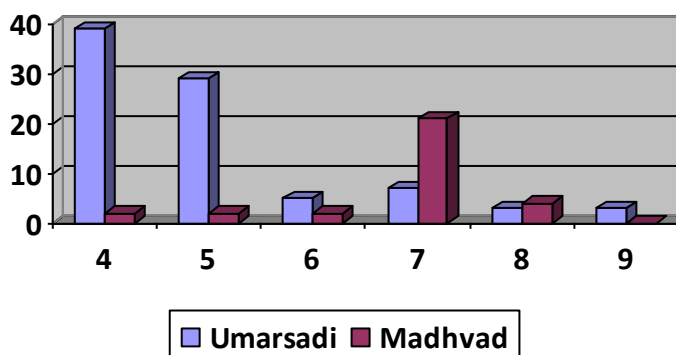
Difficulty of coping with depletion of mangroves		Area		Total
		Umarsadi	Madhvad	
Low	Frequency	66	27	93
	% within Difficulty of coping with hazard_Other	71.0%	29.0%	100.0%
	% within Area	76.7%	87.1%	79.5%
Medium	Frequency	17	4	21
	% within Difficulty of coping with hazard_Other	81.0%	19.0%	100.0%
	% within Area	19.8%	12.9%	17.9%
High	Frequency	3	0	3
	% within Difficulty of coping with hazard_Other	100.0%	.0%	100.0%
	% within Area	3.5%	.0%	2.6%
Total	Frequency	86	31	117
	% within Difficulty of coping with hazard_Other	73.5%	26.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

76.7% of the respondents in Umarsadi and 87.1% of the respondents in Madhvad rate the difficulty in coping with depletion of mangroves to be low.

Table No : 126 : Table showing total vulnerability of depletion of mangroves as rated by the households

Total Vulnerability Rating		Area		Total
		Umarsadi	Madhavad	
4	Frequency	39	2	41
	% within Total Vulnerability Rating	95.1%	4.9%	100.0%
	% within Area	45.3%	6.5%	35.0%
5	Frequency	29	2	31
	% within Total Vulnerability Rating	93.5%	6.5%	100.0%
	% within Area	33.7%	6.5%	26.5%
6	Frequency	5	2	7
	% within Total Vulnerability Rating	71.4%	28.6%	100.0%
	% within Area	5.8%	6.5%	6.0%
7	Frequency	7	21	28
	% within Total Vulnerability Rating	25.0%	75.0%	100.0%
	% within Area	8.1%	67.7%	23.9%
8	Frequency	3	4	7
	% within Total Vulnerability Rating	42.9%	57.1%	100.0%
	% within Area	3.5%	12.9%	6.0%
9	Frequency	3	0	3
	% within Total Vulnerability Rating	100.0%	.0%	100.0%
	% within Area	3.5%	.0%	2.6%
Total	Frequency	86	31	117
	% within Total Vulnerability Rating	73.5%	26.5%	100.0%
	% within Area	100.0%	100.0%	100.0%

Total Vulnerability Rating_depletion of mangroves



As seen from the above table and graphs, the total vulnerability rating of depletion of mangroves is rated high by households in Madhavad than Umarsadi.

**SECTION VIII:
INFORMATION REGARDING
CLIMATE CHANGE AND
FUNCTIONING OF FORMAL AND
INFORMAL NETWORKS**

Information regarding climate change:

In both the communities, information about climate change is gained thorough the local governance i.e. the samaj. Apart from this, the information is gained in form of warnings from the local government through public address system and also through the Sarpanch and Talati. The community leaders play an important role in providing information regarding climate change.

The formal and informal networks in form of samaj, religious organizations and occupational associations enable the community in understanding the impacts of climate change in their own way though it is to be noted that they are not familiar with the word climate change but they know the impacts through their felt experiences.

Apart from this, the three NGOs working in Madhavad – Prakruti Nature Club, Ambuja Cement Foundation and Aga Khan Foundation also act as networks for knowledge on the changes in climate and their impacts.

SECTION IX
ABILITY OF THE COMMUNITY TO
ORGANIZE

Table No: 127 : Table showing perception of the household regarding the ability of the community to make community plans to deal with climate related events

Perception of the household regarding the ability of the community to make community plans to deal with climate related events		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	22	35	57
	% within Perception of the household regarding the ability of the community to make community plans to deal with climate related events	38.6%	61.4%	100.0%
	% within Area	22.0%	50.0%	33.5%
Agree	Frequency	55	16	71
	% within Perception of the household regarding the ability of the community to make community plans to deal with climate related events	77.5%	22.5%	100.0%
	% within Area	55.0%	22.9%	41.8%
Neutral	Frequency	23	10	33
	% within Perception of the household regarding the ability of the community to make community plans to deal with climate related events	69.7%	30.3%	100.0%
	% within Area	23.0%	14.3%	19.4%
Disagree	Frequency	0	8	8
	% within Perception of the household regarding the ability of the community to make community plans to deal with climate related events	.0%	100.0%	100.0%
	% within Area	.0%	11.4%	4.7%
Strongly disagree	Frequency	0	1	1
	% within Perception of the household regarding the ability of the community to make community plans to deal with climate related events	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
Total	Frequency	100	70	170
	% within Perception of the household regarding the ability of the community to make community plans to deal with climate related events	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the perception of the household as regards the ability of the community to make community plans to deal with climate related events, 55% of the households in Umarsadi state that they agree with the statement while 50% of the households in Madhavad state that they strongly agree with this statement. 23% of the households in Umarsadi have provided a neutral rating.

Table No: 128 : Table showing perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events

Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events		Area		Total
		Umarsadi	Madhvad	
Strongly agree	Frequency	67	34	101
	% within Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events	66.3%	33.7%	100.0%
	% within Area	67.0%	48.6%	59.4%
Agree	Frequency	21	26	47
	% within Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events	44.7%	55.3%	100.0%
	% within Area	21.0%	37.1%	27.6%
Neutral	Frequency	12	8	20
	% within Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events	60.0%	40.0%	100.0%
	% within Area	12.0%	11.4%	11.8%
Disagree	Frequency	0	1	1
	% within Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
Strongly disagree	Frequency	0	1	1
	% within Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
Total	Frequency	100	70	170
	% within Perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As depicted in the table, as regards the perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events, 67.0% of the households in Umarsadi and 48.6% of households in Madhvad strongly agree to the statement while 21.0% and 37.1% in Umarsadi and Madhvad respectively agree.

Table No: 129 : Table showing perception of the household regarding the ability of the community to reorganize to respond to new situation

Perception of the household regarding the ability of the community to reorganize to respond to new situation		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	46	39	85
	% within Perception of the household regarding the ability of the community to reorganize to respond to new situation	54.1%	45.9%	100.0%
	% within Area	46.0%	55.7%	50.0%
Agree	Frequency	25	16	41
	% within Perception of the household regarding the ability of the community to reorganize to respond to new situation	61.0%	39.0%	100.0%
	% within Area	25.0%	22.9%	24.1%
Neutral	Frequency	26	3	29
	% within Perception of the household regarding the ability of the community to reorganize to respond to new situation	89.7%	10.3%	100.0%
	% within Area	26.0%	4.3%	17.1%
Disagree	Frequency	1	2	3
	% within Perception of the household regarding the ability of the community to reorganize to respond to new situation	33.3%	66.7%	100.0%
	% within Area	1.0%	2.9%	1.8%
Strongly disagree	Frequency	2	10	12
	% within Perception of the household regarding the ability of the community to reorganize to respond to new situation	16.7%	83.3%	100.0%
	% within Area	2.0%	14.3%	7.1%
Total	Frequency	100	70	170
	% within Perception of the household regarding the ability of the community to reorganize to respond to new situation	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the perception of the household as regards the ability of the community to reorganize to respond to new situation, 46.0% and 55.7% of the households in Umarsadi and Madhavad respectively state that they strongly agree to this statement. 26.0% of households in Umarsadi are neutral while 14.3% of the households strongly disagree in Madhavad.

Table No: 130 : Table showing perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems

Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems		Area		Total
		Umarsadi	Madhvad	
Strongly agree	Frequency	49	38	87
	% within Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems	56.3%	43.7%	100.0%
	% within Area	49.0%	54.3%	51.2%
Agree	Frequency	35	10	45
	% within Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems	77.8%	22.2%	100.0%
	% within Area	35.0%	14.3%	26.5%
Neutral	Frequency	13	1	14
	% within Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems	92.9%	7.1%	100.0%
	% within Area	13.0%	1.4%	8.2%
Disagree	Frequency	3	15	18
	% within Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems	16.7%	83.3%	100.0%
	% within Area	3.0%	21.4%	10.6%
Strongly disagree	Frequency	0	6	6
	% within Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems	.0%	100.0%	100.0%
	% within Area	.0%	8.6%	3.5%
Total	Frequency	100	70	170
	% within Perception of the household regarding the ability of the community institutions to support the members in need to reorganize to cope with new problems	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the perception of the household with respect to the ability of the community institutions to support the members in need to reorganize to cope with new problems, 49.0% and 54.3% of the households in Umarsadi and Madhvad state that they strongly agree with the statement. 13.0 % of the households in Umarsadi state they are neutral. 21.4% of the households in Madhvad disagree to this statement.

Table No: 131 : Table showing perception of the household regarding the ability of the community members to work well with each other

Perception of the household regarding the ability of the community members to work well with each other		Area		Total
		Umarsadi	Madh vad	
Strongly agree	Frequency	54	43	97
	% within Perception of the household regarding the ability of the community members to work well with each other	55.7%	44.3%	100.0%
	% within Area	54.0%	61.4%	57.1%
Agree	Frequency	26	7	33
	% within Perception of the household regarding the ability of the community members to work well with each other	78.8%	21.2%	100.0%
	% within Area	26.0%	10.0%	19.4%
Neutral	Frequency	19	13	32
	% within Perception of the household regarding the ability of the community members to work well with each other	59.4%	40.6%	100.0%
	% within Area	19.0%	18.6%	18.8%
Disagree	Frequency	0	6	6
	% within Perception of the household regarding the ability of the community members to work well with each other	.0%	100.0%	100.0%
	% within Area	.0%	8.6%	3.5%
Strongly disagree	Frequency	1	1	2
	% within Perception of the household regarding the ability of the community members to work well with each other	50.0%	50.0%	100.0%
	% within Area	1.0%	1.4%	1.2%
Total	Frequency	100	70	170
	% within Perception of the household regarding the ability of the community members to work well with each other	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding perception of the household with respect to the ability of the community members to work well with each other, 54.0% and 61.4% of the households in Umarsadi and Madh vad state that they strongly agree while 26.0% and 10.0% of the households in Umarsadi and Madh vad state that they agree with the statement. 19.0% and 18.6% of the households in Umarsadi and Madh vad have stated that they are neutral.

Table No: 132 : Table showing perception of the household regarding the ability of the community to access outside support when needed

Perception of the household regarding the ability of the community to access outside support when needed		Area		Total
		Umarsadi	Madhvad	
Strongly agree	Frequency	46	2	48
	% within Perception of the household regarding the ability of the community to access outside support when needed	95.8%	4.2%	100.0%
	% within Area	46.0%	2.9%	28.2%
Agree	Frequency	37	45	82
	% within Perception of the household regarding the ability of the community to access outside support when needed	45.1%	54.9%	100.0%
	% within Area	37.0%	64.3%	48.2%
Neutral	Frequency	15	1	16
	% within Perception of the household regarding the ability of the community to access outside support when needed	93.8%	6.3%	100.0%
	% within Area	15.0%	1.4%	9.4%
Disagree	Frequency	2	2	4
	% within Perception of the household regarding the ability of the community to access outside support when needed	50.0%	50.0%	100.0%
	% within Area	2.0%	2.9%	2.4%
Strongly disagree	Frequency	0	20	20
	% within Perception of the household regarding the ability of the community to access outside support when needed	.0%	100.0%	100.0%
	% within Area	.0%	28.6%	11.8%
Total	Frequency	100	70	170
	% within Perception of the household regarding the ability of the community to access outside support when needed	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

With regards to perception of the household regarding the ability of the community to access outside support when needed, 28.6% of the households in Madhvad state that they totally disagree to the statement as compared to 64.3% of the households stating that they agree to the statement. 46.0% and 37.0% of the households in Umarsadi strongly agree and agree to the statement respectively. 15.0% of the households in Umarsadi have stated that they are neutral towards the statement.

SECTION X :
ATTITUDE TOWARDS LEADERSHIP
AND GOVERNANCE

Table No: 133 : Table showing attitude of the households towards community leaders to successfully lead them through climate related events in the past

Attitude of the households towards community leaders to successfully lead them through climate related events in the past		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	50	64	114
	% within Attitude of the households towards community leaders to successfully lead them through climate related events in the past	43.9%	56.1%	100.0%
	% within Area	50.0%	91.4%	67.1%
Agree	Frequency	21	5	26
	% within Attitude of the households towards community leaders to successfully lead them through climate related events in the past	80.8%	19.2%	100.0%
	% within Area	21.0%	7.1%	15.3%
Neutral	Frequency	27	1	28
	% within Attitude of the households towards community leaders to successfully lead them through climate related events in the past	96.4%	3.6%	100.0%
	% within Area	27.0%	1.4%	16.5%
Disagree	Frequency	2	0	2
	% within Attitude of the households towards community leaders to successfully lead them through climate related events in the past	100.0%	.0%	100.0%
	% within Area	2.0%	.0%	1.2%
Total	Frequency	100	70	170
	% within Attitude of the households towards community leaders to successfully lead them through climate related events in the past	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

With regards to attitude of the households towards community leaders to successfully lead them through climate related events in the past, 50.0% and 91.4% of the households in Umarsadi and Madhavad respectively strongly agree to this statement while 27.0% of the households in Umarsadi are neutral towards this.

Table No: 134 : Table showing attitude of the households towards community leaders being interested in climate change issues and the impact on the community

Attitude of the households towards community leaders being interested in climate change issues and the impact on the community		Area		Total
		Umarsadi	Madhvad	
Strongly agree	Frequency	39	44	83
	% within Attitude of the households towards community leaders being interested in climate change issues and the impact on the community	47.0%	53.0%	100.0%
	% within Area	39.0%	62.9%	48.8%
Agree	Frequency	44	25	69
	% within Attitude of the households towards community leaders being interested in climate change issues and the impact on the community	63.8%	36.2%	100.0%
	% within Area	44.0%	35.7%	40.6%
Neutral	Frequency	16	1	17
	% within Attitude of the households towards community leaders being interested in climate change issues and the impact on the community	94.1%	5.9%	100.0%
	% within Area	16.0%	1.4%	10.0%
Disagree	Frequency	1	0	1
	% within Attitude of the households towards community leaders being interested in climate change issues and the impact on the community	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Attitude of the households towards community leaders being interested in climate change issues and the impact on the community	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

With regards attitude of the households towards community leaders being interested in climate change issues and the impact on the community, 44.0% and 39.0% of the households in Umarsadi agree and strongly agree to the statement. 62.7% of the households in Madhvad strongly agree to the statement. 16.0% of the households in Umarsadi are neutral towards the statement.

Table No: 135 : Table showing attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation

Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	35	44	79
	% within Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation	44.3%	55.7%	100.0%
	% within Area	35.0%	62.9%	46.5%
Agree	Frequency	29	23	52
	% within Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation	55.8%	44.2%	100.0%
	% within Area	29.0%	32.9%	30.6%
Neutral	Frequency	28	1	29
	% within Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation	96.6%	3.4%	100.0%
	% within Area	28.0%	1.4%	17.1%
Disagree	Frequency	7	2	9
	% within Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation	77.8%	22.2%	100.0%
	% within Area	7.0%	2.9%	5.3%
Strongly disagree	Frequency	1	0	1
	% within Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation, 62.9% and 35.0% of the households in Madhavad and Umarsadi strongly agree to the statement while 29.0% and 32.9% in Umarsadi and Madhavad agree to the statement. 28.0% of the households in Umarsadi are neutral towards this.

Table No: 136 : Table showing attitude of the households towards trust in community leaders to lead the community through climate change adaptation

Attitude of the households towards trust in community leaders to lead the community through climate change adaptation		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	52	44	96
	% within Attitude of the households towards trust in community leaders to lead the community through climate change adaptation	54.2%	45.8%	100.0%
	% within Area	52.0%	62.9%	56.5%
Agree	Frequency	16	5	21
	% within Attitude of the households towards trust in community leaders to lead the community through climate change adaptation	76.2%	23.8%	100.0%
	% within Area	16.0%	7.1%	12.4%
Neutral	Frequency	23	1	24
	% within Attitude of the households towards trust in community leaders to lead the community through climate change adaptation	95.8%	4.2%	100.0%
	% within Area	23.0%	1.4%	14.1%
Disagree	Frequency	7	20	27
	% within Attitude of the households towards trust in community leaders to lead the community through climate change adaptation	25.9%	74.1%	100.0%
	% within Area	7.0%	28.6%	15.9%
Strongly disagree	Frequency	2	0	2
	% within Attitude of the households towards trust in community leaders to lead the community through climate change adaptation	100.0%	.0%	100.0%
	% within Area	2.0%	.0%	1.2%
Total	Frequency	100	70	170
	% within Attitude of the households towards trust in community leaders to lead the community through climate change adaptation	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding attitude of the households towards trust in community leaders to lead the community through climate change adaptation, 28.6% of the households in Madhavad disagree to this statement while 23.0% of the households in Umarsadi are neutral. 52.0% and 62.9% strongly agree to the statement in Umarsadi and Madhavad respectively.

Table No: 137 : Table showing attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives

Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	40	64	104
	% within Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives	38.5%	61.5%	100.0%
	% within Area	40.0%	91.4%	61.2%
Agree	Frequency	39	4	43
	% within Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives	90.7%	9.3%	100.0%
	% within Area	39.0%	5.7%	25.3%
Neutral	Frequency	15	1	16
	% within Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives	93.8%	6.3%	100.0%
	% within Area	15.0%	1.4%	9.4%
Disagree	Frequency	5	1	6
	% within Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives	83.3%	16.7%	100.0%
	% within Area	5.0%	1.4%	3.5%
Strongly disagree	Frequency	1	0	1
	% within Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives, 91.4% of the households in Madhavad strongly agree to the statement while 40.0% and 39.0% of the households in Umarsadi strongly agree and agree to the statement. 15.0% of the households in Umarsadi have remained neutral towards the statement.

Table No: 138 : Table showing attitude of the households towards ability of the leaders to inform them from where to get climate related information

Attitude of the households towards ability of the leaders to inform them from where to get climate related information		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	46	44	90
	% within Attitude of the households towards ability of the leaders to inform them from where to get climate related information	51.1%	48.9%	100.0%
	% within Area	46.0%	62.9%	52.9%
Agree	Frequency	28	24	52
	% within Attitude of the households towards ability of the leaders to inform them from where to get climate related information	53.8%	46.2%	100.0%
	% within Area	28.0%	34.3%	30.6%
Neutral	Frequency	25	1	26
	% within Attitude of the households towards ability of the leaders to inform them from where to get climate related information	96.2%	3.8%	100.0%
	% within Area	25.0%	1.4%	15.3%
Disagree	Frequency	0	1	1
	% within Attitude of the households towards ability of the leaders to inform them from where to get climate related information	.0%	100.0%	100.0%
	% within Area	.0%	1.4%	.6%
Strongly disagree	Frequency	1	0	1
	% within Attitude of the households towards ability of the leaders to inform them from where to get climate related information	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Attitude of the households towards ability of the leaders to inform them from where to get climate related information	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding attitude of the households towards ability of the leaders to inform them from where to get climate related information, 62.9% of the households in Madhavad and 46.0% of the households in Umarsadi strongly agree to the statement. 25.0% of the households in Umarsadi have stated that they are neutral.

Table No: 139: Table showing attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change

Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	53	50	103
	% within Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change	51.5%	48.5%	100.0%
	% within Area	53.0%	71.4%	60.6%
Agree	Frequency	22	5	27
	% within Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change	81.5%	18.5%	100.0%
	% within Area	22.0%	7.1%	15.9%
Neutral	Frequency	18	15	33
	% within Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change	54.5%	45.5%	100.0%
	% within Area	18.0%	21.4%	19.4%
Disagree	Frequency	6	0	6
	% within Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change	100.0%	.0%	100.0%
	% within Area	6.0%	.0%	3.5%
Strongly disagree	Frequency	1	0	1
	% within Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

With regards attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change, 53.0 % and 71.4% of the households in Umarsadi and Madhavad strongly agree to the given statement. It is to be noted that 18.0% and 21.4% of the households in Umarsadi and Madhavad are neutral.

Table No: 140 : Table showing attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities

Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities		Area		Total
		Umarsadi	Madhvad	
Strongly agree	Frequency	37	64	101
	% within Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities	36.6%	63.4%	100.0%
	% within Area	37.0%	91.4%	59.4%
Agree	Frequency	37	2	39
	% within Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities	94.9%	5.1%	100.0%
	% within Area	37.0%	2.9%	22.9%
Neutral	Frequency	19	1	20
	% within Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities	95.0%	5.0%	100.0%
	% within Area	19.0%	1.4%	11.8%
Disagree	Frequency	5	3	8
	% within Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities	62.5%	37.5%	100.0%
	% within Area	5.0%	4.3%	4.7%
Strongly disagree	Frequency	2	0	2
	% within Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities	100.0%	.0%	100.0%
	% within Area	2.0%	.0%	1.2%
Total	Frequency	100	70	170
	% within Attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

With regards to attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities, 91.4% and 37.0% of the households in Madhvad and Umarsadi strongly agree to the statement. 37.0% of the respondent households in Umarsadi state that they agree. 19.0% of the households in Umarsadi are neutral towards the statement.

Table No: 141 : Table showing attitude of the households towards ability of the leaders to encourage community members

Attitude of the households towards ability of the leaders to encourage community members		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	37	64	101
	% within Attitude of the households towards ability of the leaders to encourage community members	36.6%	63.4%	100.0%
	% within Area	37.0%	91.4%	59.4%
Agree	Frequency	14	3	17
	% within Attitude of the households towards ability of the leaders to encourage community members	82.4%	17.6%	100.0%
	% within Area	14.0%	4.3%	10.0%
Neutral	Frequency	46	3	49
	% within Attitude of the households towards ability of the leaders to encourage community members	93.9%	6.1%	100.0%
	% within Area	46.0%	4.3%	28.8%
Disagree	Frequency	3	0	3
	% within Attitude of the households towards ability of the leaders to encourage community members	100.0%	.0%	100.0%
	% within Area	3.0%	.0%	1.8%
Total	Frequency	100	70	170
	% within Attitude of the households towards ability of the leaders to encourage community members	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the attitude of the households towards ability of the leaders to encourage community members, 46.0% of the households in Umarsadi state its neutral while 91.4% of the households in Madhavad state that they strongly agree to the statement.

Table No: 142 : Table showing attitude of the households towards their voices being heard in community planning for climate change adaptation

Attitude of the households towards their voices being heard in community planning for climate change adaptation		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	47	44	91
	% within Attitude of the households towards their voices being heard in community planning for climate change adaptation	51.6%	48.4%	100.0%
	% within Area	47.0%	62.9%	53.5%
Agree	Frequency	17	8	25
	% within Attitude of the households towards their voices being heard in community planning for climate change adaptation	68.0%	32.0%	100.0%
	% within Area	17.0%	11.4%	14.7%
Neutral	Frequency	36	18	54
	% within Attitude of the households towards their voices being heard in community planning for climate change adaptation	66.7%	33.3%	100.0%
	% within Area	36.0%	25.7%	31.8%
Total	Frequency	100	70	170
	% within Attitude of the households towards their voices being heard in community planning for climate change adaptation	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

Regarding the attitude of the households towards their voices being heard in community planning for climate change adaptation, 47.0% and 62.9% of the households in Umarsadi and Madhavad strongly agree to the statement. 36.0% and 25.7% of the households in Umarsadi and Madhavad respectively are neutral about this.

Table No: 143 : Table showing attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making

Attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making		Area		Total
		Umarsadi	Madhavad	
Strongly agree	Frequency	23	64	87
	% within Attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making	26.4%	73.6%	100.0%
	% within Area	23.0%	91.4%	51.2%
Agree	Frequency	37	3	40
	% within Attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making	92.5%	7.5%	100.0%
	% within Area	37.0%	4.3%	23.5%
Neutral	Frequency	39	3	42
	% within Attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making	92.9%	7.1%	100.0%
	% within Area	39.0%	4.3%	24.7%
Disagree	Frequency	1	0	1
	% within Attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making	100.0%	.0%	100.0%
	% within Area	1.0%	.0%	.6%
Total	Frequency	100	70	170
	% within Attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making	58.8%	41.2%	100.0%
	% within Area	100.0%	100.0%	100.0%

As regards attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making, 39.0% of the households in Umarsadi are neutral. 91.4% of the households in Madhavad strongly agree to the statement.

Part II: Qualitative Analysis:

Transect Walk:

Purpose:

The purpose of transect walk with community people was to understand the overall scenario of the community in terms of hazards, vulnerabilities and resilience. Being coastal communities, it was aimed to know the changes at the coastal area and the impacts on the community way of being. (The check list is provided in the annexure)

Observations at Madhvad:

Geographical Location and Ecological Setting:

- Vellan – Madhvad- Kotada is around 18 kilometers from Kodinar Taluka in Junagadh District. It is part of the Sodham Wetlands, one of the biggest and important wetlands of Gujarat State. One road from Vellan village goes to Kotada while another goes to Madhvad. People of the community fish for crabs and small fishes in the wetland, mangroves and check dam waters.
- On the way to Madhvad from Vellan, on the right is a small check dam which is connected to the road leading to the light house settlement through the part of Sodham Wetlands while on the right is the primary school and depleted buildings of the works department. It also has a well where the government tanker fills in water.
- As the road proceeds along, one can mark the mushrooming of the small Mangroves which are being planted since past two years. The road is a metal road which facilitates the transportation. There is a small pool in between which generally breaks down during heavy rainfall and disconnects the village from other villages.

Village Settlement:

- At the mouth of the village, on the right are the Prathana Mandir and Samaj Mandir while left is marked with construction work for new houses

and a depleted and abandoned building of Sub centre. There is also an Aanganwadi adjoining to it.

- The village internal main road is marked with houses on both the sides which are engulfed by the Arabian sea coast. The right part is known as the khadi area which is used for anchoring the boats and the waterway is also used to reach the settlement at light house which is situated on the top of a small hill.
- There were around 10-12 boats with multicolored flags anchored in the khadi.
- The coast is well lined with sand and some shells were also seen along with junks of garbage containing plastic, tins, parts of nets etc

Housing Pattern:

- There are around 14 lanes named after mythological characters. The houses face each other in the lane and the lanes are too narrow for a big four wheeler to move in.
- Each lane houses around 45 houses and there are 720 households in this village. The houses are like row houses sharing at least one common household wall making it difficult for air and light ventilation.
- Around 35-40% of the households are Pucca while the rest fall in the semi pucca houses with tiled roofs. Moreover, effect of weather is clearly marked on the houses especially those which are immediately near the sea shore. Around 20 houses of the lot showcase the damage they have suffered due to strong winds. Most of the houses have one room after the other in a lane like manner.

Water and Sanitation:

- Water facilities in form of taps are seen at the household level but there is no water in the taps. The streets are marked with water tanker where the villagers were seen buying water. The water is generally stored outside the houses in barrels.
- The used water from the houses is drained into small drain pits out side the houses. During the transect walk, it was seen that the same water is

then filled up in pails and carried out to the sea and thrown there since there is no drainage system in the village.

Other Facilities:

- The village also houses 4-5 provision stores with one kerosene depot too and small pan gallas.

Observations at Umarsadi Macchiwad-Mangelwad -Desaiwad :

Geographical Location and Ecological Setting:

- The village is part of the eco system which engulfs the waghai forest area in Valsad district. Pardi GIDC is also well known.
- The village is around 6 kms from Pardi Taluka with a well metal road
- The way to Umarsadi from the onset is marked with farms and a new colony which is around 3 kms from the main village.
- The jetty area is marked with bamboo pole structures for drying Bombay ducks.
- On the right of the jetty is the Par river while on the left and in front is the Arabian Sea.
- On the other side of Par river is Atul Limited and another village where people travel by water way. The Par Hill is also visible from the jetty area.
- Coastal erosion is visible along the coast in terms of inundation and abandoned houses since the sea has gushed in.

Village Settlement:

- Just before the main village starts, opposite the primary school, on the left is a road which leads to mangelwad and desaiwad.
- Further down are the Pump house for drinking water and the Gram Panchayat Building.
- There is a three road junction at the start of the village of which one leads to the market, one leads to Prathana Mandir and the other leads to another hamlet. Road transport in form of rickshaws and buses can be found at this junction

- In all there are more than 8 hamlets and at the junction of each, there is a small community meeting place named after the street it belongs to.
- There are two ponds in the village- a big one and a small one. People usually use this for animals and washing.

Housing Pattern:

- The village has a variety to buildings starting from huge villas to thatched houses and most of the houses in the village are pucca houses.
- Around 100 houses out of the total of about 1000 houses are situated on the coast. The seacoast is lined up with sea wall and there is a jetty for the boats. Some boats were anchored in the area.
- The village has a cascading style and at many places one has to climb down to reach the houses. This is especially so near the coast.

Water and Sanitation:

- The village has provision for drainage system and water facility also. Overhead tanks, taps and hand pumps are also marked at different locations in the village

Other Facilities:

- There are more than 20 shops in the village and two private doctor's clinics.
- There is a skill enhancement centre in the village near the village vegetable market.
- There is a big school primary school in the village which is marked as a shelter home in case of emergency. A relatively small primary school till 5th standard is also there at the hatpatathiya falia.
- Apart from the community halls, there is a big lakshminarayan temple where people gather and another one is a swadhyay prayer hall.

Focus Group Discussions:

In all there were eleven group meetings in each community. i.e. a total of 22 group meetings were held

Group composition:

Elderly Men: Men over the age of 50 were included in this.

Young Men: Men in the age group of 18- 40 were included

Elderly Women: Women over the age of 50 were included

Young Women: Women in the age group of 18- 40 were included

Community Leaders: Formal and informal leaders were included

Occupational Groups: People from different occupations were included

On an average, the groups consisted of 08 - 15 members.

Village Madhvad Bandar:

Village	Elderly Men's groups	Young Men's groups	Elderly Women's groups	Young Women' groups	Community Leaders' groups	Occupational Groups (Mix Group)	Total
Madhvad	2	2	2	2	1	2	11

Geographical Location and Village Set Up:

All the groups explained in detail the geographical location of the village as being a village which is part of Vellan-Kotada- Madhvad village, with taluka head quarters at Kodinar and district headquarters being Junagadh. 'Our village is surrounded by sea and wet land on three sides'. "The nearness to sea is a boon since we are primarily engaged in fishing and the wetland provides us small fish and crabs for our household consumption as well as for selling. This is especially the case for those who do not go to sea for fishing".

The woman's group could name the sarpanch and the community leaders of their Samaj and knew that there was someone called talati but had no knowledge as to who their talati was since "it's men who are more involved in the matters related to Panchayat than us" as stated by the elderly women's group. "We do not go to the Panchayat"

Community Resources:

All the groups were able to list down the major infrastructure in the village in the following ways:

Housing:

“Since we have recently laid down the pipeline under swajaldhara yojana, we know that there are 720 households in our village” stated the community leaders and elderly groups. “Our houses follow the traditional pattern since ancestral days which generally have storage facilities for fishing equipments and storage for fish. Being small fishermen, we have small houses. Our houses are lined one after the other since our families generally live side by side” stated the women’s group. The young men’s groups were more specific when they stated that 30% of our houses are now modern while the others are mixed type with slant roofs and roof tiles.

There were variations in number of at risk houses with respect to infrastructure. The women’s groups, elderly groups and the community leaders groups were more consistent with a range of 25- 35% .

Water:

“We have incurred cost of around two lakh rupees for the swajaldahara yojana and laid down pipeline for drinking water at each household but we do not receive any water in the tap. People up the area in other villages damage the main pipeline so that we do not get water” was stated by the leaders groups. The women’s groups –both the elderly as well as the young women’s group were agitated-“all our day is used up in arranging for water for drinking and household consumption. We have to buy water daily and sometimes, we spend 150 rupees per day since our families are big. There are private tankers coming from Kodinar and surrounding villages through out the day and provide us water. We also have to fetch water from the tank near the primary school which is time consuming”. The elderly groups of men and women stated that before 25 years, we used to rely on wells for drinking water

and household consumption. Well waters have turned salty. Also due to rocky land and nearness to the sea, wells are no more a feasible solution.

Both the women's group stated that first they wash their clothes with salty water from ocean or well and then soak them in normal water and then dry their clothes. Unavailability of water is one of the major reasons why they do not have lavatories and bathrooms in their households.

Drainage and Sanitation:

All the groups shared that there is no drainage facility in the village and people use soak pits for the same. Only the houses which are modern have facilities of bathrooms and lavatories. The men's and women's groups stated that each household has small pit in front of the house which collects the waste water of washing and bathing. Women then fill this water in pails and carry them to sea shore and throw it in the sea. "Most of our time is spent in this and we have to do it to keep our surroundings clean" stated the women's groups. "We face problem when we are having our periods" stated the young women's group.

Health:

"It is our faith healers blessings which take care of our health" stated the elderly women's and men's groups. "The charans curse our children if we do not abide to their needs". All the groups listed down health problems like Asthama, Arthritis, skin problems, hair problems and problems related to health and hygiene of women as the major ones. "We have a broken structure as a health centre and hence our doctors and ANM work from the Aanganwadi building. We prefer to go to Una or Kodinar for our health needs to private doctors since we do not trust government machinery. There is a PHC at Vellan but we do not prefer to go there too since doctors are not available".

The women's groups stated "We have to go to Kodinar for institutional delivery in whatever vehicle is available and the women have to suffer a lot since it takes more than forty five minutes to reach there. Many women have

lost babies due to this problem. “The elderly women’s group shared “we still believe in traditional dais but our young women want to go to cities to have deliveries. We too bore children and a lot of them but these young women now do not want it at home.” The young women’s group shared that they have more confusions related to women’s health problems since there is no one to guide them.

Education:

“Our forefathers never went to school and yet were happy and contented in life. Our trade does not need education. Our boys start going to sea when they are eight to nine years old and it is where they get practical training. Our boys generally study till 8-10th standard then they work full time for fishing. Fishing is not taught in the school but in the sea” stated the elderly men’s group. There was a variation related to this in the young men’s and occupational groups. “We are scorned at if we do not go to sea and want to study further. What we earn by being fishermen cannot be earned by studying and serving others. This is the main reason why we do not prefer to study further”.

The elderly women’s group stated “Our lives are all centered around fishing. We need to take care of our elders and children when our men go for fishing. We also have to weave nets and help in other works related to fishing. We have to be well versed at how to handle all this. So at a very young age, our training starts. We do not go to school. Presently the most educated woman in our community is a girl who has studied till 8th standard. Generally girls study till 5-6th standard since they are to be trained in household.” The young women’s group also supplemented by stating that they do not incline to study since they have to learn about their traditional way of living but that now they would like their daughters to study further since time has changed.

Occupations :

“Our main occupation is fishing” stated all the groups. Each household in our community is engaged in one or the other work related to fishing. Either people have small fishing business and around 7 people are engaged in this

and they sell their catch at Veraval. There are 5 big trawlers and around 200 small boats engaged for fishing. There is one matasyagandha boat of the swadhyay parivar. Around 600 to 700 women are engaged as workers in fishing industry at Veraval. There is one Public Distribution System (Fair Price Shop) in the village. There are two grosser in the village. Around 10- 12 people are engaged in Pan Shops in the village. Rest of the people is engaged in fishing.

“We are unable to think of any other occupation but slowly we will have to think about it for now fishing is getting a bit uncertain and we also have to go very far away from home. Also it is becoming increasingly necessary that we search for alternatives for our future generation” stated the young men’s and community leader’s groups.

Legal Services:

“Our samaj is our legal system” stated all the groups. “All our disputes related to marriage, family, kinship, ownership, crime etc is taken care of by our samaj. We have our own Kharva Samaj at the village level. It is functioning so well that there is no even a single case registered against anyone in government legal services. Our samaj is the backbone of our traditions and culture” stated the community leaders groups and the elderly men and women’s group. “It is our samaj who takes care of our members whenever there is a need. People do not have to go out to seek support for themselves. Right from the childbirth till death, all the needs are taken care of by the samaj”.

Vulnerable Groups:

All the groups stated that the since they have closely knit family ties and community ties, they are no cases where any elderly, widow or orphan child is left alone. There are no cases of any differently abled people in the community. “Our samaj has system where no family is left in crisis alone. Each member of our community contributes for the welfare of those who need it and hence they are taken care of by the community itself “stated the elderly women’s and men’s groups. The groups also stated that it was only when the

youngsters migrate to other places that the elders are left in the village by themselves. But the close knit community ties take care of their needs and hence they do not suffer like in other villages or communities. In times of crises the youngsters of the community first care for the elderly who are alone was stated by the young women's and men's groups.

Hazards, Disasters and Climate Change:

"In 1982, there was a devastating cyclone which claimed 14 lives and damaged around 200 big and small boats of our community. Our community suffered a loss of about one to one and half crores of damage in all" stated the elderly men's and women's groups and the community leaders groups. The oldest and intensive cyclone apart from this was of 1950 which hit the Vanakbara area on the opposite coast. Apart from this, they experienced cyclones in the year 1987, 1996 and 2007 also. But no life loss was there. The houses on the sea coast always sustain damage and people have to be shifted to other places in the village.

"Apart from cyclones, we experience floods and water logging almost in each season" stated all the groups. "Recently in 2007, we suffered due to heavy rainfall. There was hip deep water in the village and two people had taken refuge on a light tower in the sea for six hours before our fishermen could save them. Some of our men are at sea during monsoon who are trapped in the sea in high wind and rainfall. Our men know how to survive" stated the community leaders group. "Before that in 1996, there was dual impact of cyclone and rain and we had water in the temple which is the highest place in the village and where we are sitting now. Our pool was also damaged during the flood, stated the women's group ".

The elderly men's group and the community leader's groups also shared that earlier huge vessels used to come to anchor in the khadi area but now due to silt deposition this area cannot be used for navigating vessels of huge size. There were mangroves as huge as trees all along the coast of which are no more. "Our sea coast seems to have come more near than it was before. Some of our houses had to be vacated due to this. Our new residential plots

under government scheme have been built near the light house which is at a higher level”.

The community also suffered damage in terms of house damage during the Earthquake in 2001. But this was negligible.

Traditional Knowledge, Warning and Evacuation and Disaster Preparedness:

“Our forefathers used to look at the location of the stars and clouds, feel the wind and water currents and could predict whether it was safe to go to the sea or not. They also used to calculate on the basis of nakshatras about the change in weather at sea. This enabled them to fish safely. Moreover, our customs and traditions are such that from May to October are months when most of our festivals are celebrated. Social customs like marriages, Kathas etc are also carried out during this period and we do not go to sea during this month”, stated the elderly men and women groups and the community leaders groups. This was also supported by the occupational groups.

“Unlike our fathers and uncles, we do not understand the ways of nature. Weather has become so unpredictable now. We rely entirely on the government machinery for early warnings and we had gadgets for the same”, stated the young men’s group and occupational groups. All the groups stated that sometimes during the monsoon season, they heard about warnings being issued not to go to the sea by the government officials.

All the groups stated that to help each other is the basic value of their community and hence they feel that they do not need to rely on others for helping their fellow members. “We are like a closely knit family. We are all Hindu Kharvas”.

The community leaders group and the elderly men’s group stated that before five to six years some exercise was carried out in the village for disaster preparedness. Some of the members recalled that their names were there in committees but they could not recall what the present status of the same is.

The women's groups and the young men's groups were totally ignorant about any such thing as disaster preparedness plan.

Risk Knowledge and Disaster Recovery:

Risk knowledge in terms of geographical location, hazards and their impacts was vividly described by almost all the groups but the community leaders groups and the elderly groups were more vocal than the young men and women's groups.

Diversity: (Livelihood and Resource Dependency)

All the groups stated that their main source of livelihood is fishing in terms of either business or selling the fish or working in fish industry. Thus there is high dependency on sea and sea products for their livelihoods. They catch fish for selling and own consumption; use dry mangrove wood as fuel, catch crabs and prawns from the muddy water of mangroves and use them for their household consumption as well as for selling too. "Our lives are focused around our sea and the vegetation grown around it. Earlier we also used to sell Chip (Oysters), Shankh (Crouches), Kodi etc since they were available in plenty on our sea shore but now they are not found in abundance since the sea has become polluted", stated the elderly men's and women's group. The occupational group also supported this. The groups also stated that slowly from going to the sea, people are now turning towards working in fishing industry. Especially the women work in fishing industry for around 7-8 months.

"Our men are not able to find jobs since we do not have enough education. Moreover, since mainly fisheries are there in the area, we are heavily depended on this industry for our livelihood".

Three self help groups are there in the community for women and all of them are involved in saving activities. They are around two years old. They are yet to be productive, stated the women's groups.

“We are not able to come up with alternative livelihood options as community people since our girls and boys are not so much educated. Within our households we do have supplementary livelihoods like selling fish, crabs or prawns in the nearby villages and working in the fishing industry at Veraval. Around 400 to 500 women migrate to Veraval seasonally for working in the fishing industry there as workers”, stated the community leaders groups and occupational groups. This was largely supported by the other groups also.

“We worship our sea and protection of coastal and marine life is part of our culture. We worship Lord Shiva, Lord Hunamana and Ramdev Pir Baba who are symbols of conservation of nature.” Some of us had got greedy and so we were involved in fishing of whale also due to its high price. But now due to interventions of Prakruti Nature Club, we are involved in rescue work of whales and other marine and wild life” stated the elderly men’s and women’s groups.

Learning from Change:

“Over the centuries since we have come and settled down over here, our ways of living had not changed at least till twenty years back”, stated the elderly men and women’s groups and community leaders groups. “It is over the past two decades that we are facing gradual changes. Earlier our community had more big traders with big vessels now we have more small traders with small boats. The closure of the jetty and khadi has taught us an important lesson. Our men have to go all the way to Jakhau and beyond to fish. This is becoming expensive and time consuming. Moreover, our youngster’s are now exposed to newer lifestyles and they want to lead easier life styles. Of late our community understands how important it is for us to adapt to the new ways. We are now sending our boys and girls for higher education since past 4-5 years”.

Self Organization:

“Our community is governed by our samaj. Our samaj is our main link which provides us with all the help we need. We have the president of our community at Dwarka. Whenever we are not able to solve any problem at the

local level, we go to maha sabha which is held once in a year. In times of need, in emergency even before the government aid arrives, we have our own people helping us out “, stated the community leaders group and elderly women’s and men’s groups. “We go by our samaj rules and regulations not only in normal times but also in times of emergencies”, stated all the groups. At the local level, they are supported by the village level samaj while at regional level, they are supported by twelve samaj which covers 12 villages and at the state level they are supported by the Maha Sabha which governs the entire Kharva Samaj. “We have accountability and responsibility at all the levels and hence there is transparency in our system. Decisions are mostly made on the traditional systems but we also take into account the current status of society at large. Family and societal conflicts are also resolved in our system of governance.

Apart from this, they do use the gram Panchayat machinery, the taluka Panchayat machinery and the Zilla Panchayat machinery for their related work but mostly it is for some or the other developmental work. They also have to work closely with coast guards and fisheries department since they are also directly connected with their occupations. They have their own Boat association and Swadhyay Parivar in the village. Prakruti Nature Club from Kodinar, Aga Khan Foundation and Ambuja Cement Foundations also work in the community for developmental work as stated the various groups. Most of the information they gain is through the Sarpanch, the community leaders and some of their men who stay in cities like Veraval.

Village Umarsadi Machiwad: (Total 11 FGDs)

Village	Elderly Men’s groups	Young Men’s groups	Elderly Women’s groups	Young Women’ groups	Community Leaders’ groups	Occupational Groups (Mix Group)	Total
Umarsadi	2	2	2	2	1	2	11

Geographical Location and Village Set Up:

All the groups explained in detail the geographical location of the village as being a village which is part of Umarsadi- Desai Wada village, with taluka head quarters at Pardi and district headquarters being Valsad. "Our village has a coastline which is affected by coastal erosion" stated the elderly men's group. All the groups stated that "our village is very well developed as compared to other fishermen villages since we have more educated society"

All the groups knew who was the talati and sarpanch of the village. The groups also knew who the community leaders of their respective lanes were. In all they were conversant with the village set up.

Community Resources:

All the groups were able to list down the major infrastructure in the village in the following ways:

Housing:

"Our village has around 1000 houses of which 60% of the houses must be pucca houses while 40% must be kuccha houses" stated the community leaders and elderly groups. This was supported by the occupational group also. "Our house is different in different falias. While the old houses are big and are exceptionally huge, others are small and made according to modern architecture. The new colony has new houses which are made up of concrete cement while in the main villages, we have a mixed pattern. But there are very few thatched houses in the village since economically it is a sound village" stated the women's groups.

Water:

"Drinking water availability is not a problem at all in our village" stated the elderly men and women's group as was supported by the other groups too. "We have tap water from the Panchayat and also there are stand posts for water in the village. There are hand pumps too in the village but some of them are not functional. People also have bore wells in the upper side of the

village for the farms” stated the women’s groups. “At times, some families have to fetch water from the falia tap but its part of our daily routine. There is plenty of water and hence we get enough for washing clothes too” stated the same groups. The other groups were supportive of the facts.

Drainage and Sanitation:

All the groups shared that there is no drainage facility in the village and people use soak pits for the same. “Sanitation wise also, our village is much better than other villages” stated the elderly men and women’s groups. Common toilets are built near the sea coast for the women by the village Panchayat.

Health:

“There is a PHC at Desai Wad but we do not avail the facilities except occasionally. We prefer to go to the private clinics and hospitals at Pardi or Valsad and even go to Surat in case there is a serious issue “stated the elderly men’s and women’s group and also the young women’s group. This was also supported by the community leader’s groups.

“Due to the engagement in seamen’s occupation, we have to eat frozen food which is high in fats and carbohydrates and hence there is a tendency of increase in problems of increased cholesterol, heart attacks etc. Moreover the seamen after they retire generally die within 6-7 years in our village” stated the occupational group. This is a major problem but people take it as part of life.

Apart from this, there is problem of rheumatism and Blood pressure amongst men and women due to nearness to sea. The joints start paining much earlier. The children have general ailments like cough and colds and cases of SASANI are also reported. Cases of diarrhea and vomiting are also reported shared the elderly men and women’s groups and the young men and women’s groups.

Education:

“Our village is educated village. Earlier we had a fisheries school which was operational from 1949 to 1999 and was started in 1917 as a primary school. There are two primary schools in the Umarsadi Macchiwad and one more at Desaiwada which is a secondary school. The literacy rate amongst male and female is nearly equal in the new generation” stated the community leader’s group and elderly men and women’s group. Since the first sea men went to sea in 1941, people were motivated to provide education to their children stated the community leader’s group. The women’s group stated that the women too study till MA and B.Ed since their men go away and they can continue their studies. Boys study till 12th while the girls go on to do post graduation too. “There are more teachers in our community” stated the young women’s and men’s group. People also send their children to hostels for studies at Valsad and Surat shared the occupational group.

Occupations:

“We have diversified occupations in the village. There are seamen, teachers, industrial labours, fishermen, self employed etc in our village “stated the elderly men and women’s groups which was supported by the young men and women’s groups. “There are around 50-70 teachers in our village, more than 500 seamen and more than 500 women working in as labour in surrounding industries in packaging. There are more than 40 rickshaw drivers in the village and more than 30 shops in the village” stated the occupational groups. “It was because of the loss of lives in the Okha cyclone that our community turned to different occupations after leaving their main occupation of fishing” stated the community leader’s group.

Income groups:

There are large variations regarding the income groups due to diversified occupations like seamen, fishermen, farmers, labours etc. While the seamen earn anything between 7- 12 lacs per annum, there are households who are BPL too in the village stated the occupational group and the elderly men and women’s groups

Legal Services:

“We have our own legal services but over the period of time, this is disintegrating” stated the community leader’s groups which was to a large extent supported by all other groups. “Most of our problems are solved by our Macchi Samaj and there are hardly any people who resort to the legal services of the government except in case of disasters or other kind of compensations and problems. We have a very traditional system of dealing with civil problems like marriages, elderly, property matters etc which are dealt within our own samaj. “ stated the community leaders group and the elderly men and women’s groups. “There are no instances of theft within our own community but the other community members who do not belong to Macchi Samaj do have such problems for which they refer to the government machinery” stated the occupational group.

Vulnerable Groups:

“Since we have close family ties and most of the people are related to each other by ties of blood or marriage, we don’t have problems of vulnerable groups” stated the community leaders group. The widows, the elderly and the orphans are accommodated within their own households shared the elderly men and women’s groups. “The system of our samaj is such that these kind of people are cared by the families and the samaj. We have charity for such groups also. In case of emergency also, our samaj is the first one to help out people” stated the young men and women’s groups. “The religious groups like Swadhyay also help women and children out in times of need. They have also constructed houses for widows in the village” stated the men’s group.

Hazards, Disasters and Climate Change:

“The worst cyclone that we faced was the Okha mandal cyclone which turned the lives of our people. We lost around 26 big vessels and 130 men at sea who never returned. This was the turning point after which people were so afraid that they left the trade of fishing or going to sea “stated the community leaders group. ” . Our young generation does not go to sea any more” stated the elderly men and women’s groups. “Cyclones do come and go nearly every year but they are not as severe as that of Okhamandal” stated the

community leader's group. "The main problem that we face now is coastal erosion which is wreaking havoc in our community. The sea has gushed in nearly 30 feet in the past few years. We had to shift our houses backward to save them. Our land is being submerged in water like other surrounding areas like bawan deep area which is no more, Udwada etc. 15- 20 years back we had rice farms but due to pollution and salinity, they are lost. There is salinity ingress of around 2 kms in past decade. Most of the bore wells and wells are saline now. The sea level has increased to 5-6 feet in past 25 years. In high tide, the water goes up by 6-7 feet. A protection wall has been constructed now by the irrigation department" stated the community leader's group. "Another hazard is pollution especially sea pollution due to surrounding industries the rivers have become acidic which damages the head of the machine of boats, the alfanso has got affected as the flowering does not lasts long, the kind of fish that was available is also not available now and people have to go deep into the sea so more time is consumed" stated the community leaders group and supported by the elderly men's and occupational groups. "Earlier we had mangroves which are seen no more" stated the elderly women's group.

Traditional Knowledge, Warning and Evacuation and Disaster Preparedness:

"Our traditional knowledge is in ruins since our young generation does not go to sea any more. Also the weather has become unpredictable in the past few years "stated the community leaders groups and the elderly men's groups. "We do not have trawler boats any more but just the machwara boats now so people try not to go too deep into the sea. In case of emergencies, warnings are issued by the sarpanch/talati office and sometimes the public address system is also used "stated the same groups. Very few members of the elderly men and women and the community leaders groups remembered that there was a village disaster management plan for their community and the awareness was nearly absent in the young men and women's groups. "Our samaj and the religious groups and the young men helps the community in case of any mishap or emergency and outside dependence is only in case of too grave an emergency" stated the community leaders groups.

Risk Knowledge and Disaster Recovery:

The community leaders group and the elderly men's groups were vocal on this issue though the knowledge was more related to the risk associated with their livelihood within the village. "Our village is facing problem of pollution and coastal erosion which has put at risk our livelihoods like fishing, farming especially of Alfonso mangoes and rice ". In the earthquake of 2001, we had felt some tremors but no damage was reported. During the Okhamandal cyclone when we had lost vessels and our men, their families had received compensation in form of bonds. Two to three members were aware of the Village Disaster Management Plan of their village which was prepared before 5-6 years. The occupational group stated that they received compensation when any damage was there to their boats as per the rules and regulations of the fisheries department.

Diversity: (Livelihood and Resource Dependency)

"Our village has moved on after the Okhamandal cyclone (1998 Kandla cyclone) and hence there is diversity of livelihoods in the village. "We have fishermen, seamen, teachers, laborers, farmers, businessmen, rickshaw drivers, self employed, shop keepers etc. "stated the occupational group and the community leader's group. "The fishing community is rendered poor due to lack of marine resources in the area as a result of pollution. Earlier we use to get shrimps, crabs etc but they are nearly extinct now. The variety of fish that we use to get and the quality of fish we used to get is also very different and hence if we want to have a good catch, we have to go deep into the sea which our machwara boats do not permit" stated the group. "Earlier we used to use the mangroves for fuel but they have depleted entirely. There is flowering on the trees but they fall off before they bear fruit" stated the women's groups.

Learning from Change:

"Our greatest learning has come from the Okhamandal cyclone which devastated our people's lives. We lost so many vessels and so many men at sea that it is a living memory for us all these years also. We learnt to have new trades, we started sending our children to schools so that they can have

jobs, our present young generation does not go to sea at all and our girls are taking up higher education” stated the community leaders group which was largely supported by the elderly men and women’s group. Almost all the groups shared that the community had learned to live a totally different style of living in term of their lifestyles which have grown lavish due to higher income over the period of time, their livelihood patterns have change, their family patterns are changing, they are now more open group then they previously were as community and they are now fishermen only in namesake.

Self Organization:

“Most of the people living in Umarsadi Macchiwad are fishermen by caste and are members of Dakshin Gujarat Machimar Mahamandal. Thus we all are supported by each other not only in one village but the entire community comprising of 12 areas. At the village level, each faliya (lane) has four members of the samiti who look after all the matters regarding to issues and development. If the issues are not solved there, they are taken to the village level nyay samiti and then further in Mahasabha. Due to this system, in times of emergency, our community is able to organize itself much quickly and chaos is minimized” stated the community leaders group. “We are a closely knit community and hence we are helpful to each other in times of need and if at all there are differences, we set them aside in times of need. The wealthy people in the community are always supporting the needy people” stated elderly women’s group. The groups also shared that slowly there disagreements cropping up in the community but still they are a group.

Key Informant Interviews: N=36

Sr. No.	Key Informants	Madhvad	Umarsadi	Total
1	Sarpanch	1	1	2
2	Talati	1	1	2
3	Member of Parliament	1	0	1
4	Deputy Collector	0	1	1
5	Mamlatdar	1	1	2

6	Taluka Panchayat	1	1	2
7	School Principal	1	1	2
8	Health Functionary	1	1	2
9	NGO Functionary	3 (Aga khan Foundation, Ambuja Cement Foundation and Prakruti Nature Club)	0	3
10	Associations Representative	1 (Boat Association)	2 (Boat Association, Seaman's Association)	3
11	Shop Keepers	2	3	5
12	Religious Group Leader	1	2	3
13	Gram Mitra	1	1	2
14	Community Leader	2	2	4
15	Forest Guard	1	1	2
Total		18	18	36

Village Madhvad Bandar:

Brief History of the Village:

The village is located 18 kms from taluka head quarters at Kodinar with district head quarters at Junagadh. It is part of the greater eco system consisting of Gir Forest, Sodham Wetlands and the Arabian Sea. The Gir forest is the only home to Asiatic lions in the entire world. Whales and turtles are two important marine lives which are found along with other fishes along the coast. Madhvad bander is a part of Vellan- Kotada –Madhvad revenue village. Due to increasing population, Madhvad has applied for a separate Panchayat and from 2012; it will be a separate village. Madhvad bander is engulfed by the Arabian Sea on three sides and has part of Sodham Wetland and is connected to Vellan village by road. The area is part of Coastal Conservation Project.

The community has migrated from Vanakbara Bander on the other side of the sea before four centuries due to Portuguese war and till date, Vanakbara is an

important part of their community. Basically two types of community people reside here- the Kharvas and the Koli. While Kotada is dominated by the Kolis, the Kharvas is the only community which resides at Madhavad Bander.

Housing:

There are 720 houses in the village of which around 30% are pucca houses while the rest are all semi pucca. All the houses are row houses spreaded over 14 lanes. There is another section on the light house which houses Indira Awas Yojana and Sardar Awas Yojana.

Health:

There is a sub center at the village level which is not in a working condition. The PHC is situated at Vellan and CHC at Kodinar. There is an Ayurvedic doctor on visit at Vellan. There are two private doctors who come to village for offering their services. It is at Veraval, Una or Kodinar that people go for availing treatment from private doctors. There are three Aanganwadis in the village. One is run in an Aanganwadi building while the other two are run in rented buildings in the village.

Education:

There is a primary school in the village. Secondary school is at Vellan village. For higher education people have to go to Kodinar, Una, Veraval and other big cities.

Water:

There is water scarcity in the village. There is an over head tank near the school and a well where water is filled in by the government tanker which is far away from the village. Door to door pipeline has been laid down which is yet to become functional. People buy water from private tankers at the cost of Rs.3 per pail. In summer this problem becomes more intense. Ambuja Cement Foundation has constructed underground water tanks with roof top water harvesting system in the village in some houses including the Samaj Building.

Electricity:

The village gets electricity from the Government and most of the houses have this facility except the thatched houses. There are meters to monitor the usage of electricity in the houses.

Drainage:

The village does not have a drainage system. Houses have soak pits for drainage. There are very few lavatories in the houses and most of people go out to sea for defecation. The household water is collect in small pits constructed outside the houses, then filled in pails and thrown in sea by the woman.

Communication:

The village is well connected by road. Many people have their own mobile phones.

Legal Services :

There is a police outpost at Vellan for looking after legal system. There are beat guards of the forest department since the area belongs to Chara Forest Range. They look after the welfare of the chara range.

Family and Kinship Networks:

Madhvad is one big family. All the member are residing since generations in the same village. There are strong family ties. Earlier there were huge joint families due to common business but over the period of time, these have disintegrated into nuclear families now. The family cohesion is worth mentioning as it serves the basis of Kinship networks. Most of the relatives live within 12 villages that make a strong network. Sons and daughters are married within these 12 identified villages only which have sustained Kinship ties. In times of need, these Kinship networks are very useful as they provide material as well as non material support. Though there is an emerging pattern of nuclear family in the community, yet, the kinship ties have remained strong.

Occupation:

Since generations, the Kharvas is dominantly a fishing community. Almost all the people are dependent on fishing for their livelihood. There are 7-10 medium scale traders in the village, around 200 small fishermen, 5 grocers and 11 people engaged in other small shops like Pan Shops. Around 500-600 women are engaged in seasonal migration to fishing industries in Veraval. Also, daily women go to sell the catch of fish in the morning and evening in the surrounding villages. No major change is observed in the occupation in the community except from big and medium scale traders, people now have turned towards small fishermen. There is more dependency on labour then on trade after the demolition of jetty and silting of Khadi. Many people have migrated to other places like Veraval and Muldwarka permanently due to lack of jetty. People are not ready to change occupation since fishing is a profitable business.

Economic Status of the Community:

The people in the community are well off economically as compared to other people in nearby villages. Within the community there are different classes. Around 25-30 % of the people are rich, 35 % belong to middle class while the rest 35-40% are weaker class people especially engaged in labour work. People generally take loan for marriages, festivals, buying boat, in case of advance medication if required and for repairs of houses. Most of the time, they take loan from within the community from relatives. They also take loans from Bank as and when required. Poor people of the community have to depend on loan either from the samaj or from the well to do families.

Migratory Patterns:

After the 1982 cyclone due to mass scale damage, many people migrated to bigger cities like Veraval, Jakhao, Okha etc where big vessels can be anchored. There are no instances of in migration. Seasonal migration takes place for 6-7 months in the village when villagers go to Veraval for working in fishing industries. Around 500- 600 women on an average migrate in search of livelihood to factories in Veraval when their men go out to fish for six to seven months.

Health Status:

Being on the sea coast and due to salinity ingress, the entire Junagadh area has health problem like Kidney stone, renal problems and skin diseases. Malaria, diarrhea, common cold and cough are common amongst small children since vaccination is not adhered to by the community people. High rate of Infant Mortality Rate and Maternal Mortality Rates prevailed in the community which has now improved a bit after interventions. Blind faith and healing by faith healers is still practiced in the community for children as well as adults. Aga Khan Foundation is working on NRHM (National Rural Health Mission) in the village and has done a base line survey and is working since past three years on RCH(Reproductive and Child Health) project.

Special Needs Group in the Village:

There are widows in the community but they are living with their families. Cases of single women households are not there. During the seasonal migration, there are elderly who are left behind but the children and youth are there to take care of them. Also unlike cities, elderly are active and work as far as possible. Similarly, the families take care of children too and hence there are special needs groups in the village but they are all taken care of.

Climate Related Hazards/Disasters and other Hazards/Disasters:

The village is situated on the sea coast which is prone to frequent cyclones. Big cyclones which were devastating were 1982 and 1999 cyclones. Apart from this, cyclone warnings are issued in each monsoon season. Flooding and water logging are also common in the village since when due to heavy rainfall, the dam water is discharged, low laying areas like Madhvad gets flooded due to discharged water, rainfall and sea coast.

Social Networks:

The Kharva Samaj is the main network. People have faith based/religious organization in terms of Swadhyay Parivar which is working in the community since past 15 years and there has been tremendous change in the lifestyles due to this. It has helped people to connect to others through the Swadhyay moment. It conducts various religious activities like Prayers and Swadhyay,

conducts kendras for women and youth, conducts Bhav feris and in case of emergencies, is also involved in rescue and relief activities. The community also has a Matsyagandha boat, produce of which is distributed to all members.

Prakruti Nature Club is also working in Madhavad and in other villages for ecological conservation work. They are actively involved in rescue of whales, rescue of animals and other sea creatures. They are also involved in census of animals and work at local, national and international level. This has changed the perception of fishermen and they have also joined hands in rescue work of animals in the surrounding areas.

Aga Khan Foundation is working for Reproductive and Child Health Project of the government in the area since past three years. They provide training and conduct awareness programme for women and use local folk media like bhavai in the community. There is gradual decrease in Infant Mortality Rate and Maternal Mortality Rate due to NHRM and other interventions in the area.

Ambuja Cement Foundation had worked in the village and had constructed water harvesting structures in 10 houses.

There is a boat association in the village which enables the fishermen in their occupation and dealing with fisheries and marine department. It also helps by supporting the community in damage assessment of boats and nets, applying for loans etc.

Coastal and Marine resources :

Coastal resources in form of mangroves are utilized by the community people especially the poor people. Mangroves are used for their wood in building houses as well as the wood is used as fuel. The mangroves are also used to capture small fishes and crabs. Apart from this, the shells and conches have cultural value as well as they are sold to customers. Fishing being the main occupation for the community, they use them.

Livelihood sources for the community :

Fishing is the main source of livelihood in the community. Some members are involved in shops in the community. Women are engaged in selling fish in the nearby villages. Many women migrate to surrounding areas to work in the fishing industries.

Alternative and supplementary livelihoods :

Due to lack of education, the community has no alternative or supplementary livelihoods. People are not ready to experiment with alternatives as the income received from fishing is much higher than the income that is earned from a job of a labour or any office job that they can get with their limited education. Prawn culture is being practiced now in the area but the beneficiaries are not from the village. Government is planning to open a tourism centre near the village which may provide alternative livelihood to the people by developing coastal and marine tourism. There is also a plan to develop a road link between Vellan and Vanakbara which also will boost tourism from Saurashtra to Diu. People do visit the coast to view dolphins and whales which may be boosted.

Information about climate related knowledge :

It's the community leaders who are in touch with the other stakeholders outside the community who provide the necessary information or news related to changing climate of the region. Men are more aware about these than women since men are the ones who are in touch with the community leaders. Prakruti Nature Club also helps the leaders and people to know more about the nature and its changing course. Most of the conservation work is carried out with the help of some agency or departments. The sarpanch also being from the same community is aware of the situation and takes interest in the community matters. Most of the people depend on the leaders for information but how to use the information for adaptation is still a question for them. More formalized structure is needed for proper use of the information holistically.

Formal and informal networks supporting climate hazard reduction and adaptation :

Prakruti Nature Club, Aga Khan Foundation and the community leaders along with the sarpanch are the ones who support the climate hazard reduction strategies. Mostly it's in form of risk reduction and some adaptation measures like knowledge exchange, regeneration of mangrove cover, nature conservation work of species etc. At the community level, the samaj is the one that takes a leading role and acts as information dissemination network.

Ability of community to organize :

Due to the rule of the samaj, the community is able to organize itself quickly in times of emergency. The community leaders take an active role. In time of disasters also, even if they do not suffer, they organize to help others. During the 2001 Bhuj earthquake, they had mobilized three trucks worth of goods in term of food packages, blankets and clothes. People still need support to be engaged in long term measures of adaptation in case of climate change. Due to lack of highly qualified people in the community, they face problems in understanding the further impacts of climate change on the community. The leaders do plan at the community level but how to integrate it with the developmental policies requires a larger framework and support from the government machinery. People are adaptable but over the changing scenario, they need support from outside agencies. They have learnt from the past experiences and their traditional knowledge of forecasting weather is rendered useless.

Community's attitude towards governance and leadership :

People have faith in their Samaj. They comply to the rules and regulations of the samaj. There is dependence on the samaj for all the matters pertaining to development too. Its been functioning for a long time and mostly it has been able to take care of its members in almost all the emergencies so far. But the dependence on the government machinery in absence of any concrete measures to deal with climate change cannot be ruled out. Thus people have faith in the governance and leadership of their samaj which is strength of the community.

Village Umarsadi : (N=18)

Brief History of the Village:

Umarsadi village is an old village situated in Pardi Taluka 6 kms away from Pardi and is an important port along the 15 kms long coastline of the Arabian sea of Valsad District. On the right of the village is Damanganga river branch and on the left is the Par river. The village is to the south of the Valsad district. It also is in vicinity of Pardi GIDC and ATUL. The village has a jetty. To its left is Dungari village and to the left is Udwada . The Sayandri Mountain Range is visible from the jetty. The laxminarayan temple is nearly 450 years old and hence the village is older than that. There are 13 lanes (faliya) and it has four major communities of Tandels (Fishermen), Koli Patels (Farmers), Bhandaris (Farmers) and Halpatiyas (labour). There is an area called Desaiwad, mangelwad and Umarsadi macchiwad. Umarsadi Macchivad has applied for a separate Panchayat due to increasing population.

Housing:

Around 60 % of the houses are pucca houses while 40% of the houses are semi pucca and kuccha houses in the entire village. Around 10% of the houses of the pucca houses are huge triple storied houses belonging to rich fishermen. All the pucca houses are well maintained. Due to soft soil, the foundation of the houses are not so strong. Thus the kuccha houses which are around 10% are at risk. Most of the houses are well ventilated with bathroom and lavatories. There is ample space around the houses and have more than two rooms.

Health:

There is a sub centre in the village but it is generally closed. There is a primary health centre in the village at Desaivada and there are two private clinics at Umarsadi macchiwad. There are 15 hospitals in Pardi. People generally go to the private clinics which are at Pardi or Valsad. Hygiene wise, the village is very poor and hence there are instances of skin diseases, children suffer from Asthmatic bronchitis, cough and cold, vomiting, diarrhea etc, the adults have problems like Blood Pressure, alcoholism, diarrhea,

vomiting, lifestyle disease like general increase in cholesterol levels, heart problems etc. Ladies suffer from arthritis after the age of 40. People also avail services from as far away as Surat and Mumbai also in case of severe cases.

Education:

In the earlier generation, education was very low but now in the new generation, it is good. Boys generally study till 10th or 12th and then take up jobs but the girls study more doing their BA, MA or B.Ed. Some men who do not go in as seamen also study higher. There are around 50- 80 teachers in the village. There is a primary school which caters to 1-8 standards in the school faliya. There is 100% literacy in the age group of 6-14 yrs now. This school earlier was also teaching fisheries as one of the subjects and was one of the three schools of fisheries. It was established in 1917. There is another school which is at Sagiya faliya which caters to 1-5 standards. Families also enroll their children in hostels for studies in Surat, Vadodara and Ahmedabad for quality education.

Water:

The drinking water is provided by the Panchayat to the village. This water is purified by Atul industries at the filtration plant and the distribution is through the pipelines with the help of tap and water posts. Thus water is available in ample amount except occasionally in summers when people face drinking water problem. There are two ponds in the village which are also used to wash clothes and utensils by families residing on the fringe of the ponds.

Electricity:

It is the government which provides the electricity in the village. There are meters for the electricity. The farms are provided with electricity used for agriculture.

Drainage:

There is no drainage system in the village but there are soak pits for the same. Thus each house has to construct soak pits. Within the houses, the

pucca houses have the drainage facilities which are linked to the soak pits. Under the 13th Nana panch yojana, there is construction of sauchalaya for those who do not have toilets in their houses.

Communication:

The village has phone booths for making calls. People also have their own phones as well as mobiles as means of communication. In case of emergencies, the Panchayat office uses their public address system to communicate with the people.

Legal Services:

The fishermen's community has their own legal system which is hundred's of years old. They call it their Samaj. The machi samaj has a very well organized system. Each faliya in the community has 4 members who look after the people residing in the lane. Thus, first the issues are tackled by the lane leaders. Matters pertaining to marriage, property, relationships, social problems etc are first handled by the lane leaders. Then if they fail, the issue goes to the nyay samiti in the village. If at all a consensus is not reached, then the issue is tackled in the Mahamandal sabha which takes place once in the year. But most of the time, the issues are solved at the village level itself. There is no theft reported in many years, no case of abuse, divorces are very rare as people are governed by their samaj rules and regulations. Punishments are severe and hence people are law abiding. The system is very transparent and hence people have more faith. Very rarely people take help of the legal machinery of the government.

Family and Kinship Networks:

The community is a mixed community in the village and is divided into Umarsadi Macchiwad, Umarsadi Desaiwad and Umarsadi Mangelwad. In Umarsadi macchiwad, there are people belonging to fishermen community where the family and kinship networks are very strong. People are related to one another by ties of blood or marriage to a large extent. In times of need, it is the family and the neighborhood which helps first. Most of their relatives are there in the villages identified by their own Dakshin Gujarat Macchimar

Samaj. Thus they have strong family and kinship network. People value their customs and traditions which are very different from other castes, yet there is an increasing openness in their approach towards the others. Some people do marry outside their own castes also which is now widely being accepted. Thus there is a spirit of tolerance now in matters pertaining to kinship ties.

Occupation:

There is diversified occupation in the village. There are around 500 plus seamen, around 500 ladies engaged in packaging in surrounding industries, there are around 100 rickshaw drivers, 1000 people both male and female engaged in fishing and 70-80 teachers. People are also engaged in business, service sector, are self employed, there are medium scale farmers and farm labour too in the village. Thus there is diversity observed in the occupational sector in the village.

Economic Status of the Community:

There is diversity in the economic status of the community. People who are engaged in seamen trade are the rich and elite of the community while the people who are dependent only on fishing are the poor ones. Compared to other communities, they rank themselves on a higher side since their income is in lacs of rupees per annum.

Migratory Patterns:

Around 70-80 families have shifted to places like Vapi, Pardi, Valsad and Navsari and they have houses in the village also. This is a permanent migration since only for festivals they come to the village. Mostly people migrate due to jobs after leaving fishing. Also many people especially around 500 ladies go to surrounding industries for working in packaging daily.

Health Status:

There are two private doctor clinics in the village to cater to the needs of the community people. There is one sub centre at Umarsadi Macchiwad and a Primary Health Centre at Umarsadi Desaiwad. Moreover, people prefer to go to private health care providers at Pardi, the taluka head quarters or to

Valsad, Navsari and Surat in case of some specific diseases. Being near to the coast, women over 40 generally suffer from arthritis. Asthmatic Bronchitis is observed in the children. Vomiting and Diarrhea are common in the area. Due to poor hygiene, various skin diseases are observed like measles etc. The seamen, due to their lifestyle, suffer from increase in cholesterol levels, diabetes and BP. Hence they have some or the other problems related to the heart. Consumption of liquor in gents is also observed.

Climate Related Hazards/Disasters and other Hazards/Disasters:

26 big vessels and 130 men at sea were lost in the Okhamandal cyclone. Cyclones are experienced by the community every year but not much damage is incurred. The major problem identified by the community is coastal erosion and salinity ingress. The sea has gushed in nearly 30 feet in the past few years. Land is being submerged in water like other surrounding areas like bawan deep area which is no more and Udwada etc. There is salinity ingress of around 2 kms in past decade. Most of the bore wells and wells are saline. The sea level has increased to 5-6 feet in past 25 years. In high tide, the water goes up by 6-7 feet. A protection wall has been constructed now by the irrigation department. Another hazard is pollution especially sea pollution due to surrounding industries the rivers have become acidic which damages the head of the machine of boats, the alfanso has got affected as the flowering does not last long, the kind of fish that was available is also not available now and people have to go deep into the sea so more time is consumed. Flooding of Par River takes place in case of heavy rainfall but no damage is sustained by the people. A nearby bavan deep area is totally submerged in the water.

Social Networks:

Social Networks in form of Dakshin Gujarat Machimar Mahamandal is the main supporting network of the fishermen. Under the flagship of this, the entire community is governed. People are law abiding in this network. Most of their needs are catered to by their samaj. All cultural and familial issues are governed by their samaj. In time so emergency, this mandal becomes very active at the lane and village levels and is supported by the mahamandal

also. Widows, orphaned and special need people are taken care of by the families with the help of the mandal.

Another network that is catering to the community is the Swadhyay network. It is a religious group at the local, regional and national level. Apart from religious activities like regular prayers, it also carries out various developmental activities through its women's groups and youth groups. There is a concept of Matsyagandha boat known as tartu mandir. The produce of the day i.e. fish caught per day is distributed amongst the women for sale. Women also dry fish and sell them. Thus it helps economically to the poor persons. Same is the case with Vruksha Mandir which is related to the agricultural produce. Youth groups are generally linked to awareness programmes and developmental programmes through character building and holistic development of the persons.

There is a seamen's association named seamen's brother's mandal which has 566 members. They are also active in providing assistance to the seamen during their tenure as seamen. This mandal also helps poor people in times of need or emergency.

There are 4-5 sakhi mandals in the village formed by Samaj Kalyan department i.e. social welfare department. These mandals are involved in saving credit schemes and are for income generation.

There is a Machi Mahajan Panch to cater to the needs of fishermen. They are actively involved in the welfare of the fishermen at the local level.

There is another religious group called Sadguru Sevak Samiti which caters to the religious cause as well as welfare of their members. In case of emergency, they too cater to the needy persons. Mostly they are involved in religious activities.

Coastal and Marine resources :

The coast was more resourceful earlier. Earlier, there were mangroves, crabs, shells available on the coast which were used by the community for goods and services. Due to coastal erosion and pollution, the mangrove cover is destroyed. Fish variety like crabs etc is not there any more. The crabs and shells are no more found on the coast and hence except for fishing, there is no dependency on coastal and marine resources. Except for Bombay duck, no other variety of fish is available on the coast. Moreover, the fishermen have to go deep in the sea for fishing which is both time consuming and energy consuming process.

Livelihood sources for the community:

There is diversity found in the livelihood sector. Working as Seamen, fishing, teaching, labour job, Auto rickshaw driver, self employment, saving credit groups like self help groups etc are the various sources of livelihood in the community.

Alternative and supplementary livelihoods:

After the Okhamandal cyclone in 1999, people have switched over to alternative livelihoods like seamen, teaching, working as labour in surrounding companies, taking up jobs in other cities like Navsari, Surat and Pardi. The concept of supplementary livelihoods is not much practiced. Since people are literate, they help the others to have the knowledge. The opportunities are in abundance in the surrounding industrial areas for work. Threats in form of competition are acknowledged by the villagers.

Information about climate related knowledge:

It is from the community leaders that the people gain knowledge about climate change. This knowledge is poor in case of women since their role is limited in the governance. Moreover there are leaders to attend forums outside also share information with the villagers. Organized efforts at the community level are still missing for dissemination of information about climate related knowledge.

Formal and informal networks supporting climate hazard reduction and adaptation :

Both the government machinery and the informal leaders of the community in form of mandal together work for issues like sea pollution, salinity ingress, etc. But concrete measures for climate hazard reduction and adaptation are yet to be chosen and taken by the community. A sea wall has been erected for protection of the cost by the government.

Ability of community to organize:

The ability of the community to organize itself is high due to the existing structure of the Machi community. There are 13 lanes and each lane has 4 members elected every year. All these members are effective in organizing their community. There is cohesion and cooperation amongst the members. Small measure to help each other in issues of climate change are there but still it needs to be taken up as a holistic development. People have more faith in their own systems.

Community's attitude towards governance and leadership:

People have more faith in their own community leaders than the government leaders. This is partly because the system is in effect since a long period.

A comparative statement of the two communities:

Sr. No.	Particulars	Madhvad	Umarsadi	Remarks
1. Geographical Location of the Community				
1	Nearness to sea (Arabian Sea)	Most of the houses are on sea shore	Only fishermen houses are on sea shore	Madhvad is more vulnerable
2	Nearness to Taluka Headquarters	18 Kms	6 Kms	Madhvad is more vulnerable
3	Ecosystem	Sodham Wetland and Gir Forest	Waghai Forest Range ecosystem	Madhvad is more sensitive
2. Community Resources				
1	Housing	Congested, only 30% pucca houses, mostly small houses	60% pucca and with amenities	Madhvad is more vulnerable
2	Water	Wells water is salty, No hand pumps or bores, have to purchase water for drinking and washing	Hand pumps and stand posts along with tap water. Filtration plant. Scarcity only marginally in summer	Madhvad is more vulnerable

3	Drainage and Sanitation	No drainage system, some soak pits and open defecation	Soak pits, bathrooms and lavatories	Madhvad is more vulnerable
4	Health	Sub centre, nearness to PHC. Opt for private doctors but accessibility due to transportation is a problem	Sub centre, PHC, Private Clinic in the community. Nearness to pardi, easy accessibility	Madhvad is more vulnerable
5	Education	Primary School, Low level of education	3 primary school, high level of education	Madhvad is more vulnerable
6	Occupation	Fishing and working in fishing industry	Diversified-fishing, seamen, service sector etc	Madhvad is more vulnerable
7	Legal Services	Check post at Vellan, Samaj is active	Police station is there, Samaj is active	
8	Communication	Less sources	More sources	Madhvad is more vulnerable
3. Hazards, Disasters and Climate Change				
1	Cyclones	High incidences	Low incidences	Madhvad is more vulnerable
2	Floods	High incidence	Low incidence	
3	Earthquake	Low incidence	Low incidence	
4	Depletion of Mangrove	High incidence, regeneration work being carried out	High incidence	Umarsadi is more vulnerable
5	Coastal Erosion	Medium incidence	High incidence, lost 25-30 feet of land	Umarsadi is more vulnerable
6	Sea Level Rise	Low incidence	Medium incidence. Instance of total submergence in bawandee area	Umarsadi is more vulnerable
4. Vulnerability and Resilience				
1	Elderly	No single elderly, taken care by family and kinship ties	No single elderly, taken care by family and kinship ties	Both communities are resilient
2	Widows	5 widow headed households, supported by kinship and samaj	10-12 widow headed households, supported by kinship and samaj	Both communities are resilient
3	Special Need People	Taken care by kinship ties	Taken care by kinship ties	Both communities are resilient
4	Orphans	Taken care by kinship ties	Taken care by kinship ties	Both communities are resilient

5	Warning and Forecasting system	Government	Government	
6	Risk Knowledge	Present in the community	Present in the community	
7	Traditional Knowledge	Traditional knowledge not enough due to changing climate	Traditional knowledge not being utilized except the senior generation	Umarsadi more vulnerable
8	Livelihood diversity	No diversity found	Highly diversified livelihoods	Madhavad more vulnerable
9	Disaster Recovery	Government mechanism	Government mechanism	
10	Disaster Preparedness	DRM exercise carried out before 5 years, less awareness	DRM exercise carried out before 5 years but no awareness	
11	Coastal and Marine Resource Dependency	High dependency	Low dependency	Madhavad is more vulnerable
12	Learning from change	Low	High	Madhavad is more vulnerable
13	Self Organization	High	Moderate	Madhavad is resilient
14	Supplementary and alternative livelihoods	None	Many	Madhavad is more vulnerable
15	Migration Pattern	Seasonal Migration for 7-8 months	No seasonal migration	Madhavad is more vulnerable
16	Family and Kinship network	Very strong	Strong	Umarsadi is vulnerable
17	Social Networks	Kharva Samaj	Dakshin Gujarat Machi Samaj	
18	Formal and Informal Networks	Samaj, Swadhyay, Boat association, Aga Khan Foundation, Prakruti Nature Club, Ambuja Cement Foundation	Samaj, Swadhyay, Seaman's association, boat association	Madhavad more resilient
19	Ability of community to organize	High since it small	Moderate to high due to being part of big community	Madhavad more resilient
20	Attitude towards governance and Leadership	Trustworthy, faithful towards their own samaj than government	Trustworthy, faithful towards their own samaj than government	

Thus it can be said that Madhavad is more vulnerable than Umarsadi but the presence of strong social capital can be built upon for making it more resilient especially in term of climate change.

CHAPTER FIVE

FINDINGS, DISCUSSION AND RECOMMENDATION

Major Findings:

- 58.8% of the total respondents are male. The figure is high with 80% in case of Madhavad while in Umarsadi its 62.0%
- Umarsadi is dominated by the Hindu Machi caste amounting to 99%. It is the Kharvas who dominate Madhavad with 97.1%. Also all 170 respondents are Hindus. All the respondents belong to general category.
- 90% of the respondents from Umarsadi are married while 94.3% of the respondents from Madhavad are married. 5% of the respondents from Umarsadi are widows.
- In case of Madhavad, 4.3% of the respondents are graduates and 2.9% of the respondents are post graduates while in case of Umarsadi, this is 31% and 4% respectively.
- 62.9% of the respondents in case of Madhavad are Fishermen as compared to 21.0% in Umarsadi. 30.0% of respondents in case of Umarsadi are dependent on service sector as compared to none in case of Madhavad
- The house hold heads account for more than 75% of the respondents with 79% in case of Umarsadi and 78.6% in case of Madhavad. 15.7% of the respondents in Madhavad were second generation representatives of the households in terms of daughter in laws
- All the respondents in Madhavad are residents of the community since the beginning of their lives as compared to 96% in case of Umarsadi.
- 65% of the houses in Umarsadi are Pucca houses, the percentage is 34.3% in case of Madhavad. In contrast to this, 38.6% of the houses in Madhavad are Kutcha as compared to 7% in Umarsadi.
- 66.0% of the houses in Umarsadi have latrines which is only 21.4% in case of Madhavad. In case of bathrooms, 86% of the houses in Umarsadi as compared to 50% in case of Madhavad have them. 65% of the houses in Umarsadi as compared to 15.7% in case of Madhavad have ventilation; in case of separate kitchen this is 83% in case of Umarsadi as compared to 25.7% in case of Madhavad. 34.3% of the houses in Madhavad have no facilities conveying one room houses.

- 65% of the families in Umarsadi and 65.7% of the families in Madhavad have nuclear families.
- 22.9% of the families in Madhavad are large families with 8-12 members as compared to 1% families in Umarsadi. 52% of the families in Madhavad have 5-7 members as compared to 41.0% in Umarsadi.
- There is no significance difference between the genders of family members of both the communities
- 145 family members migrate seasonally for livelihood in Madhavad while only 15 members migrate for livelihood in case of Umarsadi.
- 70% of the respondents in Madhavad are not able to save as compared to 28% in Umarsadi.
- 93.1% of the households save money in form of cash at home in Umarsadi as compared to 71.4% opting for Saving accounts in Bank in case of Madhavad
- 50% of the respondents in Umarsadi rate the economic status of their households as compared to other families of the community to be above average as compared to 34.3% respondents in Madhavad stating that the economic status of their household is average as compared to economic status of others families in the community. 52.9% of the respondents in Madhavad did not respond.
- 65.7% of the respondents in case of Madhavad take debts as compared to 40% of the respondents in Umarsadi
- 95.7% of the respondents in Madhavad stated that they take debts to meet the household expenses while 80.0% of the households in Umarsadi take debts for marriage as compared to 82.6% of the respondents. 87% of the respondents in Madhavad also take debt for basic necessities. 67.5% of the households in Umarsadi take debt for building house or renovation. 84.8% of the households in Madhavad take the debt for religious purpose also
- 72.5% of the people in Umarsadi take loans from the bank as compared to 50% in case of Madhavad who resort to taking loan from relatives. 39.1% of the households in Madhavad also take loan provided by community organizations.

- 89.1% of the of the households in Madhavad are able to repay the loans while 72.5% of the households in Umarsadi are not able to repay the debts they take.
- 97% of the households in Umarsadi have been exposed to climate related hazard of storm surge as compared to 1.4% at Madhavad.
- 58% of the households in Umarsadi have rated the intensity of storm surge to be high as compared to 21.4% of households in Madhavad stating it to be medium.
- 96% of the respondents stated that their households have experienced Coastal Erosion as a climate hazard in Umarsadi as compared to 25.7% of the respondents in Madhavad.
- 54% of the respondents in Umarsadi have stated that the intensity of coastal erosion as a climate hazard as experienced by the household to be high as compared to 21.4% of the respondents stating it to be medium in Madhavad.
- 100% of the respondents in Madhavad stated that their households have been exposed to cyclone climate hazard as compared to 87% of the respondents in Umarsadi area.
- 61% of the respondents have rated cyclones to be of low intensity in Umarsadi while 97.1% of the respondents in Madhavad stated it to be of medium intensity
- 75.7% of the respondents from Madhavad stated that their households have been exposed to flood related climate hazard as compared to 99% of the respondents from Umarsadi stating that their households have not been exposed to flood related climate hazard.
- 45.7% of the respondents in Madhavad have rated the intensity of the flood as experienced by the household to be of High and 30% of them rate it as medium. This almost makes 75.7% of the respondents in the area. In case of Umarsadi, 99% of the respondents have stated it to be non applicable.
- All the households in Madhavad have stated that they have been exposed to salinity ingress hazard as compared to 16% of the households in case of Umarsadi

- 15.7% of the households in Madhvad state that there has been depletion of mangrove covers in the area. No such exposure has been felt in case of Umarsadi.
- 10% of the respondents state that the intensity of depletion of mangroves is high while 5.7% say its low in Madhvad area. No such incidence is reported from Umarsadi area.
- Regarding the frequency of cyclones witnessed by the households, 31.9% of the households in Madhvad as compared to 4.2% in Umarsadi state this to be high. 58.0% of them in Madhvad report this to be medium while 77.1% of them in Umarsadi state that the frequency is low.
- Regarding sensitivity of the households towards cyclones, 75.0% of the households in Umarsadi rate it as low and 20.8% rate it as medium as against 39.1% of them in Madhvad rating it as low and 55.1% of them rating it as medium.
- Regarding the negative impact of cyclones as witnessed by the households, 66.7% of the households in Umarsadi as compared to 37.7% in Madhvad rate it as low. 53.6% of the households in Madhvad as compared to 29.2% in Umarsadi rate it as medium.
- 71.9% of the households in Umarsadi as compared to 39.1% in Madhvad rate difficulty in coping with impact of cyclones witnessed by the households to be low while 27.1% and 20.3% rate it to be medium in Umarsadi and Madhvad. It is to be noted that 40.6% of the households in Madhvad have rated it to be high.
- Regarding the frequency of coastal erosion, 56.3% of the households in Umarsadi and 50.0% of the households in Madhvad have rated this to be high. Coastal erosion is a major hazard identified by both the communities.
- 60.4% of the households in Umarsadi and 27.8% of the households in Madhvad state that the sensitivity of their households to coastal erosion is high. It is to be noted that 50.0% of the households in Madhvad rate this to be low.
- 80.6% of the households in Madhvad rate the negative impact of coastal erosion on their households as medium while 55.2% of the households rate it to be high in Umarsadi.

- Regarding difficulty in coping with impact of coastal erosion by the households, 77.8% of the respondent households in Madhavad rate this to be medium while 58.3% of the households in Umarsadi rate this to be high.
- 60.0% of the households in Madhavad have rated frequency of increase in sea level to be medium as compared to 43.2% of the households in Umarsadi. 25.3% of the households in Umarsadi have rated this to be high while 31.6% have rated this to be low.
- 45.7% of the households in Madhavad have rated sensitivity to increase in sea level to be high as 37.9% of the households in Umarsadi rating it to be medium.
- Regarding the negative impact of increase in sea level on the households, 81.4% of the households in Madhavad have rated it to be low as compared to 36.8% in Umarsadi. 35.8% and 10.0% of the households have rated this to be medium in Umarsadi and Madhavad respectively.
- As regards the difficulty in coping with impact of increase in sea level by the households, 42.9% of the households in Madhavad have rated it to be high compared to 40.0% of the households in Umarsadi rating it to be low. It is to be noted that 33.7% of the households in Umarsadi have rated this to be as medium.
- 69.0% and 50.0% of the households have rated the frequency of salty water in the farms to be low in Umarsadi and Madhavad. This is to be noted that the respondents belong to fishermen community. While 20.7% and 28.6% households in Umarsadi and Madhavad rate it as medium respectively. 21.4% of the households in Madhavad rate this to be high suggestive of salinity ingress.
- 75.9% and 50.0% of the households in Umarsadi and Madhavad respectively state that the sensitivity to salty water in the farms is low. It is to be noted that 21.4% of the households in Madhavad have rated it to be high and 28.6% stating it to be medium.
- The negative impact of salty water in farms has been rated as low by 75.9% of the households in Umarsadi as against 53.6% of the households in Madhavad rating it to be high.

- Regarding difficulty in coping by the households due to salty water in farms, it is rated low by 72.4% and 32.1% of the households in Umarsadi and Madhavad respectively. 51.8% of the households have rated this to be high in Madhavad.
- 62.9% of the households in Madhavad and 42.7% of the households in Umarsadi state that frequency of salty water in wells is high.
- 81.4% of the households in Madhavad and 42.7% of the households in Umarsadi state that the sensitivity to salty water in wells is high
- Regarding the negative impact of salty water in wells on the households, 55.7% and 43.8% of the respondent households in Madhavad and Umarsadi have rated this to be high. 26.0% and 35.7% in Umarsadi and Madhavad respectively state it to be medium.
- 51.4% and 40.6% of the households in Madhavad and Umarsadi respectively have rated difficulty in coping with salty water in well by the households to be high and 38.6% and 26.0% have rated it to be medium
- 47.1% of the households in Madhavad state that the frequency of change in weather is medium while 85.7% of the households in Umarsadi rate it as low.
- 92.3% of the households in Umarsadi rate sensitivity to change in weather of households to be low while 55.7% of the households in Madhavad rate it to be medium. It is to be noted that 24.3% of the households rate this to be high in case of Madhavad.
- 76.9% and 72.9% of the households in Umarsadi and Madhavad respectively rate negative impact of change in weather on households to be low. It is to be noted that 27.1% in Madhavad rate this to be medium
- Regarding difficulty in coping with changes in weather by the households, 83.5% and 72.9% of the households in Umarsadi and Madhavad respectively rate it to be low.
- Regarding frequency of floods, 47.8% of the households have stated it to be high in Madhavad. It is to be noted that in Umarsadi, only 4.2% of the household have stated it to be low.
- 58.0% of the households in Madhavad out of the total 69, state that there is high sensitivity to floods of their households.

- 42.0% of the households in Madhvad state that the negative impact on flood on their households is high. In case of Umarsadi only one household has responded to the question and has rated it as medium.
- 36.2% of the households state that the difficulty in coping with impact of floods is high in Madhvad while 30.4% state it to be medium. The rest state it to be low.
- Regarding the sea water becoming hot, 92.6% of the households of the total 27 households who have responded to this question state that the frequency of sea water becoming hot is high in Umarsadi as compared to 90.9% of the 20 households in Madhvad
- Under stress free conditions, 54.0% and 39.0% of the households have Bore well and Handpump as major source of drinking water in Umarsadi as compared to 58.6%, 20.0% and 15.7% households having Tap water, Well and Tanker as major source of drinking water in Madhvad.
- In case of emergency situations, 77.1% of the households in Madhvad and 69.0% households in Umarsadi resort to tankers selling water and Government sources for drinking water facility.
- Under stress free conditions, 96.0% of the households in Umarsadi and 62.9 % of the households in Madhvad depend on government power supply. It is to be noted that 37.1% of the households in Madhvad have no electricity as compared to 4% in case of Umarsadi.
- 72.9%, 55.7% and 60% of the households in Madhvad depend on government sources, candle and lamps as compared to 30%, 55% and 64% in case of Umarsadi. It is worth noting that households in Umarsadi also have facilities like emergency light and inverters.
- Under stress free conditions (Normal conditions), 94% of the respondents go to private health care service providers in Umarsadi for their health care needs while 92.9% of the respondent households in Madhvad go to private health care service providers. In contrast to this, 31.4% of the households opt for government health care service providers in Madhvad.
- In emergency situations, households in Umarsadi resort to Government as well as private health care providers with 84.0% opting for government health care providers and 62.0% opting for private health care providers.

71.4%, 44.3% and 42.9% households in Madhvad opt for Private, 108 emergency services and government health care providers respectively.

- Regarding the sources of communication under stress free conditions, households in Umarsadi use Phone and Mobile with 35.0% and 58.0% as compared to 18.6% and 24.3% in Madhvad . 64.3% use TV and 57.1% use Radio in Madhvad as compared to 31.0% and 6.0% in Umarsadi. It is worth noting that 34.0% and 31.4% of the respondent households in Umarsadi and Madhvad have not responded to the question as they do not have any major source of communication.
- 33% of households in Umarsadi and 37% of the households in Madhvad have not responded to the question regarding sources of communication. The major source of communication in Madhvad with 40% of the households responding is Public Address System as compared to 28.0% in Umarsadi. In Umarsadi, major source still remains Phone, Mobile and TV while for Madhvad, its Radio and TV.
- 62.0% and 34.3% of the households in Madhvad use Rickshaw (chakada) and other mode of transportation like bicycle in stress free conditions as compared to 46.0% and 44% of the households in Umarsadi using two wheeler and rickshaw.
- 64.0% and 74.0% of the households in Umarsadi use Government and Private transportation in times of emergency while in Madhvad, 67.1% use the private vehicles.
- 17.1% and 3% of the respondents in Madhvad and Umarsadi have stated that under stress free conditions, they use their boats as occupation resources.
- 1.4% of the total household respondents use boat as occupation resources in times of emergency in Madhvad.
- In case of emergencies, households in Madhvad, 30% go to relatives or stay in own houses, 41.4% take shelter in School and 17.0 % take shelter in the temple. In Umarsadi, 62.0% go to schools and 32% take shelter in society.
- 68.6% of the respondents households in Madhvad utilizes coral reef as coastal and marine resources for fishing in form of goods and services for household consumption

- 8.6% of the respondent households in Madhavad utilize fishing from coral reef to sell and earn livelihood. No such activity is found to be in practice in Umarsadi area.
- 51.4% of the households in Madhavad utilize mangroves wood in the households. No such practice is seen in Umarsadi.
- 54.3% of the households in Madhavad use mangrove wood for cooking purpose. No such activity is reported in case of Umarsadi.
- 15.7% of the respondent households utilize mangroves for making coal which is used for cooking in the households. It is to be noted that no such activity is noted in Umarsadi.
- 71.4% of the respondent households in Madhavad utilize coastal and marine resource of mangroves for fishing which they sell. No such activity is found to be there in case of Umarsadi
- 71.3% of the respondent households in Madhavad and 23.0% in Umarsadi state that the main source of livelihood for their household use is in form of fishing. It is to be noted that 77% of the households in Umarsadi do not depend on fishing for household use
- 19.0% of the households in Umarsadi and 1.4% of the households in Madhavad are engaged in fishing as a main source of livelihood for business use only
- 38.6% of the respondent households in Madhavad as compared to 17.0% in Umarsadi state that it is the household head who is engaged in fishing for livelihood. 21.4% and 2.0% of the households in Madhavad and Umarsadi respectively have engagement of wives in the same livelihood. Only 12.9% of the households in Madhavad and 78.0% of the households in Umarsadi are not engaged in fishing for livelihood.
- 44.3% of the households in Madhavad depend on other marine life in form of crabs, lobsters and shells for household purpose as main source of livelihood. It is to be noted that no such activity is reported in case of Umarsadi
- As pertaining to role of family members engaged in livelihood from other marine lives like crabs, prawns and shells, 15.7% of the households in Madhavad have the wives engaged in this while 28.6% are in form of sons.

- 54% of the respondent households in Umarsadi and 1.4% of the households in Madhvad are engaged in service/job as the major source of income for household consumption
- 10% of the households in Umarsadi and 57.1% of the households in Madhvad are engaged in business as a main source of livelihood for their subsistence.
- Regarding other sources as main source of livelihood for household use, 31.0% of the households and 1.4% of the people have opted for this suggestive of engagement in other occupations like driving auto, bus etc
- 17.0% of the household heads, 11.0% of the sons, 8.0% of the husbands, and 1.0% of father and father in law each in Umarsadi are engaged in livelihood in form of seaman while no such occupational engagement is found to be there in Madhvad.
- Regarding the perception of the household as regards the ability of the community to make community plans to deal with climate related events, 77% of the households in Umarsadi and Madhvad state that they agree or strongly agree to the statement, 23% of the households in Umarsadi have provided a neutral rating. 12.8% of the households in Madhvad have disagreed to the statement.
- As regards the perception of the household regarding the ability of the community to coordinate activities to respond quickly to the impacts of natural events, 88.0% of the households in Umarsadi and 85.7% of households in Madhvad agree or strongly agree to the statement while 12.0% and 11.4% in Umarsadi and Madhvad respectively remain neutral. 2.8% of the household respondents in Madhvad disagree.
- Regarding the perception of the household as regards the ability of the community to reorganize to respond to new situation, 46.0% and 55.7% of the households in Umarsadi and Madhvad respectively state that they strongly agree to this statement. 26.0% of households in Umarsadi are neutral while 14.3% of the households strongly disagree in Madhvad.
- Regarding the perception of the household with respect to the ability of the community institutions to support the members in need to reorganize to cope with new problems, 49.0% and 54.3% of the households in Umarsadi and Madhvad state that they strongly agree with the statement. 13.0 % of

the households in Umarsadi state they are neutral. 21.4% of the households in Madhavad disagree to this statement.

- Regarding perception of the household with respect to the ability of the community members to work well with each other, 54.0% and 61.4% of the households in Umarsadi and Madhavad state that they strongly agree to the statement while 26.0% and 10.0% of the households in Umarsadi and Madhavad state that they agree with the statement. 19.0% and 18.6% of the households in Umarsadi and Madhavad have stated that they are neutral.
- With regards to perception of the household regarding the ability of the community to access outside support when needed, 28.6% of the households in Madhavad state that they totally disagree to the statement as compared to 64.3% of the households stating that they agree to the statement. 46.0% and 37.0% of the households in Umarsadi strongly agree and agree to the statement respectively. 15.0% of the households in Umarsadi have stated that they are neutral towards the statement.
- With regards to attitude of the households towards community leaders to successfully lead them through climate related events in the past, 50.0% and 91.4% of the households in Umarsadi and Madhavad respectively strongly agree to this statement while 27.0% of the households in Umarsadi are neutral towards this. This shows that leadership in Madhavad is more capable than in Umarsadi.
- With regards attitude of the households towards community leaders being interested in climate change issues and the impact on the community, 44.0% and 39.0% of the households in Umarsadi agree and strongly agree to the statement. 62.7% of the households in Madhavad strongly agree to the statement. 16.0% of the households in Umarsadi are neutral towards the statement.
- Regarding the attitude of the households towards community leaders who have knowledge and skills to effectively take charge of climate change adaptation, 62.9% and 35.0% of the households in Madhavad and Umarsadi strongly agree to the statement while 29.0% and 32.9% in Umarsadi and Madhavad agree to the statement. 28.0% of the households in Umarsadi are neutral towards this.

- Regarding attitude of the households towards trust in community leaders to lead the community through climate change adaptation, 28.6% of the households in Madhavad disagree to this statement while 23.0% of the households in Umarsadi are neutral. 52.0% and 62.9% strongly agree to the statement in Umarsadi and Madhavad respectively.
- Regarding the attitude of the households towards ability of the leaders to inform them of national and regional climate change policy or initiatives, 91.4% of the households in Madhavad strongly agree to the statement while 40.0% and 39.0% of the households in Umarsadi strongly agree and agree to the statement. 15.0% of the households in Umarsadi have remained neutral towards the statement.
- Regarding attitude of the households towards ability of the leaders to inform them from where to get climate related information, 62.9% of the households in Madhavad and 46.0% of the households in Umarsadi strongly agree to the statement. 25.0% of the households in Umarsadi have stated that they are neutral
- With regards attitude of the households towards ability of the leaders to suggest what can the community people do to adapt to climate change, 53.0 % and 71.4% of the households in Umarsadi and Madhavad strongly agree to the given statement. It is to be noted that 18.0% and 21.4% of the households in Umarsadi and Madhavad are neutral
- With regards to attitude of the households towards ability of the leaders to provide them with resources needed for climate change activities, 91.4% and 37.0% of the households in Madhavad and Umarsadi strongly agree to the statement. 37.0% of the respondent households in Umarsadi state that they agree. 19.0% of the households in Umarsadi are neutral towards the statement. Around 7.0% of the households in Umarsadi are in disagreement.
- Regarding the attitude of the households towards ability of the leaders to encourage community members, 46.0% of the households in Umarsadi state its neutral while 91.4% of the households in Madhavad state that they strongly agree to the statement
- Regarding the attitude of the households towards their voices being heard in community planning for climate change adaptation, 47.0% and 62.9% of

the households in Umarsadi and Madhavad strongly agree to the statement. 36.0% and 25.7% of the households in Umarsadi and Madhavad respectively are neutral about this.

- As regards attitude of the households towards ability of the leaders to provide opportunity to participate in community level decision making, 39.0% of the households in Umarsadi are neutral. 91.4% of the households in Madhavad strongly agree to the statement.

Findings and Discussion:

Based on the above findings, following points are put forward for discussion which would also enable the researcher to reach to certain important conclusions followed by suggestions to deal with the issues more realistically and constructively.

Demographic Details:

Caste:

Caste is an important socio economic determinant for any community especially in our country. Benefits based on reservations are a common paradigm in the developmental and emergency management sector. Homogeneous communities have stronger ties in terms of sociology and provide firm foundation for functioning of the community. In our country, reservations based on caste in various sectors do influence the developmental sectors. The general category has no privileges for accessing programmes meant for special categories. Thus single caste acts as a resilience factor

Marital Status:

Marital status also plays an important role in terms of family resilience. In terms of disaster management, researches have shown that single headed households or single women headed households have exhibited low on resilience and high on vulnerability factor. Presence of single headed or single women headed households in community acts as a vulnerability indicator. This makes Umarsadi relatively vulnerable due to widow headed households.

Education:

Education is an important indicator for social development which is integrated with the fields of disaster management and climate change. It is an accepted fact that the methods of working with literates and not literate people vary widely. Moreover right based approach is more understood by the educated

due to exposure to information and knowledge base. Education enables a community to be engaged in diversified trade and commerce also which acts as a resilience factor.

Occupation:

Occupation and diversified livelihoods acts as resilience factor in terms of disaster management and climate change. Overdependence on a particular sector especially if it is dependent on natural resources acts as a vulnerability enhancing factor when the sector is affected by climate change or disaster. Agriculture and Fishing are examples of such occupations. Overdependence on fishing along with marine and coastal resources acts as a vulnerability factor in Madhavad while diversification in case of Umarsadi over the period of time shows adaptation and acts as a resilience factor against climate change.

Housing and facilities :

Housing plays an important part in building resilience against extreme events like cyclones, floods, storm surge etc. The type of housing that a household has and its condition is one of the factors contributing to vulnerability or resilience. This kind of physical vulnerability also has its impact on overall vulnerability of a household. It is also linked to economic vulnerability. Researches in disaster management have shown that generally poor people live in kutchha or semi kutchha houses rendering them vulnerable in times of disaster. Moreover, pattern of housing, i.e. the distance between them in the lanes etc also is important as it enables or disables maneuvering vehicles or escape routes. It is to be noted that traditional housing are not to be considered vulnerable by themselves without taking into consideration the overall climate of the area and typology.

The pattern projected through the transect walk also suggests that the houses in Madhavad are adjutant to each other and the distance between the two row of houses is also very less in Madhavad rendering them more vulnerable due to its layout in times of emergency management during disasters.

Housing facilities like courtyard, separate kitchen, store room, ventilation, natural lighting adds to the overall atmosphere of the house. A well ventilated house has an advantage over a non ventilated room. Moreover, the space of housing is stated in sphere standards which are referred to while designing house according to disaster management. Facilities like drainage and lavatories plays a significant role in maintaining the over all health and hygiene of the residents. Also, access to basic sanitation need like lavatory and bathroom also plays an important part in resiliency. This clearly shows that Madhvad is more vulnerable than Umarsadi in term of facilities at household level.

Family Pattern and Size, Gender of family members :

Prevalence of nuclear families is seen in both the communities with In the Indian scenario, joint families have always acted as insurances against social problems like care of the widows, orphans, single mothers, disabled etc. Nuclear families have their own strengths. Joint families especially in traditional occupations like fisheries act as resilience factor as it paves way for division of labour amongst the family members. Nuclear families in rural areas where people are dependent on traditional occupations which are time consuming, act as vulnerability factor since it over burdens the family and at times leaves the children alone at the household. Also, if the family belongs to poor family, the vulnerability increases.

Size of the family, economic condition of the family, the occupation of the family and the space availability are all interrelated factors. If the family is poor, the size of the family and space availability is related. These three factors act as vulnerability inducing factors. The over all economic status of the families in Madhvad is low along with small semi kutchha houses while the size of the family is large. This combination adds to the social vulnerability of the community.

Gender is a very important indicator for human development and in resiliency literature, it is highlighted. In a patriarchal society, women have secondary roles to play and have secondary status as compared to men. More women

and children die in disasters than men due to their dependent status. Also gender ratio is an important determinant in the development of a nation. In Gujarat, the gender ratio is low as compared to the overall country ration. There is not much difference in the two communities as regards gender ratio.

Migration Pattern:

In the field of disaster management and climate change, in and out migration is a very important indicator of resilience. Migration due to climate change is a noted phenomenon all over the globe. In migration puts stress on the available resource of a community while out migration acts as a vulnerability factor and indicates lack of adaptation measures at the community level. It is to be noted that seasonal migration patterns are different then permanent migration patterns. In India, mostly, seasonal migration is noted. Seasonal migration is generally for livelihood by semi skilled or unskilled laborers. In case of Mahdvad people generally go to Veraval for working in fishing industries. Most of them are females who work for these industries. This shows the out migration. When women migrate for work, they leave their children with the elderly of the household. The absence of permanent migration may contribute in the adaptability of the households to manage and withstand disasters and climate change.

Economic Status, Savings and Indebtness:

Emergency risk management and safety nets in terms of savings is an important indicator. Ability to save is an economic indicator as well as a risk reduction indicator in emergency risk management. It ensures protection against exploitation also. Money saved can be invested to generate more money. Madhvad is found to be less resilient than Umarsadi in terms of savings to manage emergencies. Where do people save is also in an important indicator for resilience. Growth of money is ensured if it is reinvested in banks, bonds, securities, business etc. Also, access to banking institution and availing this kind of institutions also plays an important part in understanding the perceptions and choice of the people. Perceptions' regarding economic condition of one's household is directly related to risk perception of a household. If the household regards itself to be economically

weak, it will also rate itself high on risk related to emergency management. Taking debt is a way of meeting with the demands that a household faces when the income is not enough to maintain its functioning or when there is extra need to spend. In India, taking debts for social occasions like marriage, death rituals, religious functions etc due to prevailing social customs and traditions leverage additional burden on the household in terms of economic expenditure.

Another factor contributing to vulnerability is the reason for taking loan or debt. Vulnerability increases when the reasons for taking loans are to meet household expenses, for basic necessities and religious purpose. Moreover, source of taking debt or loans also talks about the existing traditional and modern sources. Ability of the household to repay loans is also a resilience factor related to indebtedness.

Hazards, Disasters and Climate Change:

Exposure to climate related hazards, the intensity and the damage sustained due to it are important indicators in accessing the over all vulnerability to climate change. The history of disasters in a given area and the changing patterns of ecology in the area are all important indicators for vulnerability and resilience assessment. How a potential hazard is converted into disaster depends on various factors. Though it is not possible to stop natural disaster or climate change occurrences, disaster risk reduction and climate change adaptations plays an important role in saving loss and damage to lives of people and property. While disaster risk reduction makes a community resilient, its integration into developmental policies and programmes aims at increasing the over all resilience of the communities/regions/nations. The vulnerability increases when the intensity of any disaster is high.

Cyclone has long history in Gujarat and the Gujarat coast has experienced devastating cyclones like the Kandla cyclone. For a fishing community, cyclones have always been a threat to their lives, property and livelihoods. Some of the experiences of loss of lives, livelihood and property changes the course of lives of communities like it happened in case of Umarsadi due to the

Kandla cyclone in which the community sustained loss of lives and big vessels which had gone to sea. Moreover, most of the fishing communities stay on the shores very close to water. Policies like Coastal Regulation Zones do restrict building of houses or commercial properties on the coast according to the provisions of the rules and regulations.

Flooding can be due to river flooding or due to seas or oceans or due to heavy rainfall. This is also related to the climate. Madhvad is more prone to flooding due to its geographical location since it is surrounded by the sea and the wetland on all the sides. Moreover, the floods are due to heavy rainfall which it experiences. It also cuts off the village from the main land due to over flooding. In case of Umarsadi, the flooding is there but not near the households as the households are situated at a higher ground. Par river gets flooded in the rainy season but it does not threaten the households. Thus Madhvad is more vulnerable to flooding in comparison to Umarsadi.

Salinity ingress is a well marked phenomenon on the entire Saurashtra coast. In Kodinar also, this is noted and efforts are undertaken by the government and other organizations like Ambuja Cement in combating salinity ingress by various methods.

Mangroves definitely act as a buffer against high winds, waves and tsunamis. Small fishes and crabs are found in the shallow water of the mangroves that provide source of food and livelihood for the community people. In Madhvad, once there were huge mangrove coverage which with time was depleted but for the past many years, there has been regeneration of mangroves due to government endeavors. In case of Umarsadi, the case is different. Over the decades, the mangroves have depleted completely and the pollution does not allow the mangroves to survive.

Amenities in normal times and in time of emergency:

The amenities available to a household in normal times reflect the ease or hardships that a household has to face in day to day life. These act as either resilience or vulnerability factor. If in normal day to day life, amenities are

hard to avail, in times of emergency, it acts as stressor and adds to the already stressed lives. Basic amenities are lifeline of a community. Disruption of the same in times of emergency acts as added burden. Disaster management efforts in form of community based disaster management or community based disaster risk reduction plays an important role in ensuring that there is minimal of disruption of life and the gap between disrupted life and regaining the normalcy is minimal. In terms of climate change, adaptation measures over a period of time ensure that the community has found newer ways of adjusting to the demand of times.

Drinking water:

Availability of safe, portable drinking water is an important indicator as far as basic amenities in life are concerned. Water is the basic need of all living beings. People can survive without food in emergency situation but not without water for longer time. In terms of climate change, availability of drinking water is an important indicator in terms of health and time also. There are still many communities where the women of the households have to travel long distance to fetch drinking water everyday in normal times.

In Madhvad, though the village has swajaldhara project which provides tap water at the door steps, there is no water in the taps and hence women have to fetch it from a distance. Also, even in normal times, Madhvad has to rely on private tankers for water. They have to buy water from these private providers making it more vulnerable than Umarsadi in term of drinking water during stress free times. In summer season or in times of stress or emergency, Madhvad has to resort to buying water for drinking as well as for other uses like washing adding financial burden while in Umarsadi; it's the government sources which are providing the services. Thus Madhvad is more vulnerable due to it's over dependence in case of safe, portable drinking water.

Electricity Facility:

Availability of electricity is also an important indicator for development. In our country there are still many villages where electricity is yet to be seen by the people. Electricity is a basic amenity. Kitchen appliances, home appliances,

study, entertainment, knowledge, communication etc are all dependent on electricity now a day in the evolving technical world. In absence of local provisions or alternative local technology, it hinders the day to day lives of people in a community. Thus unavailability of electricity under stress free conditions makes Madhavad more vulnerable than Umarsadi. Thus in times of emergency also, Madhavad depends on government sources for electricity.

Health Status and Health Care Services :

Availability of health services, accessibility, quality of health services and utility of the same are important indicators for health care in stress free times as well as in times of need. Health care needs are also basic needs of human beings. Incidence of malaria, dengue etc has increased due to increasing temperature in many places as shown by different researches across the globe. This is due to climate change. Maternal health care also is an important indicator along with IMR and MMR ratios. Fishermen's communities have some inherent health features like asthma and arthritis (Vaa) due to nearness to sea, skin diseases, cough and cold etc. Moreover, in case of Umarsadi, life style diseases like high blood pressure, cholesterol, diabetes are on rise. Both the communities have provisions for government as well as health care services which are easily accessible. But due to quality of services and availability of trained manpower, both the communities have heavy dependence on private health care providers. In case of both the communities, dependence on private sector at taluka head quarters is noted. In case of grime diseases, they travel long distance to other big cities like Veraval and Mumbai. Thus, in times of emergency or stress, Umarsadi depend heavily on government services for health care services while Madhavad continues to depend on private services but also utilize government services. Thus Madhavad is more vulnerable than Umarsadi in terms of health care services in times of stress as they have to travel to access these services.

Communication:

Communication is the lifeline of any community. Availability of communication tools and easy accessibility are important indicators. Communication media are

varied in nature and play an important role in communicating risk also. Diversified sources of communication lessen the dependence on any single source acting as a resilience factor. It also affects trade and commerce. There are more diversified modes of communication in Umarsadi

Transportation:

Mode of transport and its availability talks about mobility. People need transportation for accessing basic services like health care, information etc and also for purposes like going to work place, buying goods and services etc. Some households in Umarsadi also have their own cars which is absent in case of Madhvad. Also, many households in Umarsadi have bikes or scooters of their own which is less in case of Madhvad. Government bus facility in Madhvad is not there. They have to go to Velan which is two kms to catch the bus while in Umarsadi, the frequency of government buses and private buses is good providing ample amount of transportation. Thus transportation wise, Madhvad is more vulnerable than Umarsadi.

Shelter:

Emergency management especially in terms of housing is also an important indicator. Due to the Disaster Risk Reduction activity in terms of VDMP(Village Disaster Management Plan) undertaken in both the communities, people have identified and know where to go in times of emergencies like flooding and cyclones. These enable the community people to go to these places without being informed by anyone.

Resource Dependency:

People have since long been dependent on natural resources for their subsistence- for food, livelihood etc. In term of negative impact of climate change and extreme events, resource dependency leads to enhanced vulnerability and results in reduced resilience. Adaptation measures do enhance the resiliency of the community. In terms of fishing communities, over dependence on natural resources like coral reefs, oceans and mangroves leads to vulnerability in terms of absence of any alternative resources for food, livelihood and household consumption. This is especially

so in case where there is heavy dependence on one source of livelihood or there are no diversified livelihoods.

Fishermen from Madhavad travel long distance till Okha and Jakhau along the Gujarat sea coast where they find good fish catch and variety of sea fishes. It is however to be noted that the distance covered by these fishermen have increased over the decade due to depletion of natural resources. Earlier they used to get good variety of fishes near their community thus saving time and energy. Now they have to travel for days together to have good and varied variety of fishes and sea life for consumption as well as for selling. Being fisher folks, fish is their staple food.

Mangroves are an integral part of fishermen's community since they provide wood as well as livelihood to the households. Thus depletion of mangrove cover would burden the households in terms of wood availability for household consumption.

In rural fishing communities, people are still found to be dependent on fire wood for cooking purpose. Thus they are dependent on available wood of mangroves for cooking. There is a tradition of using dried wood of the mangroves for cooking. Depletion or lack of regenerating efforts may render the community vulnerable in term of resource dependency. .

The shallow muddy water of the mangroves is home to many small fishes and crabs which are used by the household as food or for selling in term of livelihood generation. Depletion of the same over the period of time or lack of regeneration efforts would act as a vulnerability factor. Resource dependency is observed more in Madhavad than in Umarsadi.

Livelihoods and Business:

Diversification of livelihoods is a very important indicator for resiliency. Disruption of livelihoods due to climate change and extreme events is a well known happening in the world. Both the disaster risk reduction literature and adaptability literature in terms of climate change talk about livelihoods and

their diversification. When an entire community is dependent on climate related livelihoods, in case of negative effect of climate change and extreme events, disruption of the same will render the entire community vulnerable. In case of fishing communities, a cyclone or warming of sea or oceanic water or pollution would stop the fishermen from going to the sea or make it difficult for them to go to sea. Industrial pollution damages the head gear of the machine boat. Similarly due to depletion of coastal and marine resource like fish variety, corals, shells, crouches, mangroves, beads etc, livelihoods would get affected. As it is noted in case of Madhavad and Umarsadi both, people have to travel long distances for finding a good catch as compared to earlier times. While Madhavad still continues with the traditional occupation of fishing, Umarsadi has seen dramatic diversity in terms of livelihood as an adaptation measure against the changing times. Resilience is closely linked to adaptation. The system is more resilient when it adapts to according to demands of time. Diversification in terms of service sector, business sector, handicraft, animal husbandry etc would act as resilience factors for a community as it minimizes the natural resource dependency of a community. Opportunities like being absorbed as seamen in the shipping industry also acts like a life line for the community as is observed in case of Umarsadi which is seeing the third generation being absorbed in the industry.

Moreover, whether the household is able to reinvest the money for further income generation is also as resilient factor. As is observed in some households, there is a tendency to reinvest the money earned from one source in some other kind of business.

Role of family members engaged in a particular occupation of a household also provides insights into the traditional, current and futuristic occupations of the community. It is observed in case of Madhavad that three generations of a family are engaged in the traditional occupation of fishing and it is adding to the resource dependency. While in case of Umarsadi, it is observed in case of Seamen's occupation. In Umarsadi, people are absorbed in the service industry.

Heavy dependence on fishing is marked in Madhvad. Fishing is the only livelihood they know and are engaged in Madhvad. There are only 5-6 medium scaled traders while others are small fishermen. There are no big vessels of fishing in Madhvad any more which also shows the kind of fishermen whether they are small, medium or large scaled fishermen or fishing traders (businessmen). Thus in term of dependence on fishing for livelihood, Madhvad is more vulnerable than Umarsadi. Small fishermen are generally engaged in fishing for self sufficiency and selling in small quantities. Some of the fishermen are engaged in fishing for business use only but this is negligible in case of Madhvad.

In case of Madhvad, second generation in form of daughter in law, sons, daughters etc are also involved in fishing unlike Umarsadi. This clearly indicates that the second generation in Madhvad is also actively engaged in the traditional occupation of fishing in Madhvad indicative of resource dependency in the generation next.

Marine life is often the main source of livelihood for the fishermen.. Thus depletion of such resources would render the households vulnerable. In Madhvad, earlier they use to get shells and crutches on the sea shore but the availability has depleted over the period of time as informed by the elderly men and women of the community. Thus being dependent on the marine resources, in absence of conservation efforts, the community has been rendered vulnerable as this has affected their income.

Service sector is another area where people are absorbed. It eases the over dependence on one resource as is observed in case of Umarsadi. It also shows the gradual shift from fishing to other sectors for livelihood. The nearness to GIDCs like Pardi GIDC and nearness to industrial areas like Vapi and Valsad also provides ample amount of opportunities for the community people to be absorbed in the near by industries . Also, the women folk from the community are engaged in the packaging industries in the nearby industries. They have pick up and drop in facilities in form of company buses. Moreover, there are many people engaged as teachers in the educational

settings. This is indicated Umarsadi to be more resilient than Madhvad as far as diversification of livelihood in the form of service industry is concerned. Many people are able to save the money earned from service and reinvest it in business which acts as a resilient factor.

In both the communities, business is in form of small fishing traders especially in Madhvad. Though they are involved in business, it is selling of fish on day to day basis which they have termed as business.

Formal and Informal Networks to support climate change adaptation:

Multilevel social networks are crucial for developing social capital and for supporting the legal, political, and financial frameworks that enhance sources of social and ecological resilience. The sharing of management/governance authority requires cross-level interactions and cooperation, not merely centralization or decentralization. In many cases, improved, strong leadership and changes of social norms within management organizations are required to implement adaptive governance of coastal social-ecological systems. There is no time to waste.

It is to be noted that in both the communities, under the DRM (Disaster Risk Management) exercise undertaken by UNDP and GOI, Village Disaster Management Plans have been made. These plans have to be modified at a regular period and mock drills are to be carried out as part of preparation. These plans are linked into the Taluka Disaster Management Plans and finally into the District Disaster Management Plans which later on merges with State Disaster Management Plans at the state level. These plans act as guidelines in times of disasters. Though no such plans are made for climate change incidences, it can be a good starting point for reference to built upon. Gujarat already has GSDMA and a separate department of climate change. What is needed is synchronization at some point.

Community resilience includes indicators like in terms of knowledge and learning from changes, adaptability in terms of vision and leadership and Self Organization in term of linkages and networks.

Planning to deal with changes, coordinating activities, ability to reorganize, helping members to reorganize within minimal of time, work in coordination with each other and seeking support from outside are important indicators for community resilience.

With respect to climate change, the ability of the community to make community plans to deal with the climate related events like cyclones, floods, coastal erosion, sea level rise etc is an important indicator of community resilience. Traditional knowledge enables a community to learn and adapt to the changing situation. On the basis of the same, a community can plan to deal with the climate changes. While both the communities have their VDMPs, there is need to update the same and carry out mock drills as only a handful of people remember about the plans.

Largely the community members think that they are able to plan effectively. However, there is a rising concern in the community regarding this ability as is reflected by households who have opt to be neutral or disagree with the statement. This is due to the fact that though the communities are able to deal with some of the impacts like cyclones, they need better plans for dealing with long term climatic effects. This is evident in case of Madhavad since the community is facing problem due to heavy dependence on fishing which has been adversely impacted due to climate change over the period of time in term of depletion of resources.

Disaster management calls for quick rescue, relief and ensured rehabilitation after any disaster. The lesser the time it takes a community to bounce back to normalcy, lesser is its vulnerability. In term of climate change, it's the adaptability which counts. i.e. the ability to change and adjust to the new way of life. Thus the communities are largely in agreement that their community can coordinate activities to respond quickly to the impacts of natural events like cyclone and floods but there is uncertainty and disagreement with respect to problems like depletion of resources due to natural events.

Social resilience in terms of ability to reorganize and respond to a new situation is an important indicator. Climate change not only calls for organization but also reorganization after a disruptive event or long term change. Its call for adaptation. The shorter the time for the same, higher is the resilience but the basic fact remains that there should be ability to reorganize to a new situation. e.g. in case of livelihoods, the ability to diversify and respond to the new situation rather than keep on depending upon the old one without any changes. While generally there is an agreement at large in both the communities, there are indications of uncertainty and disagreement to respond to the new emerging situation. This is clearly marked in case of Madhavad making it more vulnerable.

Community Institutions are the lifelines of the community. In case of the fishermen community in Gujarat and in Madhavad and Umarsadi both, their Samaj play a vital role in social organization of the community. There is a strong hold of these institutions on the community life of the people. They are governed by these institutions more than the common law and order institutions of the country. This mechanism has its limitations in case of Madhavad due to the kind of support that the members need. Degrading of occupational resources is the main reason behind this.

Being homogeneous communities in terms of religion, caste, culture and traditions, people blend well with each other. Moreover, both the communities show lineages i.e. they have their own kin and kith surrounding them. This enhances their social ties which are helpful in times of emergency too. They are well blended and their culture speaks of helping each other. Their samaj and their customs are such that helping each other in times of need is a way of life for them. There are who need to be taken care of as they are facing multiple problems.

Bridging and bonding social capital in form of social networks are the life line of community. Vertical and lateral collaboration with other institutions enables a community to seek support from outside in term of knowledge, information, expertise and other material and non material resources for the smooth

functioning of the community. These institutions played an important role in relief and rehabilitation during disasters so far but due to climate change impacts, the kind of support that the community need now is different than what they need in times of disasters like cyclones and floods. This shows weakening of the social capital in connection to outside the community ties with other institutions other than their Samaj.

Ability of the Community to Organize in terms of leadership and governance:

Adaptability in term of able leadership and governance is vital for social resilience. An able leader can see the community overcome most of its local problems. Governance since long has held the key to most of the disaster management activities and now to the climate change initiatives also. The integration of these initiatives into the developmental policies ensures the sustenance of the socio ecological systems as well as of the developmental policies. Whether the community recognizes the leader, trusts the leader, has trust in his capabilities etc does influence the resilience of a community. Both- able leader as well as good governance acts as resilience factors since they enable the community to adapt to the changing scenario in the long term. They facilitate speedy recovery and smooth functioning of the community.

Attitudes are formed based on the past experiences of the community. Both the communities have experienced climate related hazards and disasters. Their houses have experienced the negative impact also and they have overcome the obstacle successfully. In case of both the communities, their Samaj has always played an important role in disaster management. Thus the role of their leaders is very vital in the management of such events. The trust expressed in their leaders is an important indicator of resilience. This is observed more in Madhvad

Generally if leaders take interest in the issues of the community, there are more chances of these issues getting resolved. An indifferent attitude towards the issues that the community is facing will render even a capable leader helpless as the efforts put in by him/her would not be enough. Taking

interest in gaining knowledge about the issue, in the probable solutions, the resources needed to solve the same, trust in one's ability and bonding and bridging with other stakeholders all play an important part in making of an able leadership. It clearly shows that in both the communities people do believe that their leaders are truly interested in the issues and impact related to climate change which is directly linked with their welfare and livelihood. Thus it acts as a resilience factor for the community and adds to its resiliency. In case of Umarsadi there is indication that people have lost trust. This is due to changing nature of problems faced by the community. In Umarsadi, their problems are more related to pollution, coastal erosion etc for which they have to rely on the government machinery at large. Coastal regulation zones are still not decentralized and hence the community leaders may not be able to express their interests due to lack of knowledge resources at the community level.

Knowledge and skills are two important pillars of resiliency. The third one is the practice i.e. enforcement or putting in practice the knowledge and skill. A leadership with knowledge and skills is more resilient than leadership with is just a nominal head. The knowledge about disaster management and disaster risk reduction and emerging knowledge base of climate change impacts and adaptations would necessarily capacitate leadership to deal with the issues and problems. This also takes into consideration the traditional knowledge handed over from one generation to the next as well as the new technological aspects of the modern era. Many a times there is confusion as to which path to venture onto but the right integration of traditional and modern knowledge and skills is indispensable to combat the negative impacts of climate change . Thus largely, this acts as a resilience factor in both the communities but there is a rising concern in case of Umarsadi. If this is not addressed in a timely manner, people may loose their faith in their leaders knowledge and skills.

Climate change adaptations are quite different from disaster risk reduction measures. This is more so because of the uncertainty prevailing in the field of climate change. Though at the international platform, there is largely and

immerging community who accepts climate change as an imminent issue which has both positive and negative impacts, the initiatives required to combat the same are still vague. This is especially so at the community level in countries like India. What is a community like a fishermen's community suppose to do who rely totally on traditional knowledge of predicting the weather on base of nakshatras and vahana(Indian calendar) which are rendered a bit unpredictable due to the ever changing climate events? The emerging disagreement in Madhavad and uncertainty in Umarsadi are matters of concern for the leadership in terms of community resilience.

Information dissemination is the pivot of awareness generation activity. Though there are no formal platform for exchanging national level and regional level climate change policies, the informal network of the fishermen community acts as a strong information dissemination platform. This is because in both the communities, the local samaj is connected to the regional and national samaj who are in constant touch with other government and non government bodies. Thus this acts as a communication channel. The fishermen community gets updates related to fishing and its related policies and programmes from this network. Thus in both the communities, people do have access to such information which acts as a resilience factor in both the communities.

Climatic data is generated by the IMDs (Indian Meteorological Department) located at different locations in our country. Moreover, the state resource centres also help in dissemination of such information. It is practically not possible for the local governance or leaders to keep all the information pertaining to all the matters related to climate. But they can always facilitate availability of information from other sources like the government organizations, academic institutions, research centres, non government organizations and other valid organizations or institutions from where information can be accessed. Climate related information plays a very important part for the fishing communities. With the changing seasonal patters observed, such kind of information becomes an absolute need. The change observed in the monsoon cycle is also very important. Added to this is

the information related to probability of extreme event. Thus there is decreasing resilience observed in case of Umarsadi as people have expressed their confusion regarding the same due to magnitude of their problems.

Adaptation measures have long been part and parcel of community life. Some communities are able to adapt to the changes in the socio ecological systems while some are not, depending upon their resiliency. e.g. in case of Umarsadi, people have diversified their livelihoods with the help of the community while in case of Madhavad, this is not the case. Hence, both the communities have different modes of adaptation. There is a rising uncertainty in both the communities more so in case of Madhavad due to over dependence on the fishing industry which is highly dependent on climatic factor. Thus it acts as a vulnerability factor.

Different kinds of resources, both material and non material are need for climate change activities. These activities range from information dissemination, good practices, strengthening of the community assets and infrastructure, judicious use of resources to building social capital etc. There is a rising concern in Umarsadi regarding the leader's ability to provide the community with necessary resources adding to its vulnerability.

Public participation in disaster risk reduction as well as in climate change adaptation act as resilience factors for a community. Public participation ensures good governance as it leads to awareness and ownership of related decisions, policies and programmes. This increases the resilience of the community which helps it to adapt to the changing scenario. Madhavad is more resilient than Umarsadi in terms of resilience related to ability of the leaders to encourage community members for disaster risk reduction and climate change adaptations.

Good governance always encourages its community members to voice their concerns related to planning for disaster risk reduction and climate change adaptation measures. It reinforces the democratic values of governance in

true spirit in the community. Umarsadi is more vulnerable than Madhavad in terms of public participation in community planning. The hold of the samaj is such that people are not able to clearly say it and hence remain neutral.

Recommendations:

Different Socio ecological systems are dependent on each other. The interconnection between the humans and nature is a world wide phenomenon. Based on the major findings and conclusions, the researcher wishes to make the following practical and need based recommendations at various levels across various stakeholders:

National Level:

India signed the UNFCCC on 10 June 1992 and ratified it on 1 November 1993. Under the UNFCCC, developing countries such as India do not have binding GHG mitigation commitments in recognition of their small contribution to the greenhouse problem as well as low financial and technical capacities. The [Ministry of Environment and Forests](#) is the nodal agency for climate change issues in India. It has constituted Working Groups on the UNFCCC and Kyoto Protocol. Indian has already provided its National Communication (NATCOM) to the UNFCCC which focused largely on five sectors: energy, industrial processes, agriculture, forestry, and waste. This exercise involved detailed work on estimation of sectoral GHG emissions and identification of country-specific emission factors. Vulnerability and adaptation assessment is also part of the National Communication project. The Prime Minister's Council on Climate Change created the National Action Plan on Climate Change which has eight missions these are National Solar Mission, National Mission for Advanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for sustaining the Himalayan Ecosystem, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge on Climate Change. It outlines measures on climate change related adaptation and mitigation while simultaneously advancing development. The Missions form the core of the Plan, representing multi-pronged, long termed and integrated strategies for achieving goals in the context of climate change. India's 12th five year plan also has National Bio Energy mission. Besides the initiatives of the private sector and the government are those undertaken by non-governmental organizations. Also, India has NDMA (National Disaster Management Authority) at the national

level to cater to the needs of disaster management and disaster risk reduction. NDMA works through its network of state disaster management authorities. It works in coordination with various stakeholders like corporate, non government organizations, media, academia etc.

Recommendation One:

Awareness regarding India's national initiatives needs to be disseminated across cross sections of society. Presently this is limited only to the government departments at the national and state levels. The percolation of the same to the district and taluka level needs to be speed up if the impact at the grass root level is to be maximized. No other government except for Government of Gujarat, at the state level has a separate department of climate change to tackle the issue. Mechanisms for involvement of civil society organizations, academia and other stakeholder are already there which needs to be strengthened.

State Level :

Gujarat state is the only state in India to have a separate department on climate change (CCD). The department is yet to have its own websites and is still to submit its State Action Plan on Climate Change. The department is yet to set up the two climate change funds in form of Climate Change Trust Fund and a Climate Change Impact Studies & Related Projects Trust Fund for which financial allocations have already been made for two years (2011-2013). Gujarat State also has Gujarat State Disaster Management Authority (GSDMA) which looks after the needs of disaster management and disaster risk reductions activities of the state. With its full fledged working, all the districts, talukas and villages which are vulnerable to hazards, have been covered under the Disaster Risk Management activity conducted jointly by GOI and UNDP(United Nation's Development Programme) based on the community based disaster preparedness model. Villages have Village Disaster Management Plan, Talukas have Taluka Disaster Management Plan and the Districts have District Disaster Management Plans which are linked with state level disaster plans. Different task forces were trained and mock drills were conducted.

Recommendation two:

Apart from activating the department of climate change, the awareness about the climate change department and its activities needs to be disseminated especially at the taluka and village level. The active involvement of various stakeholders should be ensured through repeated refinement of the various disaster management plans. It should be incorporated as an integral part of a community life. The integration of disaster risk reduction and climate change adaptation measures needs to be integrated into the developmental policies. The players in disaster risk reduction and climate change should work in close coordination with each other so as to optimize the benefit for developmental planning.

Recommendation Three:

Citizen's forum and platforms can be created at the state level with active participation of various stakeholders. These platforms can act as a common ground to gain information and knowledge and share concerns about climate change issues, concerns and initiatives. These can also act as state level kiosks. Use of Information, Education and Communication (IEC) can be ensured in form of screening of documentaries, case studies, posters etc

Recommendation Four:

The same exercise should be followed at the taluka level also. Thus a systematic filtration of issues needs to be ensured. Micro scale interventions are to be more specific. The middle tier of governance is the one which acts as a balance and hence important in actual implementation of policies and programmes. This is more so especially in case of government functionaries and non governmental organizations.

The recommendations made above are on the experiences of the researcher during the study though the major study was carried out at the community level. The researcher took interest in understanding the issues at the state and taluka level and interacted with some of the functionaries at these levels.

The Village Community Level:

In the districts where the Disaster Risk Management exercise has been carried out in Gujarat, each village community has a Village Disaster Management Plan in form of a booklet. These plans are actualized by carrying out actual mock drills as per plans for the preparedness of the community. As for Climate Change Adaptation measures, these are sporadic in nature and are community specific. The National Mission planned for adaptation and mitigation in the National Action Plan for Climate Change are yet to be linked at the district and sub district levels. The results of DRM projects can be the starting point of interventions at the village community level.

Recommendation Five:

The present mechanisms available at the community level in the disaster vulnerable communities are in form of Community Based Disaster Preparedness.

Apart from disaster risk reduction measures at the community level in form of Village Disaster Management Plans and their gradual integration with the developmental policies and programmes at the village level, Climate Change Adaptation measures should be given an impetus. These two together should be integrated into the developmental policies and programmes.

Recommendation Six:

Integrated Coastal Zone Management offers mechanisms for adaptation through an attempt to balance environmental, economic, and social objectives. In a recent development, the Integrated Coastal Management Zone Management is being carried out on pilot basis in Orissa and Gujarat State. Thus, at the community level, this can provide the much needed platform for functioning at it takes into consideration a wider perspective.

So far the recommendations have been generic which applies to any community. Now focusing on the two communities that have been studied, the following recommendations are made:

Housing Pattern:

Housing especially in the disaster prone zone where the impact of extreme events is likely to be experienced more should be as per specifications according to ICRZ (Integrated Coastal Regulation Zones). The building codes and land use pattern code should be adhered to, to avoid buildings immediately near the coast. At risk houses should be identified and be either retrofitted to meet the design specifications or be shifted to higher altitudes with mutual understanding of the community, especially those houses on the sea shore. Care should be taken to study the traditional good practices and incorporate them in the new ones.

Water:

Water being the basic necessity of life, its availability should be ensured through projects like Swajaldhara which ensures water at the doorsteps. Alternatives like private players should not be encouraged as it many a times pave way for conflict. People should be educated and behavioral change education should be carried out. One of the ways to do so is to undertake salinity ingress measures at the village level. Rainwater harvesting system should also be encouraged to ensure safe drinking water. Water conservation practices should be given impetus wherever possible.

Drainage and Sanitation:

The local governance should take this up as an important aspect of community development. A community level mechanism like its own small drainage system can be worked out where there are no drains at all. At least make shift toilets near the sea shore can be beneficial to the community. There are schemes for drainage and sanitation from the government side too which can be implemented in the village. Care should be taken to spray disinfectants where open defecation is carried out. This way, the vulnerability can be reduced.

Health:

Accessibility to health and utility of health services can be worked upon in the communities by involving the non government organizations in the same. Health awareness is one such programme which needs constant repetition in a community. The National Rural Health Mission can reach the door steps via the government machinery as well as the non government machinery. The present government facility needs to be updated in terms of infrastructure and quality of services. Another factor is increasing accessibility by providing transportation facilities.

Education:

Where the education is less, it should be given impetus, especially in term of skill enhancement. Vigorous efforts are needed with the help of local stakeholders to see to it that more and more people are educated.

Occupation:

If traditional occupations like fishing are to be continued, it needs to be supported through management of coastal ecosystems or coast zone management so that the communities reap maximum benefits. This would ensure economic as well as social development as it encompasses two fold objectives.

Legal Services:

The formal legal services also need to be recognized by the community members since out of their own communities, they also need to deal with others. A right based approach for development can pave the way for effective synchronization with other segments of the larger society.

Hazards, Disasters and Climate Change:

The community should be equipped with dealing with extreme events and other climate change impacts. This can be done by taking the VDMPs as the starting point. It needs for a more holistic approach with multi stakeholder partnership with academia, non government organizations and the government. The ownership of these VDMPs should rest with the community

since it would enable them to modify it according to the changing scenario. What is required at this point of time is to recall and document the adaptation measures of each community e.g. the fishermen community so that the lessons learnt by one can be useful to the another one. This would synthesize knowledge needed for adaptation measures.

Reduction of coastal risk/hazards/disasters can be undertaken based on the Community Based Disaster Preparedness model with the help of multilayered stakeholder participation. Awareness regarding the new emerging issues related to climate change and its vulnerability is also a key factor for the community in terms of resilience. A culture of preparedness needs to be preserved and carried forward to the next generation.

Traditional Knowledge, Warning and Evacuation and Disaster Preparedness:

When people shift their livelihoods, there is a degradation of the traditional knowledge. The age old wisdom is lost as people lose interest in fishing. Community mechanisms in form of written down practices or folk art can enable a community to restore this traditional wisdom. A deep study of the same, the coping styles etc can act as treasures of wisdom for an entire community. e. g. earlier fishermen used to predict the sea with close observation of wind and ocean current, make predictions based on the Indian calendar with its nakshatras and vahanas. This was used as a warning too. The modern mechanisms of warning and evacuation are well understood by the community as part of disaster preparedness. Only the new and emerging issues like rapid coastal erosion and depletion of natural resources of the ecosystems are beyond their means which needs support from other segments of society.

Risk Knowledge and Disaster Recovery:

Factors like community involvement, accessibility to risk assessment, sharing of information with other institutions, formal and informal education programmes for risk knowledge all play a vital role in risk knowledge management which acts as a coastal resilience indicator. Similarly

coordinating with various agencies for disaster recovery apart from local institutions also acts as a resilience factor.

Livelihood and Resource Dependency:

Coastal Resource Management in terms of fisheries, coral reefs, mangroves etc which are used by the fishing communities for food, income and goods needs to be undertaken at the community level with the help of multi layered stakeholders. Protection and maintaining important coastal ecosystem is also the need of the hour. This is important not only for economic development but also for social development of a community which is dependent on coastal and marine resources for their livelihoods.

Regeneration of mangroves and coral reefs also plays an important part in protecting the coasts from strong winds and waves and helps in stopping erosion and also enables survival of small species in the muddy water. Such initiatives are already being taken by the government but it needs impetus and needs strict monitoring at the local level.

Livelihood diversification especially in areas where the resources have depleted over the year and it is difficult to sustain the population on the slowly regenerating resources, people should be provided with informed choices regarding livelihoods in their areas. Skilled based occupations can also be given impetus if the community opts for the same. Skill development centres are a good way of bridging this gap.

Many a times, people are not aware of the supplementary or alternative livelihoods they may have in vicinity. Such kind of opportunities and threat analysis can be carried out at the community level for better adaptation and resilience.

Formal and Informal Networks:

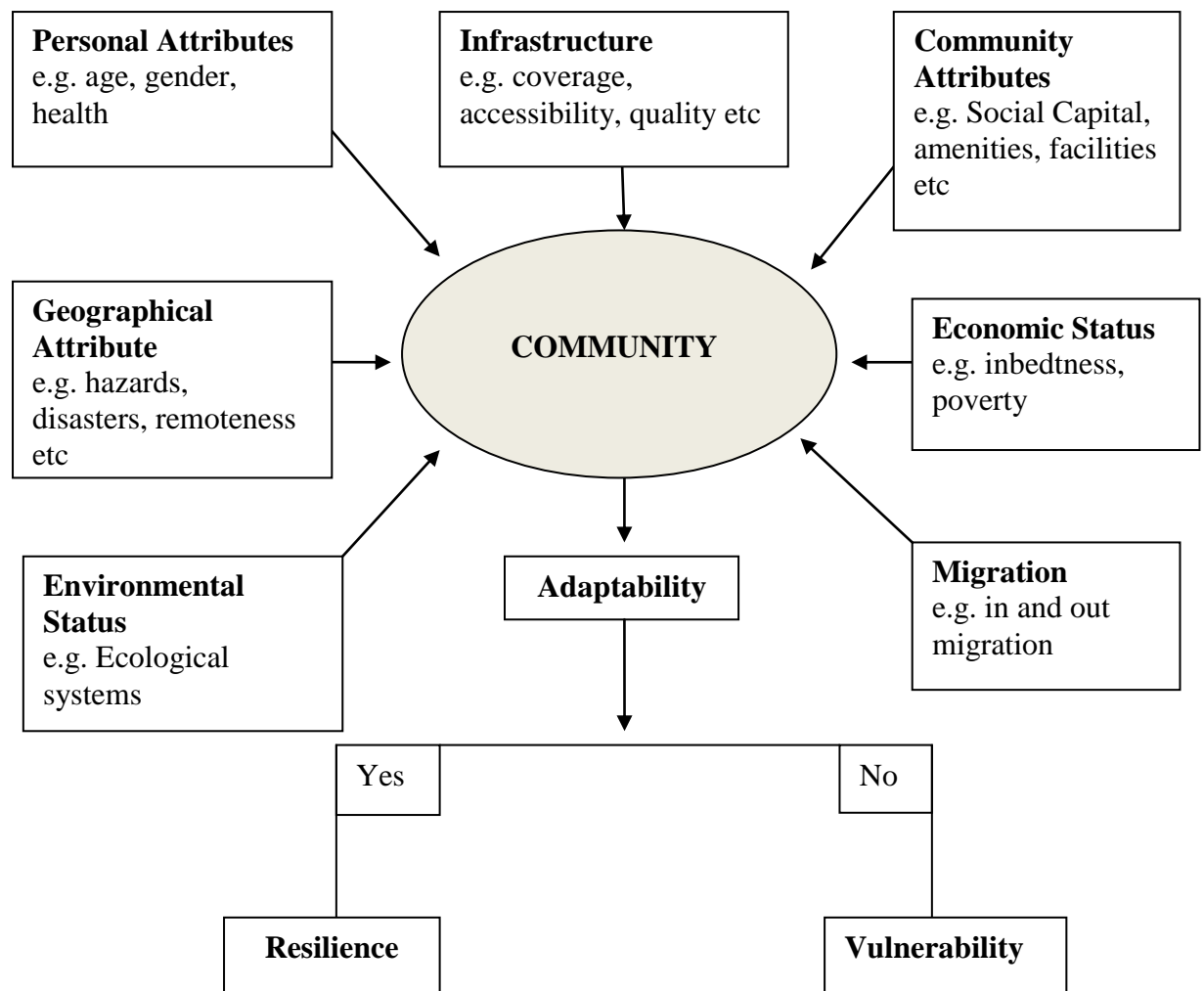
Social capital in form of bonding and bridging capitals are very important for social resilience. They not only assist in times of need or emergency but also provide basis for community participation in various strategies for community

welfare and development. While the strength of networks like community samaj like in a fishermen's community is evident, the role of religious, cultural and faith based organizations is also vital. Presence of active non government organizations also strengthens the social fabric of the community and acts as glue. These networks can be used right from awareness generation to dealing with issues of adaptation to climate change. Social networks affect motivation and cooperation and are a basis for communication in communities. Such communication provides a system of feedback among stakeholders and allows for appropriate adjustments in behavior. The present networks in the communities can be strengthened for climate change adaptation measures.

Leadership and Governance:

Governance with respect to indicators like vision, participation, consensus, transparency, responsiveness, effectiveness and efficiency, accountability needs to be integrated at different levels which are possible only in poly centric government with supportive leadership roles played by different leaders. Though the samaj is very strong governance for the fishermen community, it also needs to be integrated at taluka level, at state level, national level and international levels since climate change is a global phenomena which call for global to local actions. This increases the resilience of the community.

Towards a conceptual Model:



This can be used for understanding the concept of factors contributing to vulnerability or resilience at the community level.

Based on the research findings, the following scale for SVI and SRI is proposed:

Sr. No.	Particulars	Community One	Community Two	Remarks
1. Geographical Location of the Community				
1	Nearness to sea (Arabian Sea)			
2	Nearness to Taluka Headquarters			
3	Ecosystem			
2. Community Resources				
1	Housing			
2	Water			
3	Drainage and Sanitation			
4	Health			
5	Education			
6	Occupation			
7	Legal Services			
8	Communication			
3. Hazards, Disasters and Climate Change				
1	Cyclones			
2	Floods			
3	Earthquake			
4	Depletion of Mangrove			
5	Coastal Erosion			
6	Sea Level Rise			
4. Vulnerability and Resilience				
1	Elderly			
2	Widows			
3	Special Need People			
4	Orphans			
5	Warning and Forecasting system			
6	Risk Knowledge			
7	Traditional Knowledge			

8	Livelihood diversity			
9	Disaster Recovery			
10	Disaster Preparedness			
11	Coastal and Marine Resource Dependency			
12	Learning from change			
13	Self Organization			
14	Supplementary and alternative livelihoods			
15	Migration Pattern			
16	Family and Kinship network			
17	Social Networks			
18	Formal and Informal Networks			
19	Ability of community to organize			
20	Attitude towards governance and Leadership			

The above simple method of scaling was used in the present study by the researcher. The same can be replicated at the community level by practitioners. It can be used by the local community people also for understanding the resilience of their community.

No weightage is provided to the indicators in the present study as it was beyond the scope of study. But the scale can be refined and weights can be assigned to the indicators and sub indicators. Another way is to create a 5 point scale for each indicator and ask the respondents to provide the ranks. The sum total of all the indicators can be used to assess vulnerability or resilience of a community.

Thus the above recommendations are made on the basis of the research carried out in the two communities. The indicators explored are used to map the vulnerability or resilience of a given community. Though they are not explicit in nature, they work well at the community level.

Strategy for implementation at the Micro level:

The strategy for implementation can be better explained with the help of different stakeholders as follows:

Government:

According to the three tier system of local government, the Gram Panchayat i.e. the village Panchayat is provided with powers under decentralization. The down up approach works for sustainable development as it is need based. The government can act as a connecting link between the community and various other players across the sections till the national and international level. This is the layer which is involved in need based planning for the various sectors at the community level. It should also act as facilitator and provide able leadership as part of the larger three tier system. Another important function would be of information dissemination and awareness. It acts as a channel of communication with major stakeholders.

Non Government Organizations and others:

Non government organizations along with other like civil society organizations, trusts etc have outreach functions. These organizations need to be given impetus in various adaptation programmes and empower them as the bridging social capitals. Moreover, the community based organizations though small in size can also be empowered by connecting them to larger networks of organizations. It is the medium to revive and revamp the village level preparedness and integrate it with climate change adaptation.

Academia:

The academia is a major stakeholder. Though at the micro level there are mostly primary schools and high schools, special awareness and preparedness programmes on climate change and climate change adaptation

can be undertaken with these. A variety of programmes like elocution competition, poster competition, project making competition, quiz, games on climate change, essay writing, zingles etc can be worked up for this age group. At the higher ladder, universities should be facilitated to carry out research at the community level by the local government or by other research institutions. These way young citizens can be nurtured as torch bearers of climate change adaptation.

Media:

Media has an important role to play. At the local level, apart from the local folk music and arts, the reach of modern means like cable television and television has increased many folds. Thus awareness regarding the issues, the interventions at the various levels etc can be easily conveyed through this. Another effective way is community radio where a community has its own programme. Print and electronic media are also found to be effective for information dissemination and awareness.

Industries:

Industrial houses or the corporate in the vicinity of the community play an important role as a part of their Corporate Social Responsibility (CSR) function. They generally work for different aspects of community development. Moreover, they also provide alternative employment opportunities for community people by skill upgradation. Under the new law, 2% of the total profit of industrial houses should be used for their CSR activities. Also industries too need to adhere to the new emission rules and regulations.

Thus the need of the hour is work with multi stakeholder partnership at various levels for effective climate change adaptation and resilience.

Emerging Role of Social Work Profession:

Over the ages, especially in the 21st century, Social Work as a profession is gaining importance. From vulnerability out look to a resilient outlook, the profession has developed by leaps and bounds. Social workers are occupying

important places right from as outreach workers to policy planners. From medical, welfare, education, disaster risk reduction etc to industry- they are all encompassing. The social work education with its base of values and code of ethics empowers a professional with required knowledge, attitude and skills. The exposure to real life situations through various field exposures and rigorous training in human services provides the cross cutting edge to a professional to devote to the field of practice. With the various methods of social work available, a professional has a wide variety of methods to choose one or even work with combination of such methods.

Closely linked to climate change adaptation is the field of environment management in which social workers have played a very strong role. Similarly in the past decade, social workers have also proved their worth by adapting to different roles in disaster risk reduction measures not only in India but across the globe. They participate in important activities from need base surveys to need assessments, to risk analysis, vulnerability assessment, awareness generation, research, working with different stakeholders to acting as policy and theory makers.

Climate Change and Climate Change Adaptation is an area where one needs to work in close association with human settlements in an era of uncertainties across various sections of the society be it at local level, at regional level, at national level or at international level. The sound knowledge of vulnerabilities and resilience at individual, household and community level equips a professional to work in the field. Climate change is an issue which has encompassed the entire world today. Thus there is tremendous need for social work professions in the field. They are the agents of change who act as catalysts for transformational learning, an important attribute in resilience theory and practice.

Scope for further research:

The present research is a totally new start in the filed by social work professional. A down up approach is the need of the present hour since each community in rural as well as in urban area will have to face the wrath of

climate change. Research is needed for communities involved in different occupations especially those dependent on natural resources like agriculture and fisheries. Also communities residing in different climatic zones will face differential impacts of climate change. The tools of disaster risk reduction can be used as a starting point to develop climate change specific tools for different climatic hazards like cyclones, storm surge, floods and Sea Level Rise. More and different indicators especially social indicators which are community specific also needs further research. A special focus on adaptation measures and the role of social indicators in the same also needs to be probed further. Social work professionals as part of their training of the profession at the academic level can also carry out community based researches at graduate, post graduate and doctorate level. Also the various schools of social work in the country with their vast experience of research in the field of social work can contribute their part.

Moreover, a multi disciplinary research is also needed for a complex subject like climate change. Thus researchers from different fields need to come together to understand the socio ecological systems and how adaptation and mitigation can be worked out.

India's national mission on strategic knowledge also provides scope for research in the field of climate change by research institutions and academic research.

Thus, this present study is a starting point and paves way for further research to be built upon either by replication or by value addition to the field with different dimension.

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ANNEXURE

Annexure 1: Guidelines for Focus Group Discussion

Social Vulnerability and Resilience to Climate Change in Gujarat A social Work Response

Guidelines for Focus Group Discussion

- Name of the Village, Taluka and District
- Geographical location of the village and village set up
- Community resources in term of infrastructure and services related to housing, water, sanitation, health, basic infrastructure, education and skills, amenities, occupations, income groups and legal services
- Vulnerable groups in terms of elderly, widows, single headed households, orphans, children, differently able people or any special need group as identified by the community
- Community vulnerabilities in terms of identified hazards, history of disasters, damage, loss of lives, causes, warning and forecasting systems, traditional knowledge, depletion of resources, changes in coastal area, major changes in living after change, disaster preparedness
- Community resilience in terms of, risk knowledge, disaster recovery, diversity : in terms of livelihood and resource dependency(coastal and marine), supplementary and alternative livelihoods; knowledge and learning from changes, adaptability : in terms of vision and leadership, demographic changes(migration); Self Organization : in term of linkages, networks,

Annexure 2:

Social Vulnerability and Resilience to Climate Change In Gujarat - A Social Work Response to Vulnerable Communities (State : Gujarat, District_____)

Key Informant Interview Guide

Date: -----

General Information:

- a. Name of the Respondent:
- b. Sex:
- c. Caste:
- d. Marital Status:
- e. Age of the Respondent:
- f. Qualification of the Respondent:
- g. Occupation of the Respondent:
- h. Contact Number: Mobile:

Kindly answer the following with regards to your community:

1. Describe in brief history of the village in term of community and its surroundings
2. Explain in brief the ecology of the village and surrounding area
3. Explain in brief the infrastructure facilities available in the village in terms of following sectors:
 - Housing- No. of houses, types of houses, etc
 - Health
 - Education
 - Water
 - Electricity
 - Drainage
 - Communication
 - Legal Services
4. What kind of families are there in the community and what kind of family networks are observed?
5. What are the major occupations of the community? Is there any sudden or gradual change observed in the occupation of the community members?
6. How would you describe the economic status of the community people? What is the indebtedness status of the households in general? What are the major reasons for the same and where do they take the loans from?
7. Is migration observed in the village? If so, whether it is permanent or seasonal? Why and where do people migrate?

8. How would you describe the health status of community people? Are there any specific health problems observed amongst the people? What are the various health services available in the community?
9. Are there any persons with special needs in the community? Who provides care and support to these persons?
10. Has there been any climate related hazards identified by the community? Has there been a disaster? What has been the loss/damage due to such events?
11. What kinds of social networks are there in the community and what are major activities carried out by them?
12. What kind of coastal and marine resources and related goods and services are utilized by the community ?
13. What are the main livelihood sources for the community?
14. What are the possible alternative and supplementary livelihoods for the community? Are there enough opportunities for the same?
15. What kind of climate related hazards/Disasters and impacts has your community witnessed?
16. What kind of source is used by the community for accessing information about climate related knowledge and how is this information used?
Probe: If the community gets information but does not utilize it, why do they not utilize it? Also what kind of information is needed by them but they cannot access it and what are the barriers to accessing this information.
17. What kinds of formal and informal networks supporting climate hazard reduction and adaptation are there and how does your community benefit from them?
Probe: Quality and effectiveness of such networks
18. On a scale of agreement , please rate the following related to perception of the household regarding the ability of community to organize (Learn, Plan, Make necessary changes to cope with climate change related impacts)
19. What is your community's attitude towards governance and leadership

Annexure 3: Household Interview Schedule

Social Vulnerability and Resilience to Climate Change In Gujarat **- A Social Work Response to Vulnerable Communities** **(State : Gujarat, District _____)**

General Information:

Date: -----

Household Number:

- i. Name of the Village:
- j. Name of the Respondent:
- k. Sex:
- l. Caste:
- m. Marital Status:
- n. Age of the Respondent:
- o. Qualification of the Respondent:
- p. Occupation of the Respondent:
- q. Role Position of the Respondent with respect to household head:
- r. Contact Number: Mobile:

Kindly answer the following with regards to your household

- 1. Resident of the community since : No. of Year:
- 2. Location of the house: (Observe: How many meters away from coast, connectivity with the village, main road,)
- 3. Type of house:
 - 1. Pucca
 - 2. Semi Pucca
 - 3. Kuccha
 - 4. Thatched
 - 5. Other, Specify
- 4. The house has
 - 1. Courtyard
 - 2. latrines
 - 3. Bathrooms
 - 4. Ventilation
 - 5. Separate Kitchen
 - 6. Store Room
 - 7. Special Observation about the household:
- 5. Type of Family: Total Number of Family Members:
 - 1. Joint
 - 2. Nuclear
 - 3. Extended
 - 4. Other, specify

6. Household details:

Sr. No.	Members (role wise)	Age Yrs	Sex M=1 F=2	Marital Status Married=1 Unmarried=2 Divorcee=3 Separated=4 Any other =5	Education	Occupation	Income Rs./month	Migration for livelihood
1								
2								
3								
4								
5								
6								

7. Is the household able to save money monthly? a= Yes b= No

If yes, in what form do you save it

- Cash at household
- Saving accounts in bank
- Gold and Silver
- Business
- Any other, specify

8. Compared to other families in your community, how would you rate the economic status of your household?

- Below Average
- Average
- Above average

9. How would you rate your household income level, based on your expenses?

- Usually not enough to cover important household expenses
- Just enough to cover important household expenses
- Usually have some left after important household expenses

10. Indebtness of the household

1. Does your household takes any debt a= Yes b= No

If No, go to question number 11

2. For what reason does the household requires to take debt

- Household expenses
- Marriage expenses
- Religious Practices

- i. Livelihood Purpose
- j. Construction of house/Renovation of house
- k. Any other, specify:

3. Generally, you take loan from
- a. Bank
 - b. Money lender from the village
 - c. Relatives
 - d. Community organizations
 - e. Others, specify

4. Is the household able to repay debt? A= Yes b= No

11. Migration Status of the household.

Probe: If the family has migrated from any other place: from where, why, when, status of migration is permanent/seasonal/how many members have migrated/

Probe: If any member of the household migrated to any other place: from where, why, when, status of migration is permanent/seasonal/how many members have migrated/

12. Health Status at the household level :

Sr. No	Role of the person	Health Problem	Health Service Provider	Problems in care giving

13. Person with special needs at the household level

- 1. Does the household have any person with special needs: a= Yes
b=No
- 2. Provide the details of such persons along with their need
 - a.
 - b.
 - c.

14. Exposure of household to any of the following climate impacts?

Climate Hazard	Check if yes	Intensity			Damage
		High	Medium	Low	
Storm Surge					
Coastal Erosion					
Cyclone					
Flood					
Salinity					
Tsunami					
Others, specify					

15. What is your household affiliation?

Type	Total Members	Members from your HH	How long have they been affiliated	Activities carried out
Community				
Religious				
Self Help Group, Specify				
Occupational, Specify				
Government				
Others				

Probe: Ask whether these groups are active/when do they meet/where do they meet/what kind of activities are they involved in/ what is the contribution of the HH in these activities

16. Amenities for the household and life line:

Amenities	Basic	Back up in time of stress/emergency
Drinking Water		
Electricity		
Shelter		
Health Care		
Communication TV Radio Telephone Mobile		
Transportation		
Occupational Tools		

17. Your household is utilizing which of the following coastal and marine resources and related goods and services for personal consumption and income generation?

Sr. No	Resources	Goods and Services	% household consumption	% Sale
1	Coral Reefs	Fisheries		
		Tourism/recreation		
		Cultural value and services		
		Coastal Protection		
2	Mangroves	Wood for building		
		Wood for Cooking		
		Wood for charcoal		
		Fisheries		
		Protection		
3	Others, specify			

18. What are the main livelihood sources for your household for household use and income generation?

Sr. No.	Source	Household use	Income generation	Members engaged and role
1	Fishing			
2	Other marine life			
3	Livestock			
4	Handicrafts			
5	Salary for employment			
6	Money from relatives			
7	Private Business			
8	Pension			
9	Others, specify			

19. What are the possible alternative and supplementary livelihoods for your household?

Sr. No.	Alternative Livelihood	Opportunities	Threats	Knowledge	Capability
	Supplementary Livelihood				

20. Which of the following climate related hazards and impacts has your household witnessed?

Sr No	Climate Hazards	Experience d in past 20 years	Frequency 1=Low 2=Medium 3=High	Sensitivity 1=Low 2=Medium 3=High	Negative impact on household 1=Low 2=Medium 3=High	Difficulty of coping with hazard 1=Low 2=Medium 3=High	Total Vulnerability rating (Sum of A+B+C+D)
			A	B	C	D	
1	Storm surge						
2	Cyclone						
3	Coastal erosion						
4	Sea Level Rise						
5	Salinity ingress in the fields						
6	Salinity ingress in the wells						
7	Changes in seasons						
8	Drought						
9	Flood						
10	Increased water surface temperature						
11	Coral bleaching						
12	Hotter climate						
13							
14							

21. Which of the following source is used by the household for accessing information about climate related knowledge and how is this information used?

Sr. No.	Sources of Climate Related Knowledge	Get Information	Use this information
1	Meteorological Services		
2	Government persons		
3	Village Leaders		
4	School Teachers		
5	Family and Friends		
6	Newspaper		
7	Radio		
8	Public Address System		
9	Others		

Probe: If the household gets information but does not utilize it, why do they not utilize it? Also what kind of information is needed by them but they cannot access it and what are the barriers to accessing this information.

22. What kinds of formal and informal networks supporting climate hazard reduction and adaptation are there and how does your household benefit from them?

Probe: Quality and effectiveness of such networks

Sr. No.	Networks supporting Climate Change	No. of members	Scope of climate change issues being addressed	Gaps/ Needs of the Group
1.	Community Networks(Samaj)			
2.	Family Network			
3.	Religious Network			
4.	Self Help Groups			
5.	Occupational Groups			
6.	Others, specify			

23. One a scale of agreement , please rate the following related to perception of the household regarding the ability of community to organize (Learn, Plan, Make necessary changes to cope with climate change related impacts)

Sr. No.	Statement	Strong Agree	Agree	Neutral	Agree	Strongly Disagree
1	Community plans to deal with climate related events					
2	Community is able to coordinate activities to respond quickly to the impacts of natural events					
3	Community is able to reorganize to respond to new situation					
4	Community has institutions that support us when we need to reorganize to cope with new situations or problems					
5	Community members work well with each other					
6	Community is able to access outside support when needed					

24. Our household attitude towards governance and leadership

Sr. No.	Statement	Strong Agree	Agree	Neutral	Agree	Strongly Disagree
1	Community leaders have successfully lead us through climate related events in the past					
2	Community leaders are interested in climate change issues and the impacts on our community					
3	Community leaders who have knowledge and skills to effectively take charge of climate change adaptation					

4	We trust our leaders to lead the community through climate change adaptation					
5	Community leaders/government officials inform us of national or regional climate change policy or initiatives that may impact our community					
6	Community leaders inform us where we can get climate related information					
7	Leaders suggest to us what we can do to adapt to changing climate					
8	Leaders provide us with the resources we need for climate change adaptation activities					
9	Leaders encourage community members to take part in climate adaptation planning					
10	Our voice is heard in community planning for climate change adaptation					
11	We have had the opportunity to participate in community level decision making					