Chapter 10
Indigenous Resilience and Adaptation in High Altitude Arid Zone Communities

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Abstract India has been experiencing increasing incidents of hydro-meteorological disasters that defy trends. Flash Flood in 2010 in the arid Ladakh region of North India's Himalayan belt underlined the impending climate and disaster threats in fragile ecosystems. Mainstreaming of Climate Change Adaptation and its linking with DRR remains fragmented while the National Disaster Management Policy professes mainstreaming of DRR. Looking at diverse disciplines of cross-national breadth, this chapter examines inter-linkages between communities' indigenous knowledge and practices and scientific techniques to develop resilience to climate change effects. The study is based on a research project 'Ability of Local Multi-Stakeholder Action to Catalyze shifts in Program and Policy Environment towards mainstreaming DRR CCA,' funded by Climate and Development Knowledge Network (CDKN) along with global change SysTem for Analysis, Research and Training (START) and implemented by SEEDS, Kyoto University and local partners. The chapter argues that the rapid development of scientific techniques and increasing urbanization inclinations challenge traditional practices and common people's pace of adaptation. Based on an in-depth perception survey of 200 HHs and evaluating different parameters through a bi-variate tool, the chapter explores ability of multi-stakeholder action to influence policy formulation. The study presents analysis and findings, pinpointing common solutions that can address local people's needs and also fulfill required technical development for the common good.

Keywords Climate change adaptation • Community resilience • Disaster risk reduction • Indigenous knowledge • Multi-stakeholder action

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H.K. Nibanupudi, R. Shaw (eds.), *Mountain Hazards and Disaster Risk Reduction*,
Disaster Risk Reduction, DOI 10.1007/978-4-431-55242-0_10

10.1 Unprecedented Flash Floods in Leh

During midnight of August 6, 2010, Leh in Ladakh region of North India (Fig. 10.1) experienced flash floods due to cloud burst. There was a recorded rainfall of 14 in. in a short span of 2 h. The sudden incoming of flash floods left people in shock. The overflowing Indus River and its tributaries triggered mud flows. The devastating mud flows with height of 20 ft ran down the slopes crushing everything in its way. About 250 persons died, over 800 people were injured and many more went missing. It destroyed many houses, roads, bus stands, hospitals, etc. The local communication network and transport services were severely affected. The lone district civil hospital was flooded and filled with debris which affected medical and health facilities even more. This led to huge economic, infrastructure and life loss. People said that they had not seen flash floods of such magnitude in their lifetime (DREF Operation Final Report 2011).

When we look at the changes in climate in high altitude arid region of India, there is no significant change over the last 30 years (Fig. 10.2). There is a rising trend for temperature in the region. The maximum temperature for summer months shows rising trend of nearly 0.5 °C in last 35 years. There is rising trend of min temp at Leh and the rise is of the order of nearly 1 °C for all the winter months. The observed change in temperature is not substantial, but the effect it has on the regional ecosystem is huge. There are some major observations coming up which includes infestation of agricultural crops with worms, reduction in snowfall, increase in tree line, glacial retreat, flash floods, change in flowering and ripening time, reduction in water level, degradation of water quality, reduction in migratory birds, etc. These observations contribute to the belief in people that the climatic conditions are changing. The climate change has brought many negative impacts but also there are some of the positive changes. For example, increase in tree line has provided them with variety of crops to grow. Now they can grow potatoes, tomato, apple etc. which were unimaginable some decades back.

Fig. 10.1 Location Map

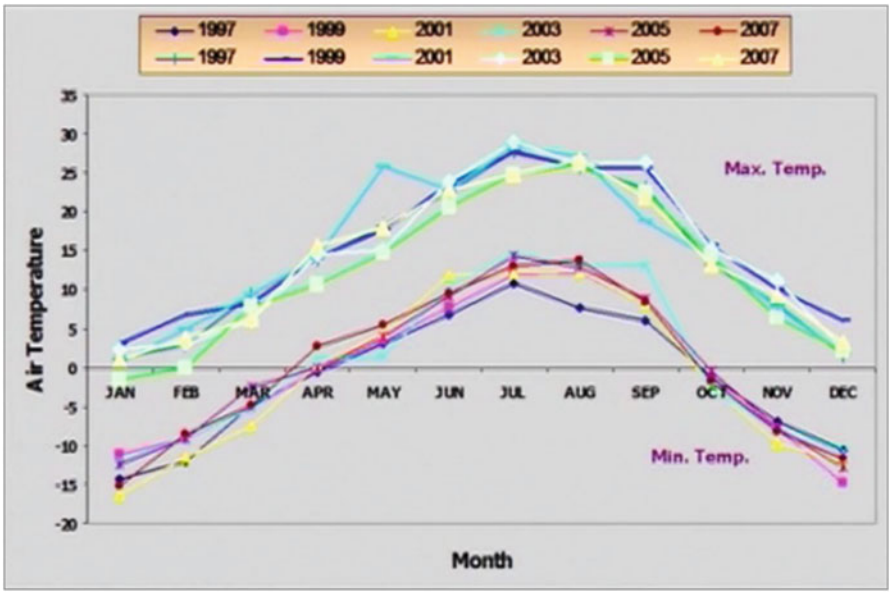

Fig. 10.2 Monthly minimum and maximum temperature from 1997 to 2007, Leh. *Source*: Defence Institute of High Altitude Research, Leh

10.2 Indigenous Knowledge and Community Resilience

Indigenous knowledge implies to people's strategies to respond to problems through trial and error. The response includes how people cope, adapt, experiment and innovate after experiencing a problem and how they learn to overcome it. These are the local practices that have evolved over time and passed on from generation to generation by word of mouth. It connects people to their surrounding environment and helps them in decision making. Their interventions are based on the access and ability to benefit from assets covering human, socio cultural, institutional, financial, economic, political, physical and natural aspects (Shaw et al. 2009).

Indigenous knowledge forms the basis of community coping practices and builds up their resilience to any disasters. It defines the local way of dealing with unprecedented events. Indigenous knowledge emerges more as a way of life rather than a set of defined tools. This makes it easier to understand and adopt. In disaster prone areas, indigenous knowledge acts as a precious resource and guides people to respond to the disasters. Indigenous knowledge is embedded into every aspect of human lifestyle and evolves continuously with gaining

Key Definitions

Indigenous Knowledge

Indigenous knowledge (IK) is the local knowledge—knowledge that is unique to a given culture or society. IK contrasts with the international knowledge system generated by universities, research institutions and private firms. It is the basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities (Indigenous Knowledge for Development: A Framework for Action 1998).

Disaster Risk Reduction

The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to 11 hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR Terminology 2009)

Climate Change

A change in the state of the climate that can be identified (e.g., by using statistical tests) 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 may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC 2012).

Adaptation

In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (IPCC 2012).

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 (UNISDR Terminology 2009).

experience. In case of disaster risk reduction, indigenous knowledge plays an important role. Be it the case of saving lives during a disaster or helping others post disaster for recovery, the rules build out of indigenous knowledge helps community to cope up easily. For example, knowledge of local medicines can help wounded people to recover when there is no medical aid during first few hours after disaster. Similarly, the social responsibilities or organizational setup as a result

of indigenous knowledge can help people overcome day to day stresses. Implication of indigenous knowledge in developing community resilience can be summarized under the following context.

Indigenous knowledge helps people to diversify their economic activities according to their needs. A number of sources of income are invaluable during the time of stresses when economic activities ceases. In rural areas, most of the people are engaged in agriculture activities, but they also undertake other works such as carpentry, handicrafts, etc. In difficult time, they are dependent on the buffers kept. They use it wisely during any crisis situation. With their indigenous knowledge they can survive even when there is no agricultural produce left. For example, the Ladakh region remains cutoff during winter season because of heavy snowfall, and during this time people depend on alternative sources for food. They consume stored food for months. Their indigenous knowledge helps them to preserve food and use them when everything else is covered in snow. People use their assets e.g. animals, tools, seeds or even land as substitute economic source. With rapid urbanization, rural communities are becoming dependent on family members who are working out of the village. There is transition from use of traditional knowledge for getting daily itineraries to use of processed items.

10.2.1 Technological

The technology developed on the basis of indigenous knowledge covers a broad canvas ranging from land management systems, water distribution systems, building materials and construction methodologies, etc. The cultivable land parcels in the hilly region of Ladakh is rare. The slopes are varying which adds to difficulty in farming. People prefer mixed cropping to reduce the risk of poor harvest in case if anyone of the crops get affected. Different seed varieties and cropping pattern are selected for different regions depending on the availability of water sources. For distributing water to fields equally, communities in the region has developed a unique system. A person is appointed as water manager, locally called as '*churpon*', collectively decided by people and paid. The person appointed ensures equal supply of water to all the fields at the required time.

The people of Ladakh face bitter cold and they have developed construction methodologies to keep their home warm. With available local materials and the use of sunlight, people have adapted to extreme cold. The walls with stone and mud and the roofing and flooring with wood keep cold away (Fig. 10.3). After major harvest season in September and October, the roofs of buildings are stored with grass which acts as insulation for cold. The same is used as fodder after winter gets over and there is little food left for cattle.

Fig. 10.3 House constructed with local materials in Leh keeps cold away

10.2.2 Organizational

The social systems present in the communities help them a lot in decision making. The social bonding developed through kinship networks and interdependence of one person to another for day to day activities helps people in time of need. The moral support developed out of indigenous knowledge acts as a platform which integrates all people of the community. During a disaster when people suffer, they immediately call upon kin, neighbours or patrons for help. Sharing of assets is standard in many communities and this helps a lot in recovery from any disaster. People living just outside the immediate community are of particular importance as they are the first rescuers in case of any disasters. The system of mutual assistance developed through extended kin relations proves to be a boon in time of distress.

10.2.3 Cultural

The beliefs and views based on the experience through indigenous knowledge is the indicator of how people view risks. Risk perceptions vary to a large extent from communities to communities. For example, the perception of risk for a poorer community may be very different from a rich community. Communities have their own way of defining their conditions for the need of external help that it qualifies as a crisis or disaster. The cultural beliefs and practices developed out of indigenous knowledge have helped in generating awareness and coping mechanisms to deal with disasters. For example, in hilly areas of Ladakh, there is practice of making small structures, locally called as '*chortens*' as shown in Fig. 10.4, after the event of any disaster. It is believed that the *chortens* restricts the events to occur again. These religious practices act as an awareness tool for the coming generations. It reminds them of the disaster and warns people to be safe.

Fig. 10.4 Religious structure (*chorten*) acts as warning tool for disasters in Leh

Indigenous knowledge helps in many ways for building resilience of a community. It represents the local knowledge gained through thousands of years of experience. It is reflected through day to day activities. The indigenous knowledge helps people to understand their own strengths and weakness and provides them with options to act upon whenever needed. This facilitates decision making and serves as the information base for a community. The most interesting feature is that it is developed as a part of the community and and is embedded in the culture of any society.

The traditional knowledge of a community in today's world of changing climate is even more important. The effect of climate change is getting worse day by day. The frequency of unprecedented events as a result of climate change is increasing day by day. In this situation the indigenous knowledge can play an important role in decision making to act forward in minimizing the stresses developed. The next section focuses on the perception of people about the climate change issues in the high altitude region of Ladakh and their opinions about the measures that can be taken to cope up with the adverse effects of changing climate and induced disasters.

10.3 People's Perception About Climate Change in High Altitude Region of Ladakh

India has been experiencing increasing incidences of hydro-meteorological disasters that defy trends. Recent flash floods in Leh in the northern mountain desert (2010) have underlined the impending climate and disaster threats in fragile ecosystems. The National Disaster Management Policy, 2009 of India professes

mainstreaming of Disaster Risk Reduction (DRR), but it remains a fragmented domain. Significant work is yet to start on mainstreaming of climate change adaptation, and it's linking with DRR. The National Action Plan on Climate Change, on the other hand, focuses largely on mitigation actions, and while identifying the Himalayan ecosystem as a priority mission, doesn't give adequate direction to adaptation actions that reduce disaster risk.

Climate and Development Knowledge Network (CDKN) along with global change SysTem for Analysis, Research and Training (START) funded a research project titled 'Ability of Local Multi-Stakeholder Action to Catalyze shifts in Program and Policy Environment towards mainstreaming DRR CCA,' implemented by SEEDS, Kyoto University and local partners. Based on the research and field practice experience of the investigators, the project studied the effectiveness of Local Multi-Stakeholder Action as an enabling factor for mainstreaming DRR-CCA in post disaster programs and ultimately in state and national policy environments. Under this project a household survey was conducted to understand the people perceptions about climate change and its relation to disasters.

The survey was conducted in January and February month of year 2013 in Serthi village in Leh district of Ladakh region in North India. A total of 200 households were interviewed. The household were selected through random sampling in the study area. The people selected for interview were more than 25 years of age. The people in the project study area were asked to give their views about the changes they have experienced during last two or three decades. The questions were asked specifically to adults and older people to obtain a clear picture of climate change and related stresses developed in the area. The impacts perceived by the villagers are summarized below:

10.3.1 Observed Changes in Precipitation and Temperature

Most people interviewed in villages said that winter temperatures have been increasing and that the duration of the cold period (winter) has been decreasing. Likewise, the warm period i.e. summer is getting longer; hot temperatures are perceived even in April which was not evident before. For snowfall (Fig. 10.5a), 77 % of the people said that it had reduced than before while the rest said that the time of snowfall has varied. For change in summer season (Fig 10.5b), almost all people (98 %) responded that there is a rise in temperature of summer season. For winter season (Fig. 10.5c), 63 % people responded that the length of winter season has decreased, 34 % said that it has varied over the years and 3 % said that the winter season has increased. The overall views of people show that there is an increasing trend of temperature in the region which has resulted into some positive and some negative aspects.

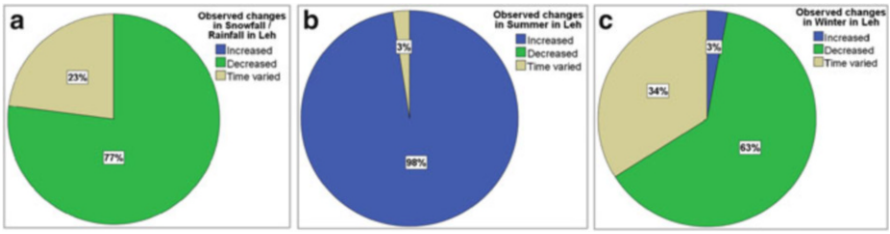

Fig. 10.5 (**a**) Observed changes in snowfall/rainfall in Leh; (**b**) Observed changes in summer season in Leh; (**c**) Observed changes in winter season in Leh

10.3.2 Other Observed Changes Related to Climate

As a result of changing climate, many changes have been observed by the people of Ladakh as shown in Fig. 10.6. The major changes which affect their day to day activities include glacial retreat, changing crop pattern and rise in water level of rivers. 29 % of the respondents believe that glacial retreat is one of the major changes, 7 % said that changing crop pattern has affected their lives more, 24 % respondent believed that rising level of water bodies have affected their day to day activities and 42 % people did not respond to this question.

10.3.3 Opinion About Link on Changing Climate and Happening Disasters

People were asked if there is a link between climate change and disasters in Ladakh region. In Fig. 10.7, it can be seen that 57 % of the respondents agreed that there is a link between climate change and disasters. They believed that because of interrupted human interventions in nature, the balance of nature is getting disturbed and as a result they are facing more climatic stresses which many times lead to disasters. 7 % of the respondents said that they don't feel there is a link between climate change and disasters and a large percentage of the respondents, i.e. 36 % people said that they cannot respond to the question.

10.3.4 Observed Links Between Climate Change and Disasters

The respondents, who felt that there is link between climate change and disasters, were asked of the specific observations. It can be seen in Fig. 10.8 that 22 % people said that glacial retreat is one of the disastrous effects of climate change, 26 %

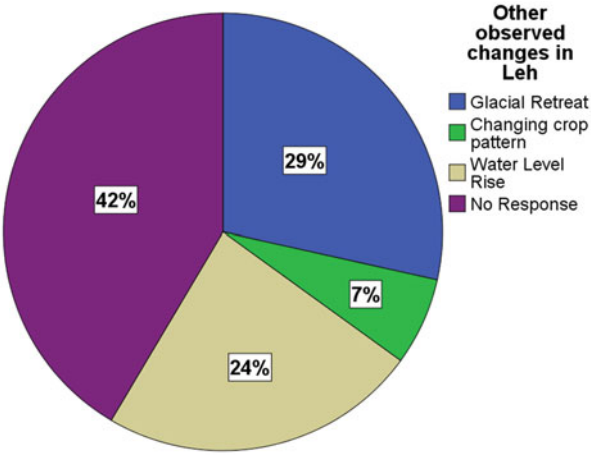

Fig. 10.6 Other observed changes in Leh

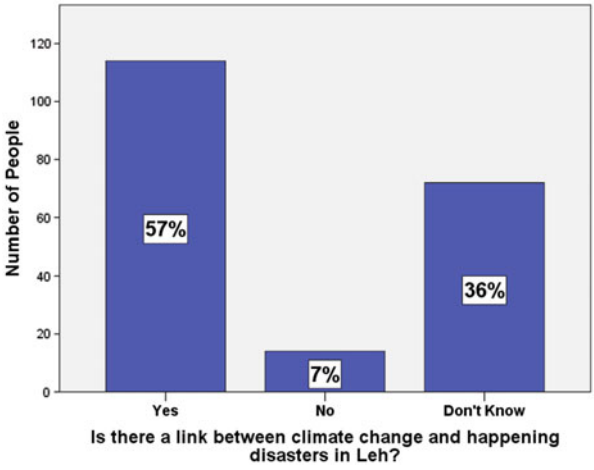

Fig. 10.7 People's opinion about link on changing climate and happening disasters

believed that the changing weather patterns are causing disasters, 10 % said that the frequent flooding conditions is a result of changing climate and 43 % said that they believe that there is a link between climate change and disasters but they could not give specific examples.

10.3.5 Resilience Building for Disasters

To understand the capacity building of people for disaster, they were asked that what has been done by government and local authorities for people (Fig 10.9). 4 % people said that there were some awareness program carried out in villages, 13 %

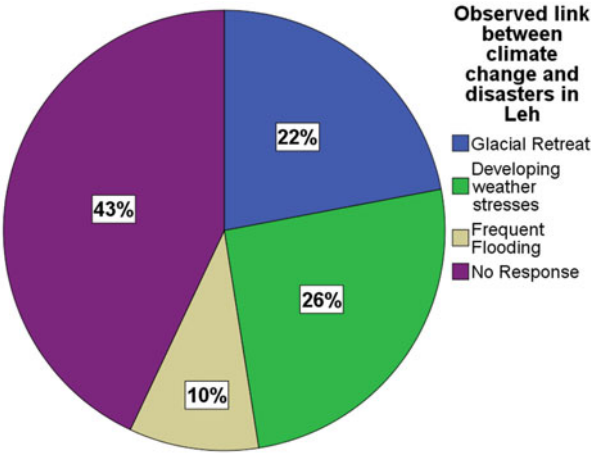

Fig. 10.8 Observed links between climate change and disasters

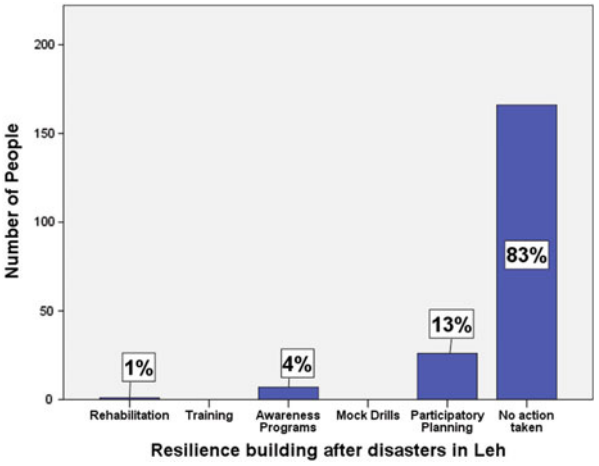

Fig. 10.9 Resilience building after disasters in Leh

said that participatory planning approach was followed to discuss the key issues of villages and prepare a road map for developmental activities. But these were restricted to certain communities and individuals. Most of the respondents (83 %) said that there were no appropriate actions taken for helping them out with disasters.

10.3.6 Information About Weather Forecasts

People were also asked about the information they get about daily weather and warnings in case of any emergency situation. As presented in Fig. 10.10, 24 % people said that they get information through radio broadcasts, 24 % said that they

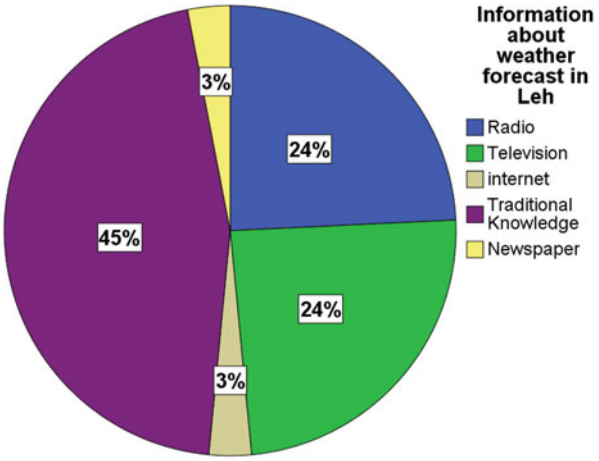

Fig. 10.10 Resilience building after disasters in Leh

got the information through television, 3 % said that they read out from newspapers, 45 % respondents said that they do not follow the scientific observations but they have a traditional system of knowing about the weather forecasts. There is a traditional calendar called '*lotto*' which defines all the coming seasons according to dates in the calendar and people follow that for all the weather advisories. Some of the people (3 %) also used internet to know about the daily weather situations.

10.3.7 Suggestions to Reduce Risks

People were asked for suggestions on what should be done to address the risks arising because of changing climate and increasing disasters (Fig. 10.11). The suggestions that people referred includes introduction of training programs, awareness campaigns, creating protection bunds, developing water resources, more plantation, conservation of nature and performing rituals to god. 10 % of people said that training programs will be helpful in risk reduction, 16 % people said that creation of protection bunds will reduce the risk for flood situations, 1 % emphasized on development of water resources to solve increasing fresh water availability problems, 6 % said that more plantation should be done to strengthen the natural ecosystem, 8 % said that natural systems should not be disturbed and its conservation should be focused, 25 % respondents said that awareness program would make people more resilient, 28 % people believed that disaster events are acts of god and nothing major can be done to prevent it and so people should perform rituals to god avoid disaster events, and 7 % people could not give any suggestion.

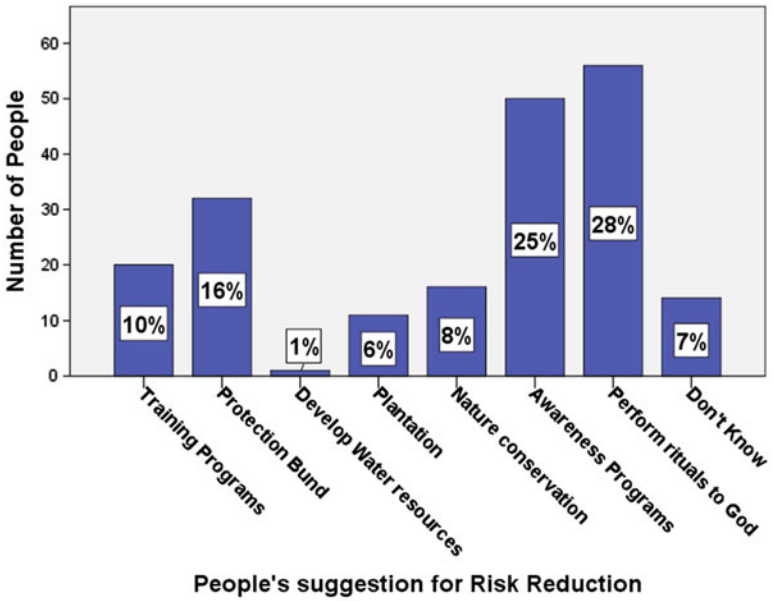

Fig. 10.11 People's suggestions for risk reduction

10.3.8 Who Should be Responsible for Action for Disaster Risk Reduction?

For the implementation of suggested actions for reducing disaster risks, people were asked who they consider as most appropriate for taking actions for risk reduction. This is presented in Fig. 10.12. 34 % people responded that government organisations should be responsible for taking actions, 18 % people said that NGOs are suitable for taking actions, 5 % said that people should take their own responsibility of taking actions, 34 % respondents believe that community as whole can take action for risk reduction, and 11 % people had no suggestions for who should be responsible for taking actions for disaster risk reduction.

10.3.9 Individual's Capacity to Catalyze Change

People were also asked for what they can contribute for reducing risks arising out of changing climate and happening disasters (Fig. 10.13). 31 % people said that they can share whatever information they have with the community strengthen

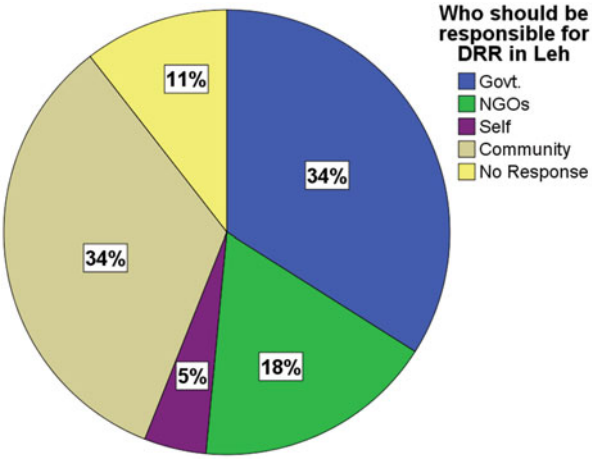

Fig. 10.12 Who should be responsible for risk reduction in Leh

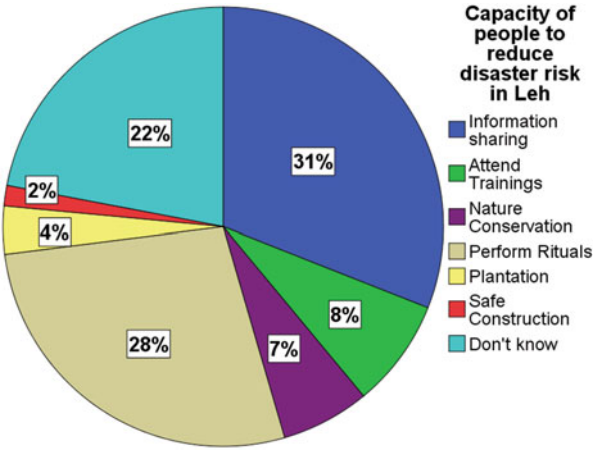

Fig. 10.13 Capacity of people to reduce disaster risk in Leh

participatory planning approach to deal with disasters, 8 % said that they can attend trainings to develop specific skillsets which can be used for reducing risks, 7 % said that they can stand up against human intervention in nature and help to conserve it, 4 % said that they can do more plantation of trees to develop greenery, 28 % said that they do not have anything in their control but they can perform rituals to god who can take care of all, and 22 % respondents did not responded to the question.

10.3.10 Conclusion of HH Survey

The household survey conducted gave a deep insight of people's perception about changing climate in the high altitude arid region of Ladakh. The people responded

well to certain questions but also they were clues to some questions. For example, people gave immediate response about temperature variations in the region, but when asked of the specific changes, people were mostly unable to answer. People see climate change stresses and disaster events as the areas where they could intervene much. Out of the household survey of 200 households, the following conclusions were drawn:

1. The climatic conditions in the region have changed with a rising trend in temperature and decreasing trend in precipitation.
2. The changing climatic condition of the area has resulted into many negative aspects, but there are some positive aspects as well.
3. The changing climate in inducing more disasters and there is a link between climate change and disasters. Glacial retreat, changing crop pattern and rising level of water bodies are some of the examples of climate change effects.
4. Temperature variations are clearly visible to the communities' but when asked for other specific changes observed due to climate change, they are confused to respond. Thus most of the people did not have a clear concept of climate change impacts and disasters as separate issues, though they experience climate induced disasters and stresses.
5. Restricted interventions are made to build resilience into communities. The interventions need to be more transparent and the frequency of resilience building has to be increased.
6. Traditional knowledge is a major component of information sharing about weather. But with the rapid urbanization, use of traditional knowledge is fading.
7. For reducing risks of climate change and disaster, government bodies and NGOs are considered to be responsible. Also collective approach as a community is considered as an entity responsible for reducing risks.

10.4 Technological Advancement and Pace of People's Adaptation

With increasing Centre of Excellence around the globe in each sector, the amount of knowledge base developed so far is massive. There is a pool of scientists who are involved in research activities and develop scientific technologies for solution to specific problems. When these technological developments reach to common people, its implications get reduced to the area of knowledge of the end user. It becomes difficult for a person to use a technology which he/she is not familiar with or which does not serve their purpose. The people's pace of accepting a technology and adapting it to the environment is based on the following criteria:

1. Technology should be implementation oriented. It should be usable to users and they should find it doable with their experience.
2. The technology developed should be understandable to users.

3. It should serve their interest for its applicability.

Technologies should be developed with rational means and knowledge of specific objectives that serves the need of end users. The knowledge of implementation and practice should be owned by people. In this context, the technologies developed out of indigenous knowledge are far more acceptable and implementable. People adapt to it very easily as they find it with their knowledge domain and the purpose of the technology developed is crystal clear to them.

10.4.1 Adaptable Technology in High Altitude Region of Ladakh: Artificial Glaciers

The technologies developed with the knowledgebase of community are highly acceptable and functional. For example, development of artificial glaciers in Ladakh region based on the local knowledge has solved the problem of water scarcity in many area.

The fury of global climate change is clearly visible in Ladakh with receding glaciers. This has caused the problem water shortage. The concept of artificial glaciers was locally evolved based on the local needs and indigenous knowledge of people. The construction methodologies are locally evolved with a very less cost of operation. The addition done by modern science was to evolve the same practice with a bit of addition to serve the purpose on a large scale. The technique of artificial glaciers is a very simple technique and is replicable in similar geo-climatic regions as Ladakh. The knowledge ownership of artificial glacier concept has made it a great success and people are using it wherever possible to benefit the communities. This has built up people's resilience to drought situations in the region (Angmo and Heiniger 2009).

If a technology has to be introduced from outside the community, people have to be shown their importance. The innovative technologies can provide windows of opportunity for new ideas to be developed and let people to explore their capabilities and develop it in a way to best suited for their development.

10.4.2 Innovative Technology: Installation of Automatic Weather Station in Serthi Village of Leh District in Ladakh

As part of its efforts to understand the ability of local multi-stakeholder action to catalyze shifts in program and policy environment towards mainstreaming DRR CCA in Ladakh, SEEDS has conducted a variety of activities since the start of the project to engage local stakeholders in discussions and actions towards integration of DRR CCA and its mainstreaming in broader development plans and policies.

SEEDS conducted a district level workshop in Leh to discuss the response of the district to the 2010 flash floods and ways to build on that for better risk reduction and adaptation to climate change impacts. With discussions at community level, it was discussed that besides other stresses erratic weather conditions were becoming a challenge for their traditional cropping practices. They felt that with better weather information and some agriculture extension support, the community could not only know when to sow their crops, but also how to manage pests and make most of the 'rising' temperatures. Farmers in Sakti felt that while there was potential to grow new kinds of vegetable and fruits with the changing weather conditions.

As a result of the above discussions and suggestions, SEEDS planned to establish a climate field school in Serthi village. As part of this project, SEEDS installed an Automatic Weather Station (AWS) in a community center in Serthi. The meteorological data collected by AWS give the micro weather condition of the valley. With the help of AWS farmers can be trained to monitor weather conditions and use them to generate "expected weather conditions" and forecasts with the help of India Meterological Department (IMD), Jammu and Kashmir. The department of agro-met services Jammu and Kashmir can be approached to help farmers apply weather forecasts to farming practices.

10.5 Multi-Stakeholder Approach to DRR CCA

The challenge towards mainstreaming DRR and CCA in India is at the national and state level where in there is a lack of substantive interface between Ministries and departments concerned. The functional body of disaster management at district level sits in the Revenue Department whereas the effect of climate change is looked after by Ministry of Environment and Forests. With the enforcement of Disaster Management Act, 2005 in India, the hierarchical structure of disaster management department has strengthened and the implementing bodies have been assigned at district level, but climate change is still seen as national or regional issue and the departmental structure is still vague. The disaster management activities and planning process are carried out with inputs from various interfaces. The same situation is followed for dealing with effects of climate change. The works are done in silos and are rarely integrated which reduces the final outcome of planning and implementation process.

However, there have been some efforts at national and international level to set up a platform where people of different activities can come together and give their collective inputs for disaster management. The Regional and National Platforms set up by UNISDR are a good example to follow multi-stakeholder approach. The multi-stakeholder forums or committees for disaster risk reduction reflect the commitment of governments to improve coordination and implementation of disaster risk reduction activities while linking to international and national efforts. National Platforms collaborates on resource mobilization for DRR at the national level, serving as the networking hub and liaison between different DRR

stakeholders, facilitating country-level implementation of the HFA, advising on how to establish National Platforms, fostering dialogue between different National Platforms regionally and internationally, and lobbying regional and international organizations to establish and strengthen National Platform. National Platforms (NP) builds on existing systems relevant to disaster risk reduction and includes representatives from all stakeholders involved, such as government, international organizations, NGOs, academic institutions, the private sector and the media.[1] But there is a lack of inclusive planning process. The stakeholders involved in National Platforms lacks the experience of ground realities and the views of people at last mile in seldom taken into account when the policies are made.

At community level there are potentials to understand the ground realities and plan for the changing environment. Multi-stakeholder alliances at local level can influence and act on DRR and CCA threats. They can also advocate with and influence the local government. SEEDS, through the undertaken project, tried to review the lacunas and set up platforms for local multi-stakeholders to review the situations at micro level and take decisions to solve the identified problems. The idea was to help localise and institutionalise the Hyogo Framework for Action (HFA), creating concrete links between national policies and local implementation. In simple words, the initiative was to help integrate 'resilience' into local level development activities. The Citizen Platform created includes representatives from all groups of society covering govt. officials, local leaders, members from local civil society organizations, engineers, academics and researchers, key sectoral members from the education, media, environment and health fields, etc.

10.6 Using a Bivariate Tool for Micro Planning

At local level, climate change impacts and disasters is not seen as separate issues. People believe that these are part of stresses being developed as due to human interventions in nature. To face the challenges and cope up with the increasing differences between habitats and surrounding environment, appropriate planning needs to be done at micro level. The effects of disasters and climate change can be very well understood in respect of several indicators. For efficient planning, these indicators at local level needs to be explored to understand the specific issues related to DRR and CCA separately. The indicators can be correlated to analyze the common points of intervention for risk reduction due to climate change or disasters.

To make the planning process more fruitful, along with the participatory approach with multi-stakeholders, SEEDS undertook a bivariate approach in which separate indicators for disaster risk reduction and climate change adaptation were identified covering local issues. Various indicators were listed down for DRR and CCA. The major indicators for DRR can be summarized under three heads,

[1] http://www.unisdr.org/we/coordinate/national-platforms

i.e. general indicators, resilience indicators and operational/policy indicators. The general indicators included number of lives saved, number of reduced injuries, % of population significantly affected, % of affected people able to resume sustainable livelihoods, compliance with codes and regulations, adequate emergency service capability. Resilience/capacity was suggested as an area needing measurement and possible indicators were given as equity of income distribution, educational attainment, medical services use, unemployment, housing, morbidity and mortality rates of different social groups (residence, gender, social class, age, ethnicity, etc.), quality of life, livelihood sustainability, environmental sustainability, strength of the local economy. Operational and policy indicators included reaction times and degree of preparedness, recovery period and the degree of efficiency with which recovery is carried out, losses compared with recovery costs, cost of the disaster reduction system, inclusiveness of planning and management (potentially to include between emergency management, social services agencies, disabilities, minorities and other vulnerable populations, health departments, fire/police, etc (UN/ISDR 2008).

The indicators for CCA included variation in temperature, variability in amount and timing of precipitation, changing soil conditions, reduced water availability, receding glaciers, natural and built environment, physical topography, new agriculture species, water management techniques, urbanization inclinations, frequency of extreme events, insurance and financial mechanisms, knowledge and training, emergency planning, etc (Harley et al. 2008).

The above indicators were looked into at local level through a participatory process. The people were consulted discussing common interventions that can be done at local level to reduce risks. Out of the various issues discussed, the major ones that came out of the discussion were water shortage due to receding glaciers which affected agricultural practices and daily activities, and the variability in weather patterns. People said that due to variability in weather conditions and lack of information, they were not able to plan for the agricultural activities. As a result they could not get sufficient produce. It was suggested that if they could get correct information about the weather forecasts and agricultural advisories, it would be a boon for them to adapt to the changing climate patterns. As a result of this approach, SEEDS installed an Automatic Weather Station (AWS) which gives meteorological data of the area. The data generated can be used to assess the micro climate of the area and take accurate decisions for micro planning of the area.

Conclusion

The project experience in studying the ability of multi-stakeholder action to catalyse shifts in program and policy environment towards mainstreaming DRR and CCA provided insights into the local problems of people in the high altitude arid zone communities. The project yielded some key lessons as under:

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1. At community level increasing impact of climate change is being felt through stresses and disasters
2. People do not have a clear concept of Climate Change and Disasters as separate issues
3. Stresses, invisible disasters and small scale disasters are not getting the attention required
4. At district level and above, DRR and CCA are different verticals and very difficult to address together
5. Traditional knowledgebase of communities needs to be explored and taken into account for developing approach for DRR and CCA at micro level
6. Cross sectoral participation at local level needs to be exercised to involve people in decision making and ensure sustainability of interventions
7. Local multi-stakeholder action can play a role, but needs:
    - Continued convergence
    - Information and communication strength
    - Stronger sub-national level mechanisms to influence policy convergence

The research led to better understanding of some of the key issues at ground level that need to be addressed while making policies for integration of DRR and CCA. Some of the recommendations are as follows:

1. There needs to be a planning and response mechanism for unprecedented disasters
2. Policies need to consider and formulate measures for day to day stresses arising due to disasters and climate change that are going under the radar
3. CCA and DRR policies need to be linked at operational level including funding through a participatory process to ensure the smooth implementation of the implementation
4. Traditional knowledge should be explored and validated to understand the people's way of addressing the needs and their coping mechanisms
5. The interventions done should include the following criteria to relate the interventions to the end users:
    - Understandable and acceptable to end users
    - Easy to implement by end users
    - People should know the importance and benefit

Acknowledgements The authors are thankful to START CDKN project titled "Ability of Local Multi-Stakeholder Action to Catalyze shifts in Program and Policy Environment Towards Mainstreaming DRR CCA", which provided funding support. People and local authorities and counterparts' contributions are highly acknowledged.

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