



Climate Change and Sustainable Rural Livelihoods: Constraints and Adaptation Strategies

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Abstract: In today's era, one of the most important threat to existence of human in climate change. Climate change is damaging people's lives today. The impacts of climate change on health are core consideration of both the UN Framework Convention on Climate Change (UNFCCC) and reports by the Intergovernmental Panel on Climate Change (IPCC). Climate change has created havoc for the sustainable rural livelihoods in developing countries. Rural households are most vulnerable to climate change because of dependency on climate related resources like agriculture, livestock, forests etc. resulting in less diversification of livelihoods which further increase their vulnerability. Although various sustainable livelihood practices are being used by rural households but due to various constraints, they are not fully effective. Adaptation to climate change requires adjustments at all levels. The communities which are suffering from the climate change have to increase their resilience towards climate change by adopting appropriate technologies while make proper use of their traditional knowledge. Indigenous knowledge is increasingly being used as a tool for climate change adaptation. Vulnerable communities have used indigenous practices to plan adaptation and disaster risk reduction activities. Furthermore, government is focussing for sustainable development and climate change adaptation by finding and administering alternative methods to deal with issues of poverty and environmental degradation in context of linkage between livelihood and the immediate environment of the people. Finally, there is great potential for current policies to be implemented strategically towards building true adaptive capacity for the rural communities. At last, adaptation to climate change requires adjustments and implementations at each level- be it community, national or international.

Keywords: Climate Change, Sustainable Livelihoods, Indigenous Knowledge and Adaptation.



1. INTRODUCTION

Climate change can be defined as more unpredictable and extreme variations in weather conditions over a fairly long period of time. It is change in the average weather situations over a longer time period. The United Nations Framework Convention on Climate in its Article 1 defines climate change as: “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”. The average annual temperature of the earth has shown an upward trend during the past hundred years. (Rockström, et al 2009) argued that discussion on planetary boundaries has tried to strengthen the issue of undesirable changes in earth system. The study identified nine processes which define the concept of planetary boundaries. Out of the nine processes climate change is the one. Climate Change does not only mean that everything around us will become hotter. Instead, there will be more irregular & extreme weather conditions. Some places will have heavier rainfall; some will experience more snow whereas other places will suffer from severe droughts and frequent heat waves. These causes are both natural as well as man-made. The natural causes include continental drift i.e. the drifting away of continents from each other. It is considered to be the most important cause of climate change. Increase concentration of CO₂ cause green house effect which cause heating up of the earth atmosphere and become another important cause of climate change. Other important factors causing climate change includes plate tectonics, variation in earth orbital, volcanic eruption etc. There are various human induced factors leading to change in earth’s atmosphere. These factors are collectively called as anthropogenic factors.

The concept of “sustainable livelihood” first came into existence when Robert Chambers and Gordon Conway used it in 1991 to analyse the poverty of people (Chambers and Conway, 1991:1). A livelihood is considered sustainable when it is able to recover from various shocks and stresses and still able to maintain or enhance its capabilities as well as assets, both in present and future without decreasing the natural resource base (Chambers and Conway, 1991). Sustainable livelihood as a concept is very vast and requires an extensive discussion on the interaction between poverty and environment. As per (Carswell et.al, 1997), definitions of sustainable development are mostly inconsistent narrow and less clear. Without proper clarification there is always a risk associated with mixing up of the concept. Sustainable livelihood helps in creating such a livelihood that allows the individuals and households to earn that much money so as to be able to get the basic amenities of life such as food, clothing and shelter. This make people secure and thus help them in leading a dignified life in a sustainable manner.

Climate Change and Rural Livelihoods

The livelihood system is composed of various aspects which include physical, economic, social and cultural aspects, wherein families live and sustain. Although all human beings are vulnerable to climate change but rural people are the most vulnerable ones. Rural household’s livelihood is mainly dependent on resources which are highly vulnerable to changing climate like agriculture land, local water supplies etc. Another worrying fact is that even their main activities like arable farming, livestock husbandry and their natural resources like fuel wood



and wild herbs are very much influenced by the phenomenon of climate change. The continuous change in climate could cause a decrease in availability of these natural resources and limits the livelihood options for rural households whose livelihood is mainly dependent on these resources for both consumption as well as trade.

Agriculture is considered to be the most important aspect of rural livelihood and is also seriously affected by climate change. Climate is the primary factor in determining the productivity of agriculture and the changing climate would have its affect on the agriculture productivity. Changing climate will have negative impact on growth of plants and their grazable yield. There are a number of ways in which climate change have its influence on agriculture. As the temperature starts to increase it have an inverse relation to production i.e. with increase in temperature, crop yield stars decreasing. Further with the increase in temperature, the rate of transpiration in plants increases resulting in loss of moisture in plants. Continuously changing climate would lead to decrease in soil capacity to support agriculture because of increase in water content in soil making soil loose and thus soil can't hold crops firmly. As far as India is concerned, the situation becomes somewhat more severe. Various predictions have been made for impact of climate change on India. M.S.Swaminathan, one of the pioneers of Green Revolution in India estimated that wheat production could decrease by 6 billion tones with every degree rise in temperature.

As far as human health is concerned climate change affects it both directly as well as indirectly. Climate change will intensify the health risk associated with environment. A variety of medical problems like ulcer, glaucoma, bronchitis etc are related to changing climate. Many diseases in children like cholera, typhoid, and diarrhea are also a result of climate change. Extreme and intensive increase in temperature can directly cause death of people. Extreme heat results in diseases like cardiovascular and respiratory disorders which ultimately cause death of people, especially elders, who are suffering from it.

Objectives

1. To analyze the constraints affecting sustainable livelihoods.
2. To analyze adaptation strategies practised by rural households to achieve sustainable livelihoods.

2. STUDY AREA AND RESEARCH METHODOLOGY



Doda is situated on the eastern side of Jammu province and is the largest district in the whole province. The district is located at a height of about 5000 feet above the sea level. Doda is located at $75^{\circ}32'52''\text{E}$ Longitude and $33^{\circ}08'45''\text{N}$ Latitude. The total area of district is approximately 8912 sq.km. Historically speaking the district got its name from the utensils makers of Multan who were called “Deeda”. It is believed that these people came all the way from Multan and settled in this part which is now called Doda. Two blocks i.e., Doda and Bhaderwah were selected and Stratified random sampling was used in which the population sample is taken. Overall, 300 households were selected using stratified random sampling, 150 from each block. It has also been kept in mind that the households selected covers all the groups i.e. women headed, literate, illiterate, government job holders, farmers, self-employed etc. so as to make the study more relevant and logical. A structured questionnaire survey, participatory rural appraisal (PRA) and focus group discussion (FGD) methods will be used to collect primary data and information.

3. RESULTS AND DISCUSSION

Climate Change and Livelihoods

Climate change has severe impact on livelihoods of the rural households. Most of the livelihood strategies in rural area are based on resources which are sensitive to changing climate like agriculture, livestock rearing and forest based livelihood which further increases the vulnerability to climate change. The table below reveals how climate change affects various livelihood sources. A look at the table 1 shows that out of total sample households 30 percent believes that climate change causes decrease in livelihood followed by decrease in



health status of households i.e. 26 percent, illness of livestock 22 percent and others issues 22 percent.

In Doda 31.3 percent household believes that climate change has cause decrease in agricultural productivity whereas 24 percent believes that changing climate cause illness in livestock. A total of 26 percent sample household believes climate change deteriorates their health and 18.7 percent believes that climate change is causing other effects also. Similarly in Bhaderwah, 28.7 percent household believes that climate change has cause decrease in agricultural productivity whereas 20 percent believes that changing climate cause illness in livestock. A total of 26 percent sample household believes climate change deteriorates their health and 25.3 percent believes in other effects on livelihood.

Table 1: Climate Change and livelihoods (Percentage)

Effects	Doda	Bhaderwah	Total
Decrease in agricultural productivity	31.3	28.7	30
Increase illness in livestock's	24	20	22
Decrease in health status	26	26	26
Other	18.7	25.3	22
Total	100	100	100

Source: Survey Data

A look at the table reveals that two main sources of rural livelihood i.e. agriculture and livestock are being affected by changing climate. During the survey households argued that that winters have shrunken and rain fall is less than it used to be due to which the productivity of lands over the period has shown a decreasing trend. Decrease in production means the farmers are able to sell less as they need food to sustain their life also. Less selling means that the income generated also decreases which most of the times is not sufficient to sustain daily needs. Also decrease in production mean less fodder for the animals especially livestock on which the agriculture sustain as they are used for ploughing, carrying output to market etc. Further more heat and less water results is many types of illness in the livestock which also cause decrease in their working capacity which ultimately has an effect on agricultural production. Third aspect which has been taken is the human health. Healthy person is able to contribute better in production process than the one who is ill or no healthy. It is also noticed that disease like cholera, tuberculosis and fever were very common and children are often more susceptible. When households were asked the reason most of them said that extreme climate as one of the main reason for these diseases. Low health means less working hour which ultimately affects production. Thus climate change also affects health which ultimately affects the livelihood o the rural households.



Sustainable Livelihood Practices

In this section we will be discussing the various sustainable livelihood strategies being practiced by the rural households in the study area. The main livelihood strategies being practiced in the study area includes farming, livestock rearing, small businesses, collection of forests products and labour. Table 2 gives us an indication regarding various livelihood practices in the sample area.

Table 2: Sustainable Livelihood Practices (Percentage)

Sustainable Livelihood practice	Doda	Bhaderwah	Total
Modernized Farming	43.3	45.3	44.3
Diversified Livestock rearing	24.7	20.7	22.7
Small Business	11.3	7.3	9.3
Collection of forest product	9.3	18.7	14
Skilled and unskilled labour	11.3	08	9.7
Total	100	100	100

Source: Survey Data

Modernized Farming

As it is evident from then table 2, modernized farming is the main source of livelihood of the households in the sample area. Modernized farming can be defined as use of modern agriculture tools like tractors, hand pumps, chemical pesticides and sprayers. The use of these modern techniques decrease labour saves times and helps in increasing the agricultural output. It can be clearly seen from the table that 44.3 percent of the households earn their livelihoods through farming. It provides them food which can be traded like cereals, fruits and vegetables which apart from their personal consumption are sold in nearby market to earn livelihood. The reason for framing being the basic livelihood practice is that almost all are having their own land holdings although land size differs. To make farming more sustainable apart from modern tools various hybrid varieties of seeds are available which are more resistant to climate and related events and also needs less rain thus help in good yield to framers. In Doda, 43.3 percent of households are dependent on modernized farming for their livelihoods. Similarly in Bhaderwah, 45.3 percent are dependent on modernized farming for livelihood.

Diversified Livestock Rearing

Livestock rearing is the second most important source of livelihoods for the households and is also an important tool for climate change adaptation. More diversification means that even if some of the livestock are ill and have disease other will take up their position and do the work resulting in almost no change in productivity. A look at the table reveals that 22.7 percent of households in the sample area are dependent on livestock for their livelihood.



Livestock keeping is an important livelihood strategy in the sense that apart from providing food and income, it provides trading products like meat, milk etc. In Doda, 24.7 percent of households are dependent of livestock for their livelihoods. Similarly in Bhaderwah, 20.7 percent are dependent of livestock for their livelihood.

Small Business

Another important sustainable livelihood strategy being adopted by the rural households is the establishment of small business like opening of shops, dairy farms etc. in the village which are complimentary to the main livelihood options. Villagers argued that due to irregularities in climate, their production may suffer in agriculture and because of less fodder productivity of livestock also decrease. Thus to overcome this problem, the households have also stated small businesses so as to overcome this shortage in productivity and to sustain livelihood. Overall in the whole sample area 9.3 percent of the households are taking small business as their livelihood option. In Doda, 11.3 percent households are dependent of small businesses for their livelihood. Similarly in Bhaderwah, 7.3 percent are dependent on small businesses for their livelihood.

Collection of Forest Products

Another important sustainable livelihood practice observed in the area is the collection of forests products. A look at the table reveals that a total of 14 percent households in the area are engaged in this activity. A look at the table further reveals that out of three blocks Bhaderwah has more households associated with this strategy than other two blocks. In Doda, 9.3 percent household practice this livelihood strategy and in Bhaderwah the percentage is 18.7, which is a very good number. The reason for Bhaderwah having high percentage is the more forest area and more fertile land. In fact there are few species which are very rare and fetch huge prices for example **kuchh** a wild vegetable can be sold as high as 6000-8000 per kg. The cost of collecting these products is also very less and thus encourage households to engage in such business.

Skilled and Unskilled Labourers

Another important sustainable livelihood strategy which comes out during discussion is working as skilled and unskilled labourer. During the focused group discussion with households it comes out that family size is large and productivity is low due to which they are not able to generate ample income for sustenance. To overcome this shortfall in income, households are forced to move out of villages and work as labourers in nearby towns. Overall in the whole study area 9.7 percent population is engaged in labour as livelihood strategy. In Doda, 11.3 household's percent are working as labourer to earn their livelihood. Similarly in Bhaderwah, 08 households percent are working as labourer for their livelihood.

Threats to Sustainable Livelihoods

We may be talking about the concept of sustainable livelihood but the main problem is in achieving the optimal sustainable level. In rural areas, the achievement of sustainable level is even tougher which may be due to various threats which are hampering the achievement of sustainable livelihoods. During the study, the respondents talk about various constraints which are affecting their livelihoods. Overall five major constraints are categorized which are

hampering the achievement of sustainable livelihood. Table 3 shows data on the various constraints being faced by households to achieve sustainable livelihoods. In Doda block of the sample area, 36 percent consider lack of finance as a major threat, whereas 28 percent consider diseases in crops and livestock as major threat, 12 percent consider lack of government support, 16 percent small size of holdings and 8 percent consider lack of infrastructure as major threat affecting sustainable livelihoods. Similarly in Bhaderwah Block, 37 percent consider lack of finance as a major threat, whereas 30 percent consider diseases in crops and livestock as major threat, 11 percent consider lack of government support, 10 percent small size of holdings and 12 percent consider lack of infrastructure as major threat affecting sustainable.

Table 3: Constrains Affecting Sustainable Livelihoods (Percentage)

Threats	Doda	Bhaderwah	Total
Lack of Finance	36	37	36.5
Diseases in Crops and Livestock	28	30	29
Lack of Government Support	12	11	11.5
Small Size of Holdings	16	10	13
Lack of Proper Infrastructure	08	12	10
Total	100	100	100

Source: Survey Data

Opinion Regarding Indigenous Knowledge

During study, one thing which prominently comes out is the use of indigenous knowledge by the local households to tackle climate change. The households are using their traditional knowledge to show resilience towards changing climate. Thus indigenous knowledge holds a very important place in climate change adaptation of the rural households. Based on this, the households are asked regarding their concept of indigenous knowledge. The households give different perceptions regarding indigenous knowledge which is given in table 4. The table reveals the various perceptions which the sample households have with regards to climate change. In Doda block of the sample area, 32 percent consider it as local knowledge, whereas 14.7 percent consider it as firsthand knowledge, 12 percent take it as mouth to mouth knowledge, 20 percent consider it as traditional knowledge and 21.3 percent sample household think that all the above terms can be used for indigenous knowledge. Similarly in Bhaderwah Block, 25.3 percent consider it as local knowledge, 20.7 percent consider it as firsthand knowledge, 08 percent take it as mouth to mouth knowledge, 26.7 percent consider it as traditional knowledge and 19.3 percent sample household think that all the above terms can be used for indigenous knowledge.

Table 4: Opinion on Indigenous Knowledge (Percentage)

Perception	Doda	Bhaderwah	Total
Local Knowledge	32	25.3	28.7



Firsthand Knowledge	14.7	20.7	17.7
Mouth to mouth Knowledge	12	08	10
Traditional Knowledge	20	26.7	23.3
All of the above	21.3	19.3	20.3
Total	100	100	100

Source: Survey Data

Now another important aspect is to see how much the sample households are using indigenous knowledge as an adaptation mechanism to tackle climate change. Table 5, gives us information regarding use of indigenous knowledge as adaptation mechanism. If we take the whole study area into consideration 56 percent of the total sample households are using IK as an adaptation mechanism whereas 44 percent are not using it as a tool for adaptation. In Doda, 52.7 percent are using IK as an adaptation mechanism and 47.3 percent are not using it. Similarly in Bhaderwah, 59.3 percent are using IK as an adaptation mechanism and 40.7 percent are not using IK as an adaptation mechanism.

Table 5: Indigenous Knowledge as an Important Adaptation Mechanism (Percentage)

Response	Doda	Bhaderwah	Total
Yes	52.7	59.3	56
No	47.3	40.7	44
Total	100	100	100

Source: Survey Data

Adptation Mechanism

Adaptation mechanisms are the various strategies that help individuals or a whole community to make adjustments to the impact of climate change. Rural households are using various adaptation mechanisms based on indigenous knowledge and little of scientific knowledge so as to lessen their vulnerability to climate change and attain sustainable livelihoods. Some of the prominent adaptation measures include migration, crop diversification and keeping various varieties of livestock. Apart from that some other measures are also used but very less like small private business, dairy business etc. Table 6 reveals the various adaptation mechanisms used by sample households. A look at the data reveals that among the whole sample household’s majority 33.3 percent are using crop diversification as a source of adaptation followed by migration 23.3 percent. Furthermore 22 percent of the households in sample area are keeping different varieties of livestock as adaptation mechanism whereas 21.3 percent are using other methods of adaptation. Now let’s have a look at various adaptation mechanisms separately. In Doda block 32.7 percent are using crop diversification as an adaptation mechanism. The other adaptation mechanisms include migration 20.7



percent, keeping different livestock varieties 22.7 percent, and other measures 24 percent. In Bhaderwah block, 34 percent are using crop diversification as an adaptation mechanism. The other adaptation mechanisms include migration 26 percent, keeping different livestock varieties 21.3 percent, and other measures 18.7 percent.

Table 6: Adaptation Mechanisms Used By Sample Households

Adaptation Mechanism	Doda	Bhaderwah	Total
Migration	20.7	26	23.3
Crop diversification	32.7	34	33.3
Diversification in livestock	22.7	21.3	22
Others	24	18.7	21.3
Total	100	100	100

Source: Survey Data

Crop Diversification

Households across the whole sample area agreed that crop diversification as the main source of adaptation in the area. The reason being, that most of the households are dependent on agriculture for their livelihoods and any decrease in the production will directly affect the livelihood of the villagers. Further villagers are emotionally attached to their land and thus they don't strive hard for other adaptation alternatives. The rural households introduce new and improved varieties of seeds and crops in their agriculture system which are high yielding and more climate resistant. The farmers said that this technique has led to increase in their income because of good output and less damage. Also these crops or seeds need less water and as such are not much affected by low rain. Another important benefit of crop is that it ends the dependence of farmers on a single crop. Having variety of crops is an important source of climate change adaptation.

Different Varieties of Livestock

Another very important Adaptation mechanism used by the households is keeping of various varieties of livestock. The study reveals that that rural household in the past used to have a single or two varieties of livestock but later on it was realized that having limited livestock varieties will increase the risk of diseases and other issues related to livestock. To overcome the problems associated with having limited or single species, the villagers started to maintain various varieties of livestock. The main benefit is that having different varieties (cattle, camels, sheep and goats) will help in reducing the risk villagers suffer from a particular event. Also the grazing area where these livestock's are grazed can be fully utilized. Further people argued that having various varieties increase their income and livelihood because more livestock mean more fodder, milk and milk products. Even some have started dairy business in the village.

Migration

Another important mechanism which comes out during the survey is the migration of households to other parts to decrease their vulnerability to climate related events. When the



households asked are having different arguments with regards to reason for migration. Some argued that because of climate change their productivity in agriculture has decrease although they are using crop diversification but they still the increase is not that much to support full family. So male members are moving towards towns and cities and are working in farms, shops and factories so as to earn livelihood to complement the income generated from agriculture. It is a kind of forced migration because the villagers are not moving out of their own will. Another argument they give for migration is that in cities there are more option to tackle extreme climate events and also their children get better education as in villages especially during winters when there is heavy snow and rain which shut down the transport system and ultimately effects the children because of shutting of schools due to non availability of teachers. Further some also have are having their well established business in towns where clientele is much higher than villages which further boost their livelihood options.

Apart from the above three main adaptation strategies the village households have been using various other strategies so as to decrease the vulnerability due to climate change. The main adaptation mechanisms are small private businesses, dairy business, govt. jobs, working as mason and carpenters etc. One important thing to be mentioned is that although they have diversifies their livelihood option but agriculture is still their main source of livelihood.

Success of Adaptation Measures

Although different adaptation measures are being use but if they are not successful then the whole process will be futile. Table 7 reveals the success rate of various adaptation measures being used by households,

Table 7: Success of Adaptation Measures Being Used (Percentage)

Perception	Doda	Bhaderwah	Total
Successful	56	60.3	58.2
Unsuccessful	44	39.7	41.8
Total	100	100	100

Source: Survey Data

It is clearly visible from the table 7 that the adaptation strategies are moderately successful. Overall a total of 58.2 percent household have successfully used these adaptation mechanisms whereas 41.8 percent household doesn't have success in these strategies.

3. CONCLUSION

This paper gives an analysis of the various threats affecting sustainable livelihood and adaptation techniques being used in the study area. The paper gives an insight about the various sustainable practices and the constraints which are there while using the sustainable practices. The study also shows that rural households are dependent on indigenous knowledge to adapt rather than scientific technology because of lack of proper knowledge and information regarding scientific technology. Further whatever scientific techniques are



used by locals is unable to get the desired result as that requires skills which local households don't possess. Thus what is required is the need to have a proper system of implementation of policies so that the results are desirable. Efforts should be made to break the cyclical nature of the factors causing vulnerability at different levels with immediate, medium and long-term interventions. Having proper implementation of policies will result in removal of threats affecting the sustainable livelihood and also provides road map for implementation of adaptation mechanisms which will help in decreasing the vulnerability of rural households and helps them in breaking the menace of climate change.

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