

Impacts of Climate Change in Ladakh and Lahaul & Spiti of the Western Himalayan region

Introduction

The cold desert regions of Ladakh and Lahaul & Spiti are an isolated, inhospitable terrain that lies in the western Himalayas sandwiched between Pakistan and China. The region typically has average weather conditions characterized by extreme seasonal temperatures ranging from +40 to -40 degree Celsius, meager annual rainfall (10-100mm) during summer season, high wind speed movement, heavy influx of ultraviolet and infrared radiations and low atmospheric pressure.

Over the last few years, impacts of global climate change have been increasingly visible in Ladakh and Lahaul & Spiti. Rainfall and snowfall patterns have been changing; small glaciers and permanent snow fields are melting affecting water runoff in the rivers/streams, and rise in temperature and humidity inducing favorable conditions for the invasion of insects and pest aggression.

The impacts of climate change are being felt most seriously in such extreme regions because on one hand they belong to the most vulnerable ecosystems and on the other hand, people living in these regions often lack the possibility to adapt to the changing conditions. Data obtained from the meteorological department (Air Force Station, Leh) clearly indicates that there is rising trend of min temp at Leh by nearly 1° C for all the winter months and nearly 0.5°C for summer months in last 35 years. There is clear declining trend in precipitation from November to March i.e. reduction in snow fall.

Context:

In this region small glaciers and snow melt water play a very important role in the sustenance of life as they are the only source of water, be it for irrigating the field or for any other domestic purpose. The most critical factors for extension of glaciers are extremely low temperatures complimented by heavy snowfall during peak winters which in the older days was favorable. However, over the past 35 years due to changing temperature and precipitation, small glaciers in the region are retreating at a much faster pace than imagined especially since the rising temperature trend is sharper in min temp of winter months and the declining trend in precipitation is sharper for the winter months. The winter precipitation is of utmost importance as 70% of the total precipitation (in the form of snowfall) over the entire year takes place in the winter months.

In the long run, glacial retreat translates into drying up of natural springs, streams; depletion of underground water hence decreased water availability challenging the very existence of the mountain people. Impact of climate change on water availability is already reported in various parts of the region. The main Indus River which runs through Ladakh has comparatively less water, in Spiti the main Kaza stream has completely dried up, four households in Langsa (Spiti) had to migrate permanently to Kaza due to water shortage problem, natural springs and streams in Kargil and Leh are having less water discharge.

Area of Study:

In Jammu & Kashmir two districts i.e. Leh and Kargil and in Himachal Pradesh the district of Lahaul & Spiti were covered.

Methodology:

An amalgam of three approaches was used for assessing the impacts of climate change on the local livelihoods and environment in the cold regions of Ladakh and Lahaul & Spiti. These three approaches are:

a. Analysis of meteorological data (Temperature and Precipitation)

To ascertain whether a warming in this region was actually taking place, it was first considered a priority to get data on temperature for at least 30 years. Collaboration with Dr. S.N. Mishra, Head of the Meteorological Department of the Indian Air Force was made and monthly data for mean minimum and maximum, absolute minimum and maximum temperatures as well as monthly precipitation data could be analysed for the past 35 years for Leh town. Unfortunately meteorological data for other places of the four areas were not available.

b. Interviews with villagers and prominent persons (especially aged people)

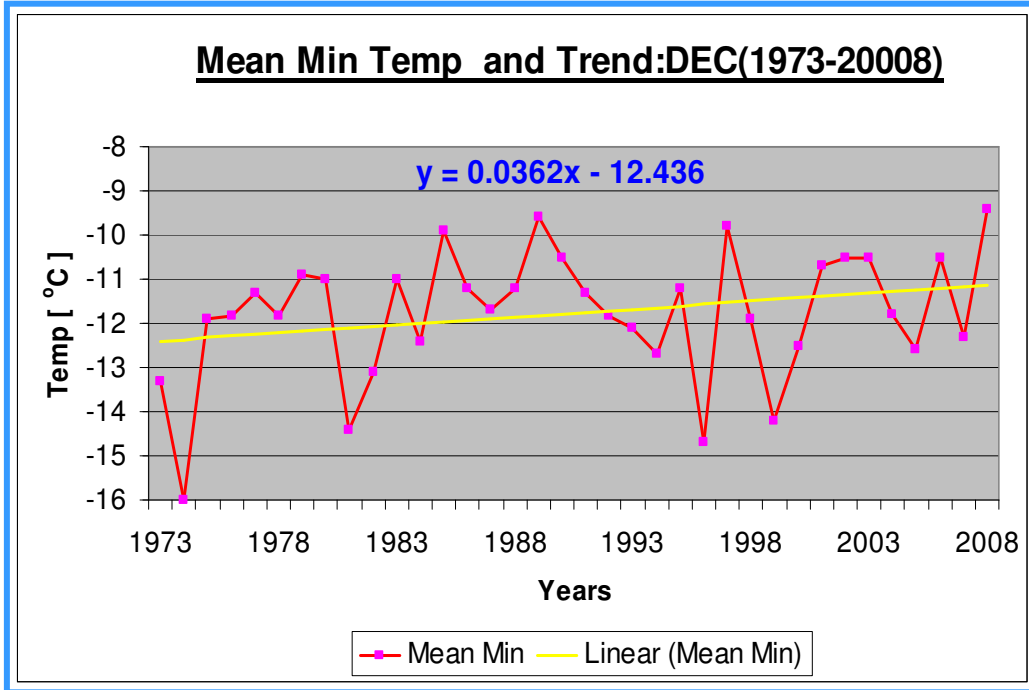
An overview about observed changes in the different areas and villages compared to 20-30 years ago was then obtained. For this purpose field workers from several Ladakhi NGOs were asked to compile a list of villages within their working area where either they themselves had perceived changes over the past years or where they had heard about changes in environment or livelihood that could be related to Climate Change. Interviews were then held with aged people from some of these villages. Additionally aged people in the headquarters of each area (Leh for Leh district, Kargil for Kargil district, Kaza for Spiti sub-division and Keylong for Lahaul sub-division) having a large store of knowledge with respect to changes over a longer period of time. These interviews with aged people were complemented with the information obtained from governmental officials (agriculture and horticulture department) and researchers such as from DIHAR (Defence Institute of High Altitude Research) and SKUAST (Sher-E-Kashmir University of Agriculture Science and Technology).

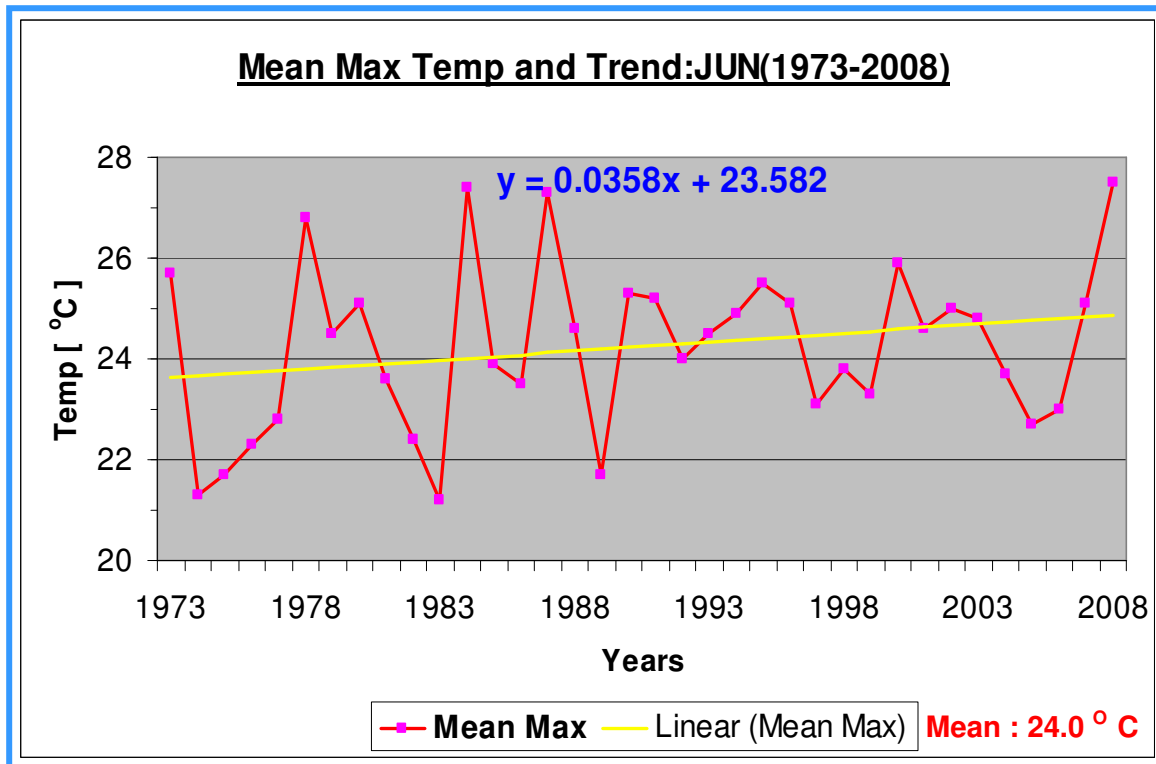
c. Broad survey about Temperature and Precipitation Changes among 200 villagers older than 35 years

Questions related to changes in temperature and precipitation over the last 20-30 years was included in the climate change awareness baseline study. These questions were asked specifically to those villagers above 35 years of age and were conducted in all the three districts (i.e. Leh, Kargil, and Lahaul & Spiti) in a total of 30 villages. The aim of this approach was to obtain a clear picture with respect to changes in these two key parameters of Climate Change and to cover the whole area.

a. Analysis of meteorological data (temperature and precipitation)

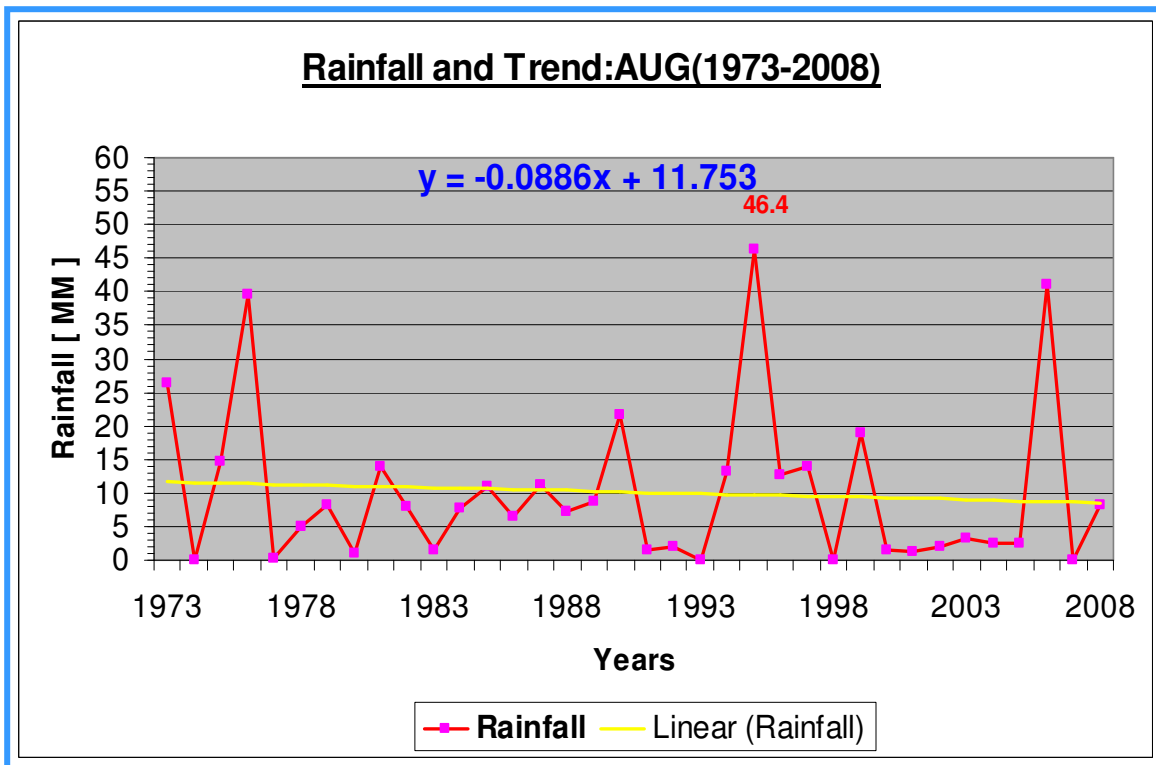
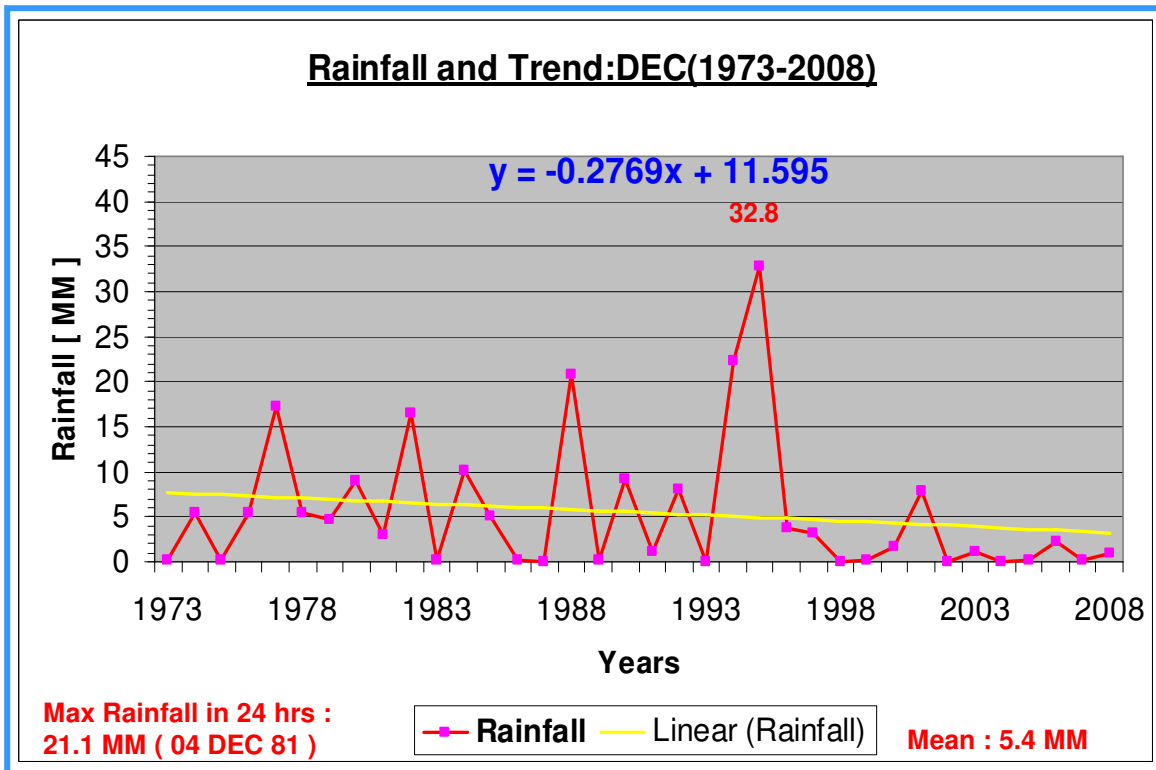
To ascertain secular trends, mean Min temp for winter months and mean max temp for summer months from 1973 to 2008 for Leh airport have been analyzed. For peak winter months and peak summer months, mean max temp and mean min temp has also been analyzed. Trend analysis for precipitation data (1973-2008) for Leh has been carried out for all months to ascertain, if there is any significant change in precipitation data.





Summary of findings for temperature data analysis:

- ⇒ The Max temp for summer months shows rising trend of nearly 0.5°C in last 35 years.
- ⇒ Analysis clearly indicates that 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
- ⇒ Though, the rising trend is sharper in min temp of winter months.



Summary of findings for precipitation data analysis:

- ⇒ There is clear declining trend in precipitation amount from Nov to March (reduction in snow fall). This is the season for 70% occurrence of precipitation over Ladakh and mostly in the form of snow.
- ⇒ Jan trend is rising due to one extreme event of snowfall during Jan 2008.
- ⇒ During summer season, no significant change noticed in precipitation amount as it accounts for 30% of annual precipitation and in the form of rain.

b. Findings/ Impacts of Climate Change:

A summary of the impacts perceived by villagers and experts from the development field is given below:

1. Temperature:

Most people interviewed in villages said that winter temperatures have been increasing (2008 being an exception) 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. This was validated by the climatic data analysis for Leh and the baseline survey questions on changes in temperature conducted with people above 35 years of age.

2. Precipitation:

As per data obtained from meteorological department, Air force station, there is definitely less snowfall in winter than previously, but there is no significant change in summer precipitation (rainfall). This was validated by local people who said that rainfall in summer has become unpredictable sometimes (no rain at all and then very heavy rainfall) and untimely which is further harmful for agriculture and fruit trees.

3. Glacier extension:

Even though there is no long-time study on glaciers in Ladakh and Lahaul Spiti, people gave many examples of retreating glaciers like Gyung-Kangri, Stok-Kangri, Kang-Yangtze, glacier above Dhomkar, Hemis Shukpachan (in Leh), Kanamo glacier, Lhari Ghaman glacier (Spiti). Interviewees said that because of less snowfall, the glaciers were not being fed as much as before and warmer winter temperatures were further accelerating the speed of its melt.

4. Water availability:

Water availability is apparently one of the gravest /serious impacts of climate change in this Trans Himalayan region which is mainly dependent on glacier melt water for irrigation and domestic purposes. Most interviewees especially in Spiti and Lahaul reported less water availability either in the river/streams or the natural springs that are fed by glaciers. Some examples are:

1. The main Spiti stream which separates the old Spiti town from the new town is completely dry. Earlier people could not cross it at all as there was water flowing throughout the year but now people use it as a shortcut/footpath to reach the other side.

2. Likewise Langsa, Kibber, Dimul which are the upper lying villages in Spiti faced critical problems with water supply in 2004-2005. All the natural springs had dried up and there was not even sufficient water for drinking. As a result 4-5 Khangbu (younger brother's) households in Langsa had disbanded everything and migrated to Spiti.
3. In Zanskar, the entire village of Shum Shadey has migrated to Chumik-Gyatsa (which means literally mean "land of hundred natural springs") as the glacier that fed the village completely melted.

However, in some villages in Leh and Kargil it is unclear as within the same village, some say that there is more water; others say that there is less water. Many other factors could influence this, such as cultivated area as compared to past years, increased water consumption due to higher living standards, introduction of water intensive crops, etc.

5. Agriculture/Horticulture:

Again many factors other than Climate Change can influence this and some people interviewed were also aware of this: gain of knowledge, other varieties of seeds, use of fertilizers, changes in water availability, changes in varieties due to rise of market possibilities (military, tourism).

An interesting point could be changes in flowering and maturing of apricot trees, since they are less influenced by the above mentioned other factors. All respondents in the four regions mentioned that apple cultivation has shifted in the higher altitude region. Earlier apple was found only in the lower regions (Kullu in case of H.P and Sham in Ladakh) at an altitude of 9000 feet but now it is found at a height of 12,000 feet. Another point is the appearance of pests and insects on plants, something that has not happened before. Changes in the time when they start seeding barley/wheat are difficult to establish, since most farmers rely on the traditional calendar to decide when to start.

6. Wildlife:

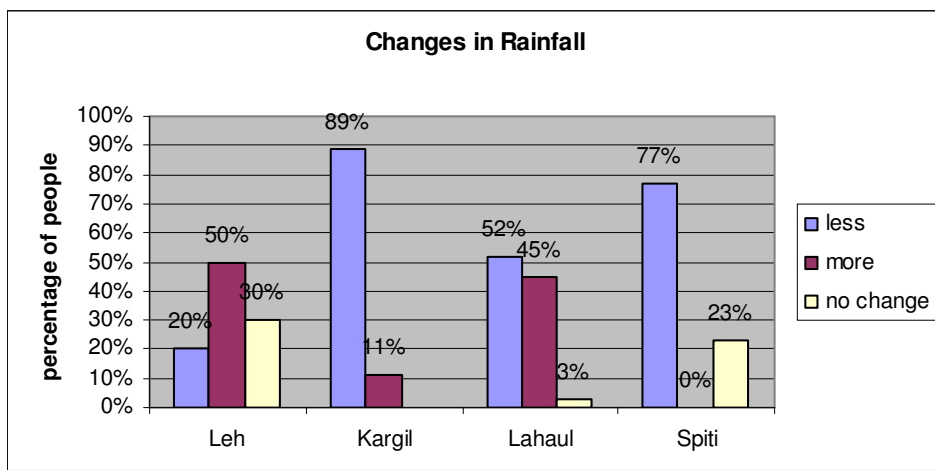
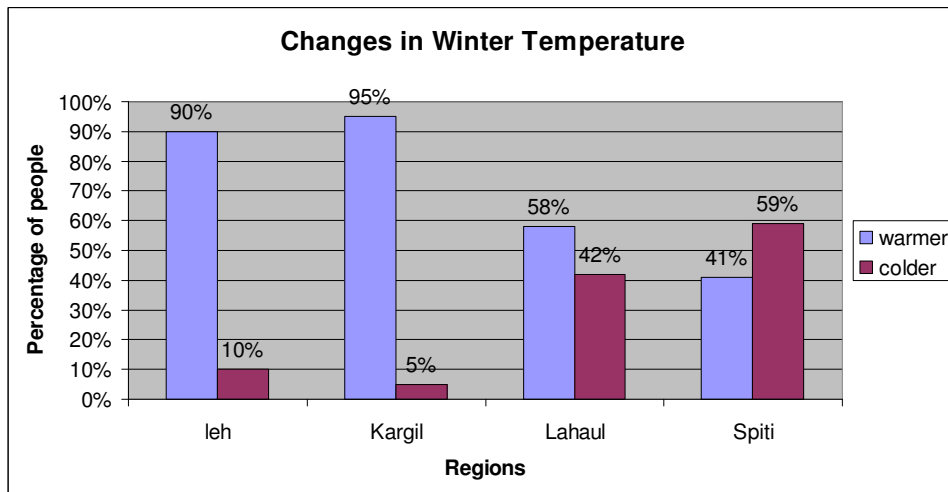
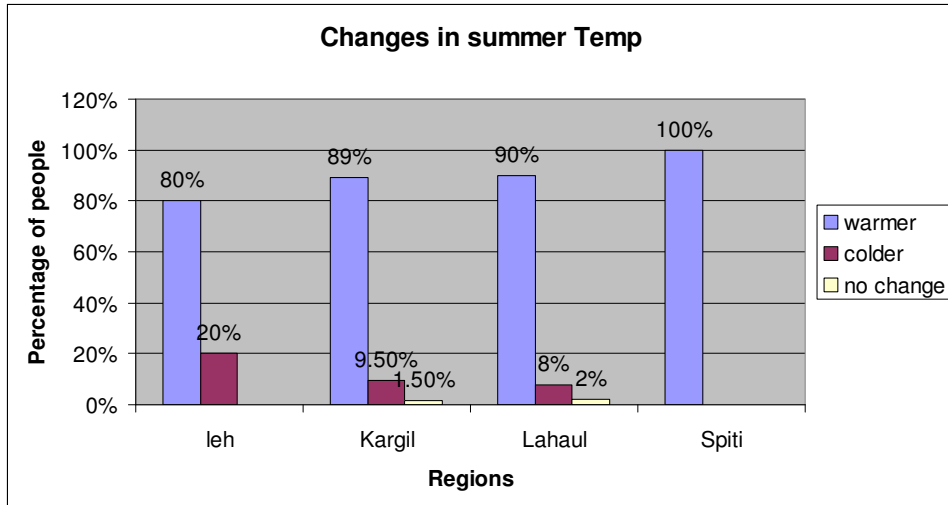
Some changes in migration patterns of birds have been noticed in villages and also at Tsomoriri (as reported by WWF and wildlife warden). The number of black necked cranes around Tsomoriri lake have increased; this could be because of warmer conditions plus other factors such as increased participation of the community in its preservation. However, some other migratory birds like the geese, Brahmini duck have stopped migrating outside; they are found in this region throughout the year.

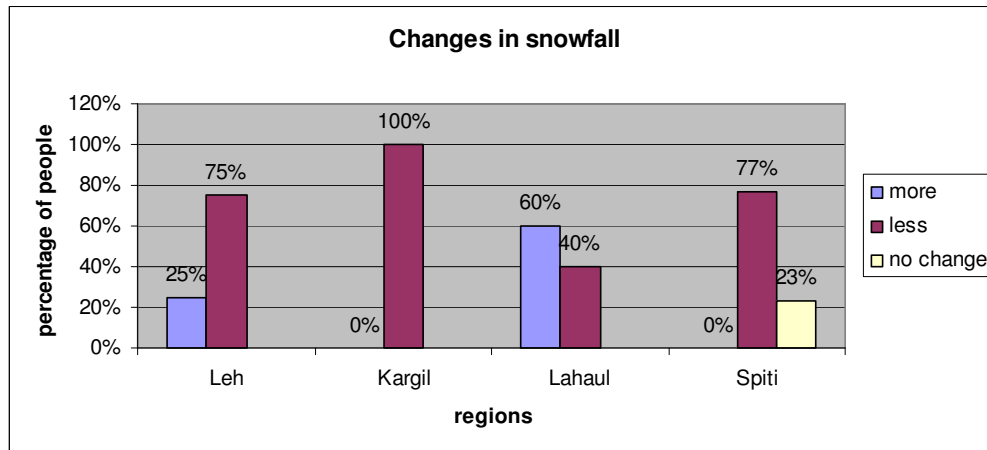
7. Others:

Chadar trek is getting shorter (Jan-Feb. instead of Dec. to March) and Tsokar Lake starts melting beginning of March instead of middle of April which makes it difficult for the nomads to cross it with their cattle. Likewise, the Tsomoriri and Pangong Lake are rising due to increased melting of glaciers and this is evident from the fact that the roads close to it are completely submerged under water.

c. Baseline Report Findings:

Total 30 villages in four regions (Leh, Kargil, and Lahaul & Spiti) were covered under the baseline survey and these interviews were conducted with 1 211 people above 35 years. Given below is the graphic representation of the findings.





Baseline findings:

- There is consistency between the climatic data and the findings of the baseline survey (for Leh).
- In all regions, more than 80% respondents felt summers were getting warmer.
- In Leh and Kargil more than 90% felt that winters were getting warmer and in Lahaul & Spiti the perceptions varied.
- The response for snowfall patterns was similar for all regions i.e. 60-100% agreed that snowfall was decreasing.
- However regarding rainfall, the perceptions varied. Except for Leh, all other regions felt rainfall was decreasing.

Limitations of the Study:

So far there is no scientific work /research done on glacier retreat/extension in this region which needs to be done urgently or the role of changing climate on various aspects of agriculture or horticulture.