

## IMPACT OF CLIMATE CHANGE ON AGRICULTURE, FOREST AND TREE SPECIES IN GARHWAL HIMALAYA UTTRAKHAND, INDIA

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### Abstract

Large change observed in climatic factors whereby reported many affect on forest, agriculture and forest trees. Climatic impact on traditional crops has drastically declined (>60%) during the last three decades however many crops are at the brink of extinction. In 2013, was reduced -268 km<sup>2</sup> (50%) of forest cover in Uttarakhand state. In Garhwal region had observed the changes in phenomena of different plant species such as *Rhododendron arboreum* and *Myrica esculenta*.

**Key word** : Burans, Climate, Forest, Agriculture and Species.

### Introduction

Modern plant taxa have continued to exist through a long period of variable climate, including glacial-interglacial cycles with a large change in temperature, precipitation, and CO<sub>2</sub> concentration, over the completed 2.5 million years. Regional temperature changes were as rapid as lot degrees Celsius within slight decades or as slow as 1<sup>o</sup>C per millennium. The changes in species circulation authentication by fossils provide a complete record of plant responses to these changes (Davis and Shaw 2001).

Global warming like climate change is the biggest and challenging issue presently globally. The whole over the world is facing it; especially in the agriculture and forest biodiversity viz flora and fauna. In the Asian continent, India country also has been highly influencing for a long time by now and observed so many drastic changes that highly deteriorate the agriculture and forest diversity such as saw the losses in large quantity as well many phenotypic changes also.

### Observation

The Uttarakhand state is the part of the northwest Himalaya in India whereas reported average annual rainfall of 1,550 mm and an average annual temperature of 00C-430C (FSI, 2017). If the moment, looks at six to seven-year backs the moment, I observed many incidents within the mentioned period related to the natural calamities and climate change that affected the quantity and quality of forest and agriculture due to the horrible storm. The Uttarakhand state in June 2013 came flood at four districts like Chamoli, Rudraprayag, Uttarkashi, and Tehri, etc. there were losses the agriculture and forest at maximum quantities. In the Tehri district, at Ghansali Block I had seen cloud bursting and flood at many places such as Arhgar, Gonhgar, Bud hakedar, Kemar, and Nelchami in June 2013 and May 2016. There was affected highly agriculture I and and crop, whereby that reduced the agriculture and forest area, even lose the field canal, which changed the cropping pattern then there have been raising non irrigated crops only. However, there raised irrigated crops before the produced non irrigated crops. As far as I think and what I noticed timing in crop showing and harvesting period by now, in Ravi and Kharif crops. A couple of years ago paddy crop had been transplanted in before June 15 but now currently, it is possible after June 15, even shifted harvesting time latter.

Negi & Palni (2010) were reported in the Himalayan region. The impacts of climate change on mountain agriculture. There was observed following factors such as reduced availability of water, during in rainfall period to see extremely drought event whereby failure of crop germination and fruit set, the weed's invasion (*Lantana camara*, *Parthenium odoratum*, *Eupatorium hysterophorus*) in croplands, insect and pest attack chances are more and crop-yield decline (Negi et al. 2012). Due to these factors change agri-diversity and cropping patterns. The Himalaya Mountains have been a rich warehouse of agro-biodiversity and non-rigid to crop disease viz. in Uttarakhand over 40 different crops and 100 cultivars selected by farmers, comprising cereals, millets, pseudo-cereals, pulses, and tuber crops are cultivated (Agnihotri & Palni 2007; Maikhuri et al. 1997). Twelve crops are mixed cropping (Baranaja), it is another best example for the rich agri-diversity of the region (Ghosh & Dhyani 2004). Climatic impact on traditional crops has drastically declined (>60%) during the last three decades however many crops are at the brink of extinction viz *Glycine* spp. *Hibiscus sabdariffa*, *Panicum miliaceum*, *Perilla frutescent*, *Setaria italic*, *Vigna* spp (Maikhuri et al. 2001; Negi & Joshi 2002).

As soon as the talk about forests viz forest area and forest species, it appeared to be seen phenotypical changes respective to climate change. A couple of years ago in 2013, during this time was reduced -268 km<sup>2</sup> (50%) of forest cover in Uttarakhand state (FSI, 2015), while as per the 2013 FSI report had published the forest cover (45.82%). The report exposed the reason forest area are reduced due to the rotational felling and diversion of land for many development activities but so far as I think, it's reduced because of natural calamities or natural disaster, which happened in June 2013. If look eight to nine a year back, it observed the changes in phenomena of different plant species such as *Rhododendron arboreum* and *Myrica esculenta*. There had been noticed at Rudraprayag district in Uttarakhand at two different places like Makumath and another in 5-6 km back of NagnathPokhari. At these places was shown flowering and fruiting time 2 and 3 months before like in December and January in *Rhododendron arboreum* and *Myrica esculenta*.

It seems to plant is not getting the proper environment before the reproductive period and in case plant in a stress state then plant metabolic activity very fast therefore pre-flowering occurring in these species or these are tree species getting suitable climate. Rana.K.(2019) was conducted a study on *Rhododendron arboreum* in 2017-18 and 2018-19 respectively. He had observed first flowering in the 2nd and 3rd week of December. This was due to a great change in climatic factors viz temperature and rainfall, it observed during winter months of both the season. In 2018-19 reported high rainfall and snowfall so it was the more chilling year, therefore causing delay and extend of flowering time this year. Khanduri et al. (2008) had published that if temperature increase and humidity decrease during the reproductive period still result is a pre-flowering phenomenon and a shorter flowering period. Gaira et al. (2011) reported advancement flowering in *Aconitum hetrophyllum* over a period of the last 100 years due to increased warmth during winter months.

Soil physicochemical properties and species genetic characters to cause variation in the flowering phenomenon of the same species within homogenous environment condition (Nord and Lynch, 2009; Pollard and Briggs, 1982; Ranjitkar et al. 2013). Trees showed dominant flowering quite earlier (starting December) as compared to the remaining sample trees that flowered during late December and early January. This might be due to superior genetic characters, better access to soil moisture, organic manure, and higher sunshine hours that trees were exposed to overall, early and better flowering was seen in branches (of all trees) that are receiving better sunlight and lesser shade thought the growing season (Rana, K. 2019).

## Conclusion

As per as the climate change is coming many effects on agriculture crops which are indicating the showing and harvesting time-shifted to latter so local inhabitants are adopting other alternate crops according to time and microclimate. There is shown the change s in many forest species as per as phenotypic point of view but especially changes observed in two species phenotypic characters such as *Rhododendron arboreun* (Burans) and *Myrica esculenta* (Kaphal) due to climate change and what is another reason behind it, we should conduct research so that we could find other scientific reason. In another case, there is a loss of maximum area of agriculture and forest, how to reduce the losses, and how to maintain the agriculture and forest, government will have to make better policies and strategies for its according to the microclimate.

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