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Climate Change and Its Effect on the Medicinal Plants.

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Overview of Tibetan Plateau:

- ❖ Tibet is roof of the world.
- ❖ Tibet is referred to as 'The Third Pole'
- ❖ The plateau holds the Hindu Kush Himalayan Ice Sheet, the largest ice mass outside the two poles.

More than 46 ,000 Glaciers

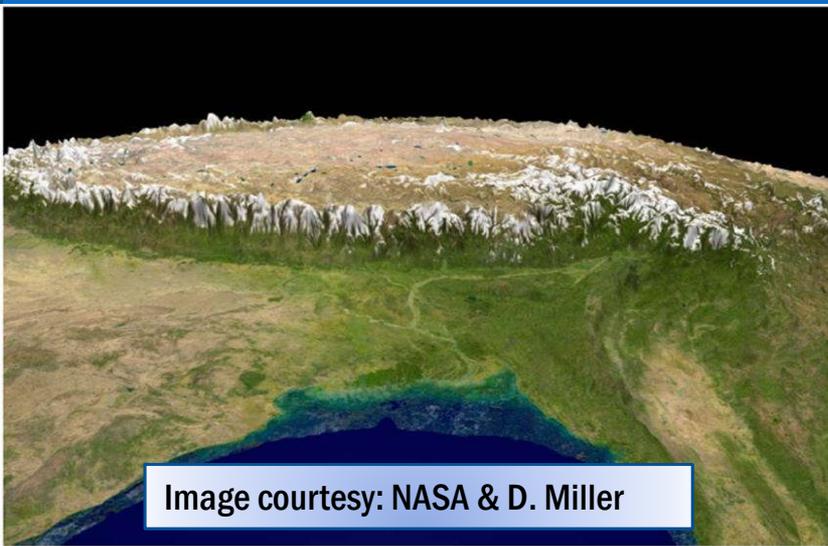
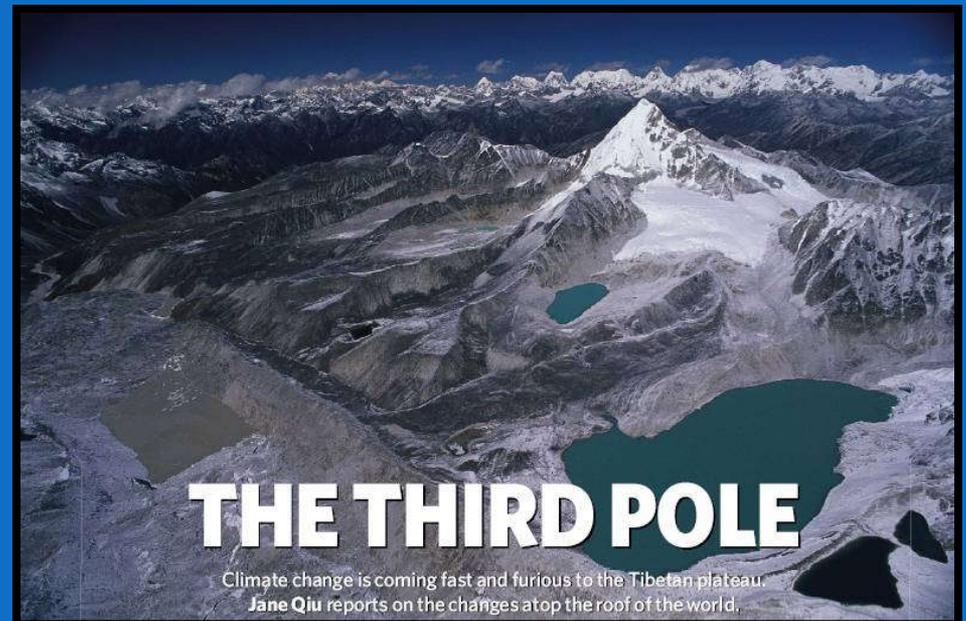
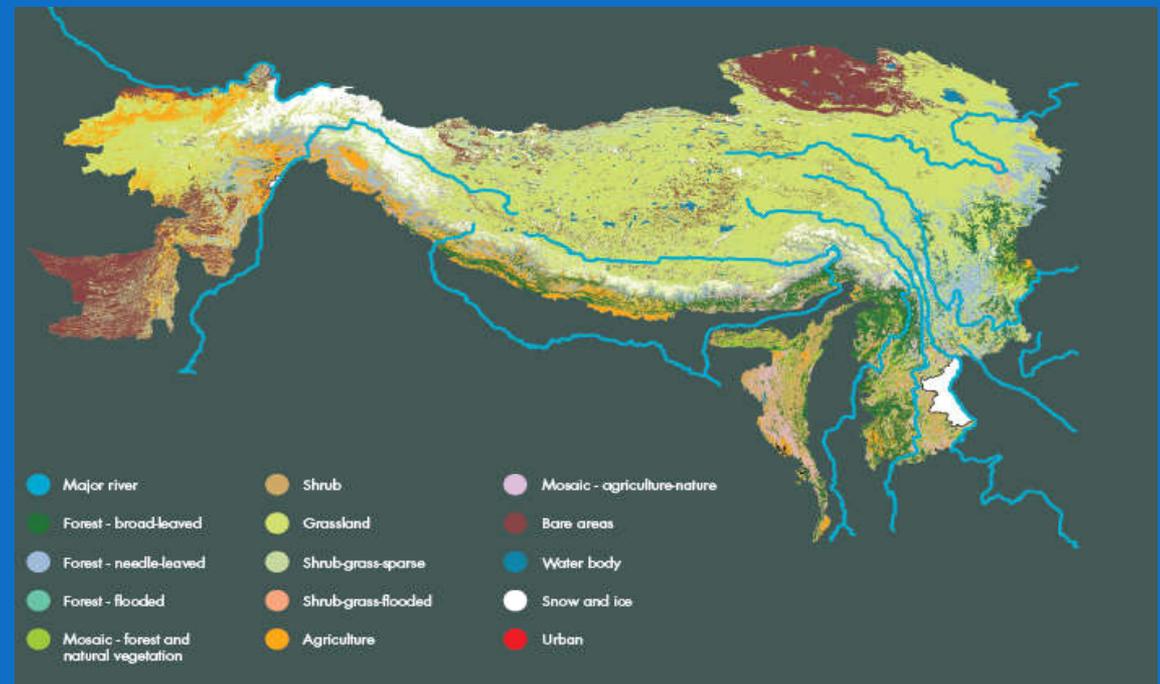


Image courtesy: NASA & D. Miller



- ❖ Tibet is referred to as 'The Water Tower of Asia'
- ❖ The major Asian rivers originating from its plateau, these rivers, *Yarlung Tsangpo* (Brahmaputra), *Macha Khabab* (Ganges) and *Sengye Khabab* (Indus River), (Sutlej River) *Langchen Khabab*, *Drichu* (Yangtze), *Machu* (Yellow), *Zachu* (Mekong).



total drainage basin
area: Above 5.6
million sq. Km

Overview of Himalayan Ecosystem:

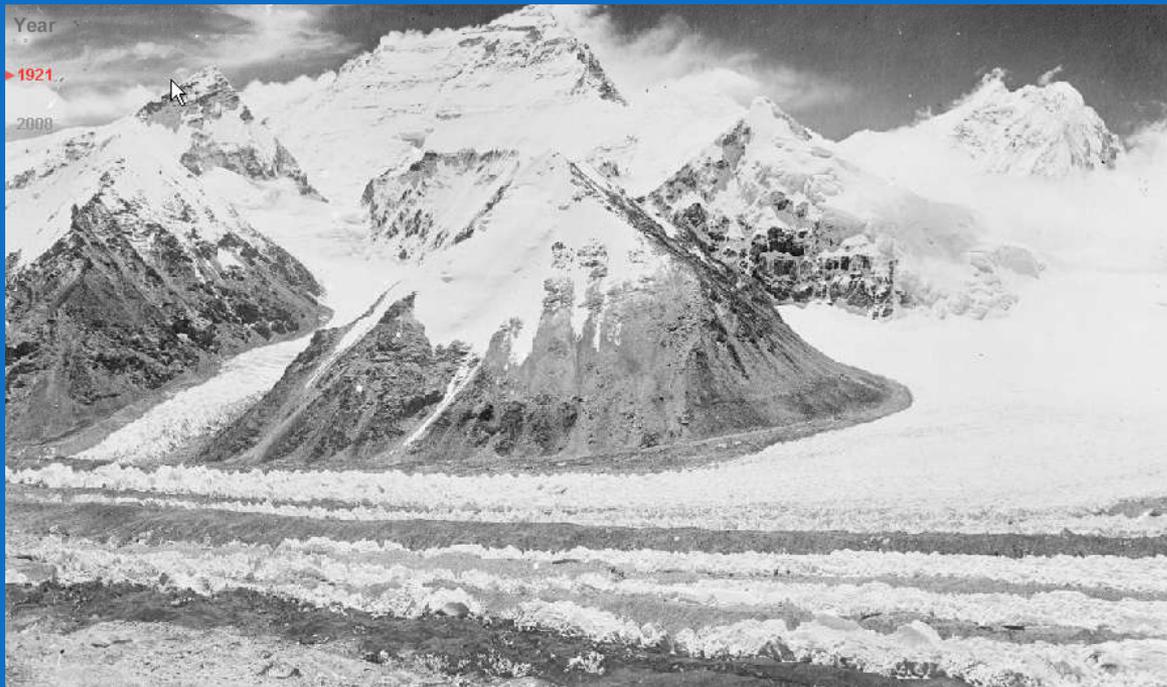
- ❖ The people living in the Himalaya make the highest mountains range on earth unique both ecologically and culturally.
- ❖ The people living in the Himalayas, belong to diverse geopolitical zones such as Tibet, India, Pakistan, Nepal and Bhutan.
- ❖

Hindu Kush Himalayan Ice Sheet:

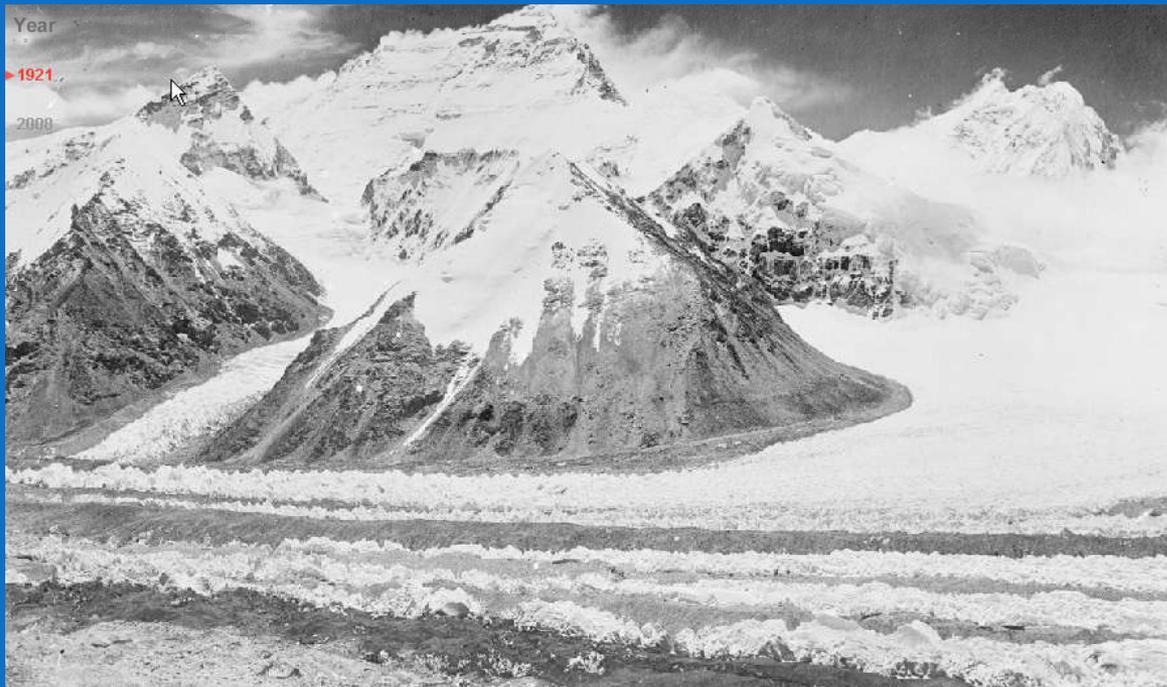
- ❖ The Himalayan mountain belt is home for 14 highest peaks and it covers over fifty mountains.
- ❖ The Himalayan range is bordered on the northwest by the Karakoram and Hindu Kush ranges, on the north by the Tibetan Plateau and on the south by the India-Gangetic Plain.



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- ❖ Himalaya is a source of numerous life-giving perennial rivers that have sustained / is sustaining such as rich civilization and are the basis of the life support of the almost half of humanity
- ❖ Himalaya has rich diversity of flora and fauna due to these life-giving perennial rivers and it contains the third-largest deposit of ice and snow in the world.



Tibet and Himalaya is rich in medicinal plants:

❖ Tibet and Himalaya is home to many of flora and fauna adapted to the alpine temperate climate or cold climate and high elevation regions, and it is rich in biodiversity of flora and fauna coexisting in peace and harmony for centuries in their natural habitat without hindrance by modern disturbances.



- ❖ Classical Tibetan medical texts mention more than 3,000 medicinal ingredients used to treat various diseases.
- ❖ A Flora of Xizang, the Tibetan Autonomous Region of Tibet, survey and researched by a group of Tibetan physicians and scholars found more than 6,000 plants stretching from the north to Mongolia and beyond, and eastwards to Sichuan and Yunnan, north-west to Ladakh, and north-east towards Nepal and the Trans-Himalayas of India.

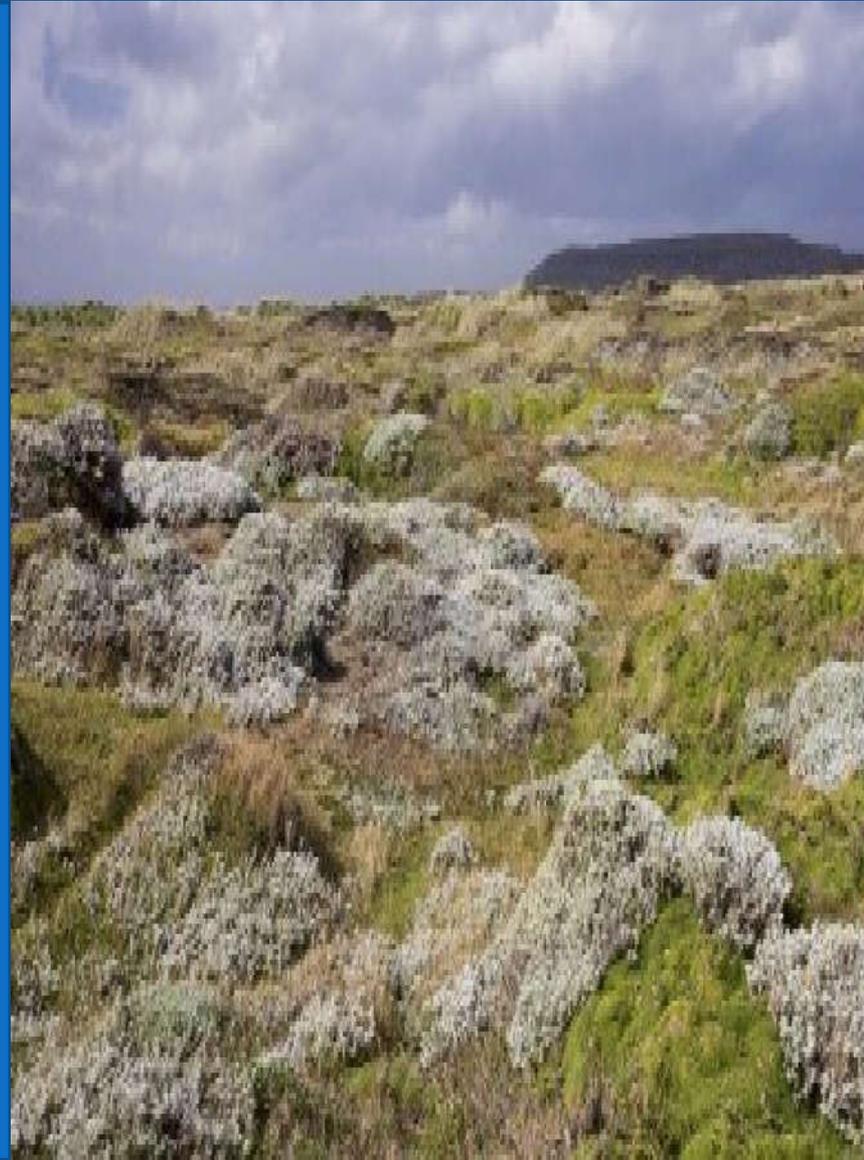


The Important Various Vegetations Occurring in Tibet and Trans-Himalayans belts:

1. Cold Steppes Vegetation
2. Pastoral Semi-desert Vegetation
3. Giant *Kobresia* Bogs Vegetation
4. Alpine Cushion Vegetation
5. Conifer Forests Vegetation
6. Birch Forests Vegetation
7. Subalpine Herb Meadows Vegetation
8. Alpine Screes Herb vegetation
9. Boulder Slope Herb vegetation
10. Alpine Humid Pasture Vegetation
11. Dwarf Scrub Vegetation
12. Montane *Caragana-Artemisia* Scrub Steppes Vegetation
13. Cold Desert Vegetation

Cold Steppes Vegetation:

❖ The vegetation in places of West Tibet like *Jhang-Thang*, with large-scale pasture, is related to cold steppe vegetation. The vegetation is characterized by a very short life cycle due to the cold summer. Precipitation is very low, and is mostly concentrated in summer. The plants that grow in cold steppes have soft leaves, and are often woody semi-shrubs which are spread loosely across the landscape. The vegetation is predominated by tussock grasses. These steppes are good grazing grounds for domestic animals such as yak and sheep. However, this vegetation is a very poor hunting ground for the collector of the medicinal plants



Cold Steppes Vegetation:

The vegetation is strongly dominated by pasture weeds, and contains quite a few important medicinal plants such as *Stellera* and some other species, in particularly Leguminosae of the genera *Astragalus*, *Oxytropis* and *Thermopsis*. The vegetation is scarce and patchy due to the impact of animals. It is colonized by short-life plants such as members of the Boraginaceae, whose bur-fruits and seeds are transported by animals



Alpine Humid Pasture Vegetations:

This vegetation type consists of meadows of rich tall as well as small herbs, with medicinal plants such as *Iris* spp. and *Phomis*. The vegetation is affected by increased grazing on these meadows, which are then transformed into grassland with patches of the most unpalatable and resistant herbs like *Iris* spp. In this short-grass vegetation, low-growing and creeping plants such as *Lagotis* spp., some *Gentiana* spp. and *Cyanathus* spp. occur in large amounts. Some of the more tender *Pedicularis* species also find a suitable habitat in these areas.



Alpine Scree Herb vegetation:

Scree slopes are Typical natural habitat of mountain and their common characteristic is that plants are constantly in danger of being damaged and covered by debris falling from cliffs above, plant such as *Rheum nobile*.



Cold Desert Vegetation:

- ❖ The western and northern regions of Tibet are cold desert regions.
- ❖ In India, the trans-Himalayan zones fall under this category, i.e. Ladakh in Jammu & Kashmir, and Lahual and Spiti in Himachal Pradesh, as well as very small pockets in Garhwal in Uttar-Kashi with similar climatic conditions.



Depletion of Tibet and Himalaya Vegetation Due to Causes by Climate Changes and Global Warming

- ❖ A natural wealth of flora in the alpine and high altitudes regions particularly in Outer and Inner Himalayans belt, home for many plants species are depleting due to the alarming rate of unseasonable weather events and global warming on the planet.
- ❖ The unseasonable weather events and global warming not only affect the alpine temperate vegetation but also Tropical and sub-Tropical vegetations.
- ❖ As a result some regions in the high-altitudes areas have become a barren desert.

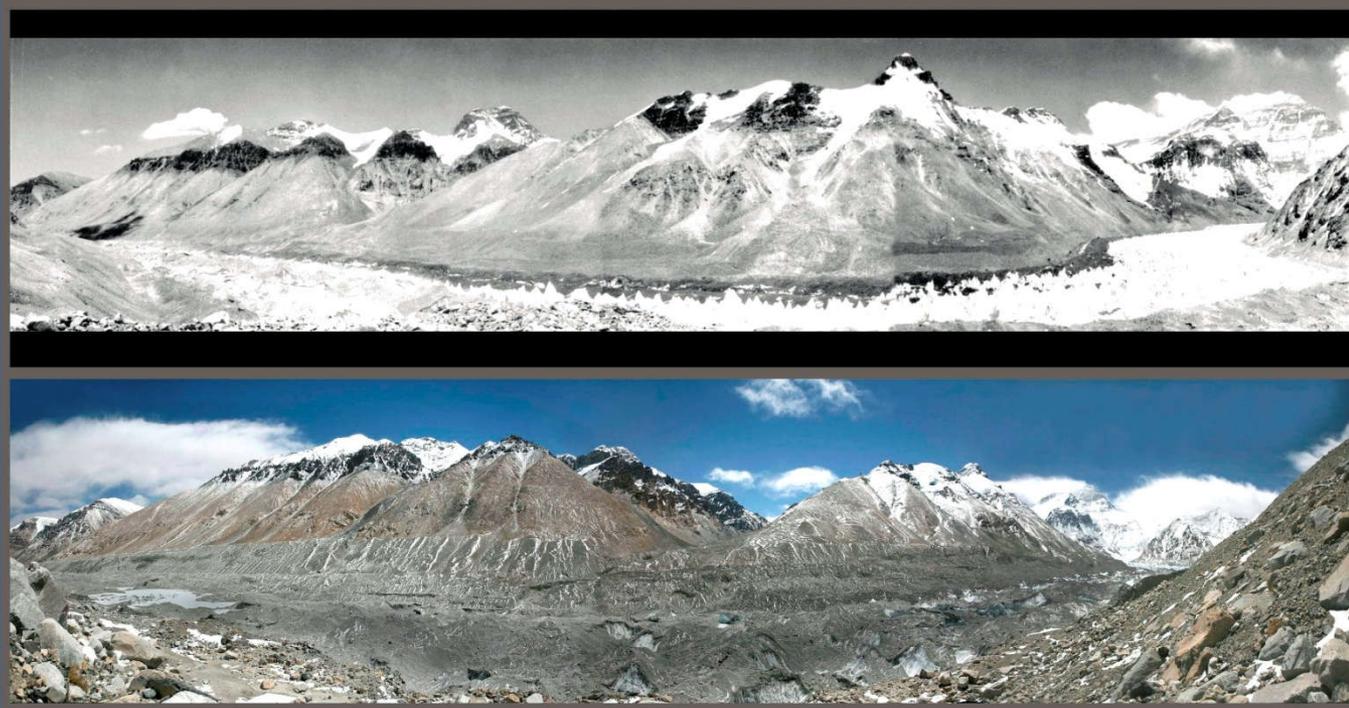
Degradation of Himalayan plants is Caused by the Following Factors:

Unfortunately, much of the flora and fauna existing in the alpine temperate and high altitude regions as well as lower tropical and sub-tropical vegetations is decreasing due to:

- | | |
|--|---|
| <ul style="list-style-type: none">❖ Deforestation,❖ Tourism and trekking parties❖ Over-exploitation,❖ Unseasonable weather events,❖ Pollution,❖ Over grazing,❖ Fire, | <ul style="list-style-type: none">❖ Floods,❖ Drought,❖ Disease❖ Destruction of habitat because of industrialization,❖ Urbanization,❖ Roads and❖ Water reservoirs constructions. <p>The consequence is that some important and valuable medicinal and aromatic plants are becoming rare and scarce in their natural habitat.</p> |
|--|---|

Climate Change Impacts:

Glacial Retreat on the TIBETAN PLATEAU



(NASA, 2010).

20 percent of Tibetan glaciers have retreated in the past **40 years** and if the current trend continues, more than **60 percent** of the existing glaciers could be gone in the **next 40 years**

Climate Change Impacts:

Glacial Retreat (RONPUG WEST)



1921



1921



2008

Picture courtesy: RGS



2008

Climate Change: Permafrost Degradation or Loss of Carbon Sinks from Degraded Grassland (Herbal Pasture):



Thaw slump started in the early 1990s and has **not stabilized yet**.

Permafrost Degradation: Desertification



Desertification near Matoe © EDD/ DIIR & Dechen



Desertification near the head regions of Senghe Khabab - Indus River © EDD/ DIIR

Climate change impacts on Floral and Faunal Species

Name of the Plant Species

Observed impact

Medicinal Plants:

Flowering and fruiting period advanced

ଋ *Meconopsis aculeata*

ଋ *Carum carvi a*

ଋ *Allium humile*

ଋ ଐ *Hippophae rhamnoides*

ଋ ଐ *saussurea obvallata*



Climate change impacts

Plant species above snow line :

ଝ *Rannunculus lobatus*

Expanding limited

ଝ (ଝ) ଝ *saussurea gnaphalodes*

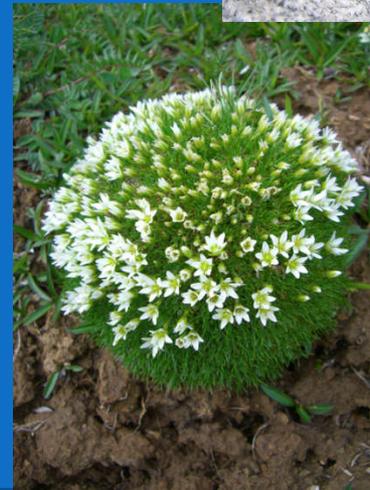
ଝ *Corydalis meipholia*

ଝ ଝ *Saxifragas mucronulata*

ଝ *Leontopodium fimbriigerum*

ଝ *caragana versicolor*

ଝ ଝ *oxytropis lapponica*



Climate change impacts

Tree Species at Timber line:

☞ Taxus baccata

Abies pindrow

Picea smithiana

Cedrus deodara

Pinus wallichian

Reduction in regeneration

Climate change impacts

Wildlife: Mammal Species:

Barasingh (Swamp deer)

Sambar , *Bhalu* (Bear)

Kakar (Barking deer)

Bagh (leopard)

Tendua (Tiger)

Safedbagh (Snow leopard)

Reduction population

Impacts of climate Change on People's livelihood in high regions:

The people living in high altitudes regions dwelled on some cash crops such as wheat, barley, mustard, oat and pea and potato, beans and radish, fruits such as apple, apricot and walnut. They also grow medicinal plants such as *Saussurea lappa*, *Inula racemosa*. Despite the harsh climates they very much depend on these stuffs for many years and sustaining their lives. The recent scenario these local communities are facing lots of challenges in their livestock and livelihoods due to climate changes and global warming threatening to their survival. During the last nearly two decades my medicinal field trips to alpine high altitudes areas, I had had numerous contacts and interaction with these local inhabitants about the alpine vegetations and ecosystem and their lives. Especially I was fond of asking about climate changes and how its impact to their livelihood. I do remember local old women age of 70s at Nubra valley “I grow potato as a cash crop which has failed completely these last few years due to rain failure. But this year I lost my house and agricultural land in the flood. Only God can help us now from dying.”

Aconitum heterophyllum Wall.ex.Royle



Aconitum sp.

ལྷོ་མཚོ་ *Meconopsis aculeata* Royle



ལྷོ་མཚོ་ *Meconopsis horridula*



Santalum album L.



Pterocarpus santalinus L.f.



३

Inula racemosa Hook.f.

३१

Saussurea costus (Falc.) Lipsch
/lappa (Decne.) Sch. Bip.



From the beginning of 1998, Men-Tsee-Khang has taken initiative in the project on cultivation and conservation of rare and endangered medicinal plants.

1) **Sonada in Darjeeling (West Bengal),**

2) **Agling in Ladakh,**

3) **KITPI in North-East of India and Pradesh)**

4) **Choundra So-wa Rig pa in (Himachal Pradesh)**



Sonada in Darjeeling (West Bengal), this site was first initiated pilot cultivation program since 1998, the inception of cultivation programs. In this site cultivated such as *Inular racemosa* and *Meconopsis sp.* *Berberis asistata* & *Saussurea lappa*.



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Agling in Ladakh, (15000sq ft) this site has been initiated five years before and the cultivated some of rare and endangered high altitude medicinal plants.



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Thank You