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Inside the Issue ....

Highlights of this issue

1- Total seventeen participants and ten resource persons were participated in this workshop

2- Field sampling and data collection methods of vegetation assessment and plant identification were explained to researcher

3- During the field survey 35 Pteridophytes, 27 Lichens and 49 species of Bryophytes were recorded and identified by the participants

4- In the high altitude forest *Quercus semecarpifolia* was recorded dominant and *Rhododendron arboreum* as co-dominant species

Lower Plants of High Altitudes of Western Himalaya

Vegetation Assessment, Collection and Documentation of Foristic Elements (Higher and Lower Floral Groups)- Brief Report of a Field Workshop

The Himalaya is warming 2-5 times more than global average rate and the degree of temperature rise increases with altitude leading to glacier shrinkage and upward movement of many species and communities. Shift of timberline is mainly reported. Generally, timberline defined as the high-altitude limit of forests is highly sensitive zone to temperature change and often considered as an indicator of climate change. The importance of timberline, apart from being climate change indicator, is realized as provider of ecosystem services, such as medicinal plants, grazing site for migratory livestock, snow melt water fed springs and religious and adventure tourism. More importantly it harbours many unique assemblages of plants and animals. Therefore, timberline needs to be investigated thoroughly for the identification of effective indicators of climate change and to know the distribution range of timberline over the Himalaya region.

Under the Indian Himalayan Timberline project (funded by NHMS) entitled, "*Timberline and altitudinal gradient ecology of Himalayas and human use sustenance in a warming climate*", a field-based workshop titled "Vegetation assessment, collection and documentation of floristic elements- Higher and lower flora" was organized by Centre for Biodiversity Conservation and Management (CBCM) of G.B. National Institute of Himalayan Enviornment (GBP-NIHE) during 20-25 September, 2020 at the project site Chopta-Tungnath treeline ecotone falling in Chamoli and Rudraprayag Districts of Uttarakhand. The objective of this field workshop was to fulfill the targets of this project also to build capacity and skills of young researchers. Thus over twenty researchers were selected from the regional universities/institutions and a couple of resource persons from Botanical Survey of India, northern regional circle, Dehradun,

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The **"ENVIS Centre on Himalayan Ecology"** collects, collates, compiles and builds quantitative and qualitative databases of information in the fields related to the Himalayan Ecology. The information is disseminated regulary via online as well as hardcopies to several valuable stakeholders and various users such as DICs, universities, institutions along with other ENVIS Centres across India to support overall Environmental Information System in India.

Editor's Note

I am pleased to share the 17th volume of ENVIS- Newsletter published by the Institute that covers proceedings of a Field Workshop organized by Center for Biodiversity Conservation and Management (CBCM) at Chopta-Tungnath timberline region of Garhwal Himalaya involving subject experts of lower plant groups and trainee researchers from regional Universities / Institutions under NMHS-IHTP project. In the recent years timberline and treeline ecotones have become a focus of research due to its sensitivity to climate change impacts. The significance of this zone apart from climate change indicator is in provisioning of a range of ecosystem goods, such as medicinal plants, grazing site for migratory livestock etc. Often in such investigations lower plant groups are ignored those are in fact the potential bio-indicators of such climate change induced changes. An article on sighting of wild animals during Covid-19 period, those were otherwise of rare occurrence during normal years gives an indication that wildlife not necessarily move upward as an impact of climate change but to escape from anthropogenic disturbance in the lower altitudes. This Newsletter contains details of field exercises and checklist of lower group of plants (Pteridophytes, Bryophytes and Lichens) recorded during the field work by the team of researchers under the supervision of experts. The participants were quite enthusiastic to learn various field methods of vegetation assessment, plant collection, identification and plant preservation and built their capacity during the workshop. While facing the current situation of Covid-19 pandemic and lockdown including various social restrictions, it's a matter of appreciation that CBCM successfully conducted the field workshop in which 27 participants and resource persons participated. At the end of the Newsletter affiliation, contact details and views of the participants are given that adds value to this document. This publication will encourage the young researchers to take up similar task in plant biodiversity research particularly on lower plant groups.

R.S. Rawal

Wildlife Institute of India, Dehradun, Kumaun University, Nainital, GBP-NIHE and IHTP project PIs participated in this workshop involving both lectures and field work (Annexure-I).

Inaugural Session: In the inaugural session of the workshop, Dr. G.C.S Negi, Scientist, GBP-NIHE & Nodal Person, IHTP welcomed all the resource persons and participants and briefly mentioned the project activities and presented outlines and objectives of the workshop. Expert from Botanical Survey of India, Northern Regional Center Dehradun, Dr. B.S. Kholia (expert of Pteridophytes) explained about the Pteridophytic flora of Himalaya and mentioned that this region is yet to be explored fully for lower plants. He highlighted the scope and importance of research work in lower plant groups. Dr. Manish Tripathi (Lichen expert) from S.S.J. Campus, Kumaun Univesrity, Almora and Ms. Manisha Bhandari (Bryophytes expert) from Mahila Degree College, Haldwani briefly introduced the basic concepts and need of lichen and bryophyte assessment in field based studies and their importance in plant kingdom. Later on all the participants introduced themselves and area of their research work and usefulness of this field workshop for their career. In his inaugural remarks Dr. R.S. Rawal, Director GBP-NIHE and PI of vegetation component of IHTP project briefly explained about the opportunities on field-based research work (i.e. ecology, taxonomy, phenology, qualitative and quantitative research etc.) and importance of the research work on lower plant groups. He underlined that such type of training/ workshops provide opportunity direct interaction with nature and learning from each other. He encouraged the participants to take full advantage of this field workshop and the experts of lower plant groups (Fig. 1 a & b).

Fig. 1 (a & b) Inauguration session and address of Dr. R.S. Rawal (Director, GBP-NIHE) during the session

The inaugural session was followed by a trekking to Chopta-Tungnath treeline zone. During the field work Prof. S.P. Singh, FNA and Project Coordinator, IHTP addressed the participants through video call and boosted moral of trannies to contribute to the Himalayan research and work with new ideas in field based studies as the Covid pandemic situation has changed the life style and working behavior of all of us.

Dr. R.S. Rawal explained to the participants at the timberline zone of Bhujgali (on way to Tungnath) about the terminologies - Subalpine, Timberline, Treeline, Alpine zones and described about the vegetation and significance of these zones particularly under the influence of climate change. He also explained about the altitudinal changes and its influence or impacts on microclimatic conditions, vegetation patterns and the pastoral movements and impacts of anthropogenic activities in the high altitude forests and alpine meadows as well (Fig. 2 a&b).

Delivering Module-1 of the training workshop, Dr. Pradeep Singh, GBP-NIHE explained

Fig. 2. (a). Prof. S.P. Singh (Coordinator, IHTP project) addressing to participants on telephone/speaker, (b). Dr. R.S. Rawal briefing about timberline, treeline and alpine zones and vegetation types of these zones

in details about the significance of phenological observations in plants particularly in the context of climate change and the sensitivity of treeline. Taking example of two important treeline species Rhododendron campanulatum and Abies spectabilis, he briefly described about timing of flowering, fruiting, budding, leafing, senescence etc. and also demonstrated the methods

Fig. 3. (a). Field demonstrations on phenological measurements by Dr. Pradeep Singh

and measurement of phenophases along with the information about the use of instruments for recording climate data (i.e. soil moisture meter, Kestrel 4000NV pocket weather meter etc.). This deliberation was supplemented by Dr. G.C.S. Negi, who is looking after the phenology component of IHTP project and responded to the questions of the participants. Thereafter Mr. Rahul Kumar from Wildlife Institute of India, Dehradun explained about the phenological assessment of herbaceous flora of alpine grasslands (Fig. 3 a&b).

At this site an experiment on hydrology of the treeline has been setup by Dr. Rajesh Joshi, PI of the meteorology component of IHTP, which was explained to the participants by Mr B.S. Bisht. In this hydrological study (stem flow, crown flow and surface flow) of treeline species (*Quercus semecarpifolia*, *Abies spectabilies* and *Rhododendron campanulatum*) is being recorded. All the participants and resource persons then visited the famous, world's highest altitude Shiva temple (Tungnath).

In the post lunch session Dr. B.S. Kholia, Dr. Manish Tripathi and Ms. Manisha Bhandari along with participants trekked down from Tungnath to Chopta treeline and collected pteridophytes, lichens and bryophyte flora of alpine, treeline and timberline zones. They explained the methods of collection of plant samples, identification key and herbarium preparation to the trainees. After returning to base camp at Bhulkarn-Chopta a detailed discussion session on the day-1 activity was organized and the participants/resource persons revisited the day-long activities and responded to the curiosities of participants on: (i) Terminologies and significance of timberline, treeline and alpine region, (ii) Phenological assessment of tree and herb species, and (iii) Fern, bryophytes and lichens of timberline to alpine zone.

Day-2 (Activities- sampling and assessment of lower plant groups (i.e. Bryophytes, Pteridophytes and Lichens)

Day-2 began with briefing of Day-1 activities by one of the participants at the base camp before moving to field site at 08:30 am. The module and activities of day-2 was followed by dividing trainees into three groups i.e. Pteridophytes, Lichens and Bryophytes, and each group was rotated during the field work so that each of the participants could attend all the plant groups.

Two altitudinal transects (Mandal-Dhotidhar, 2411-2814 m asl and Pothivasa-Dugalbhitta, 2115-2331 m asl) located in two different aspects (SW and NW), respectively were selected for collection, identification and habitat specific details of the lower plants. The resource persons imparted detailed training on collection and identification methods on these three groups of lower plants to the participants. A belt transect (50 m x 20 m) approach was followed for the detailed field work for exploration of the lower plants. Belt transects were laid at three different altitudes roughly with an interval of 200 m asl across both the SW and NW altitudinal transects. At places population density of the plants was counted across these sites.

Dr. B.S. Kholia (Pteridophyte expert) explained and demonstrated various key points used to identify the pteridophytic flora particularly ferns (Fig. 4 a&b). Dr Manish Tripathi (Lichen expert) (Fig. 4c) and Ms. Manisha Bhandari (Bryophyte expert) (Fig. 4d) explained basic methods of collection, enumeration and identification of lichen and bryophytes, respectively, and also highlighted that the habitat and substrate (where species are growing) play a key role in species distribution and identification. Habitat based classification of Lichens such as species growing on barks known as corticolous, those growing on rock known as saxicolous lichens etc. Moreover plant specimens of

Fig. 4. (a, b, c & d). (a & b) Dr. B.S. Kholiya explaining about the collection, identification and herbarium preparation of Ferns, (c). Dr. Manish Tripathi explaining field sampling of Lichens, and (d). Ms. Manisha Bhandari demonstrating sampling of Bryophytes on a tree trunk

each lower groups were collected by trainees under the supervision of resource persons and methods of preparation of herbarium specimen for authentication were explained by the experts. Also precautions in field based studies for lower plant groups were also explained to the participants.

While returning back to base camp participants also visited the HAPPRAC (high altitude plant physiology research center) field station located at Pothivasa. In the evening participants prepared list of all lower plant groups collected by them and consulted with the experts for any doubts and botanical names of these plants. Later on senior researchers Dr. Pradeep Singh, Mr. Ripu Daman and Mr. Rahul Kumar (all associated with IHTP) interacted with the participants and summarized the day-long learning's on: (i) Sampling and identification methods of pteridophytes, (ii) Sampling and identification methods of bryophytes, and (iii) Sampling and identification methods of lichens and preparation of day-3 activities.

Day-3 (Activities- Phytosociological assessment of forest and grassland)

The day-3 started with the briefing of day-2 activities by one of the participants, after that participants were divided into two groups (rotation) forests and alpine grassland. The Shawkharak area (3075 m asl) was selected for phytosociological assessment of grassland and forests. The phytosociological assessment of trees and herbs of alpine region was handled by Mr. Rahul Kumar, WII, whereas phytosociology

of forests was handled by Dr. Pradeep Singh, Mr. Vinod Joshi and Mr. Sahil Joshi of GBPNIHE. All the participants learned about the basic sampling methods of forests and grasslands assessment by quadrat method (Fig. 5).

In case of alpine grassland, species area curve method was explained to the participants and vegetation assessment was made using three quadrats of 1x1 m size. Participants counted species numbers and density in these quadrats. The experiment on effect of snow melt on growth of herbs (setup by WII under IHTP), Dehradun at this site was also explained to participants. In the forests phytosociological studies involved three, 10 x 10 m quadrats. In these quadrats participants measured CBH, species listing, differentiation between

Fig. 5. a & b. Field sampling and ecological assessment of grassland flora, (c) ecological assessment of forests, and (d) CBH measurement of trees

tree, saplings and seedling, grasses and sedges, regeneration etc. Also they learned the methods of specimen collection and herbarium preparation for identification and authentication. Further after reaching base camp all the participants compiled the collected phytosociological data and learned the basic analysis such as calculation of density, frequency, TBA, IVI etc. In the timberline forest, *Quercus semecarpifolia* was dominant species (IVI- 165; density- 475 ind./ha and TBA- 58.2 m^2/ha) and *Rhododendron arboreum* as co-dominant (IVI- 103.28; density- 525 ind./ha and TBA- 15.4 m^2/ha) and total tree density and TBA was recorded 1050 ind./ha and 77.4 m^2/ha, respectively at Shawkharak forests. The total shrub density was recorded 175 ind./ 25 m^2 area. While sapling and seedling density was recorded 425 and 250 ind./ha, respectively. Herb density in the grasslands was recorded 86.8 ind./ 1 m^2. All the plant species found at these sites (lower and higher plants) were also listed by the trainees.

During the discussion session, participants were explained about basic sampling methods, designs and techniques used in ecological assessment of higher taxa i.e. random, stratified and systematic random, types of vegetation sampling methods and difference between belt, altitude and line transects. Following are the main points of learning's from day-3 workshop: (i) Phytosociological assessment of herbs, grasses and sedges; (ii) Phytocosiological assessment of forests (trees, saplings and seedlings); (iii) Herbarium specimen collection of higher plant groups; and (iv) Difference between grasses and sedges.

Day-4 (Activities- Nature Interpretation at Deoriyatal)

The day began with the briefing of Day-3 activities, and explaining the commonly used terminologies in field work such as slope, aspect, altitude, elevation, catchment, basin etc. This day was devoted for interaction with nature by researchers at a high altitude lake Deoriatal (2438 m asl.) surrounded by the beautiful dense canopy forests of *Quercus semecarpifolia*. This natural lake is also a part of Kedarnath Wildlife Sanctuary. While trekking to Deoriatal the participants observed the interaction of Sari village people with timberline vegetation/ecosystem for their alpine pastoral livelihood. At this site a feedback session was organized wherein all the participants filled their feedback forms. Further after reaching back to the base camp (Bhulkarn-Chopta) the closing session was organized in which the resource persons and participants shared their experiences about the training and discussed the learning's of this programme. During this closing session it was summarized that during the field work a total of 35 species of pteridophytes, 27 species of lichens and 49 species of Bryophytes were recorded. Site-1 (Mandal forests, SE aspect; 2114 m asl) was particularly rich in Pteridophytes (20 spp.), Site-4 (Pothivasa forests; NW aspect; 2107 m asl) was particularly rich in Lichens (14 spp.) and site-2 (Kanchulakharak; SE aspect; 2428 m asl) was particularly rich in Bryophytes (40 spp.). A detailed article on the findings of this field workshop written by the participants is given in this issue. At the end certificate of participation to all the participants were distributed by Dr. G.C.S. Negi.

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Lower Plants of Tungnath-Chopta Timberline Zone, Garhwal Himalaya

Lower group of plants (i.e. ferns, mosses, liverworts and lichens) are the oldest organisms on earth, and they play important role in ecosystems as primary producers and as nutrient and water recyclers. These differ from each other with respect to several ecological and physiological features including dispersal by spores rather than seeds, mobile male gametes (ferns, bryophytes), and poikilohydry (lichens, bryophytes, filmy ferns). Because of this, these taxa often have similar abiotic requirements, and usually require high air humidity, and may abound in the same habitat such as humid montane forests. Field identification of bryophyte and lichen species is often difficult to determine, however, and requires time-consuming work in the laboratory. The present study describes the variation in species richness and other community characteristics of lower group of plants i.e., Pteridophytes, Bryophytes and Lichens of Tungnath region in the Garhwal Himalaya. Finding of this study is an outcome of a "Field Workshop" organized by the CBCM, GBPNIHE involving experts of lower plant groups and research scholars of various regional Institutions (please see details in Workshop Proceeding this issue).

Study area: This study was carried out in Chopta-Tungnath (N 30°29'–30°30' and E 79°12'–79°13') region of Garhwal Himalaya, India. Tungnath forms a part of Kedarnath Wildlife Sanctuary. Total six sites across a gradient of altitude (2100-2850 masl), aspect (NW and SW) and habitat type (dense forests to timberline and alpine meadow) were selected for this study in September 2020 (Table 1). The rocks around Tungnath are mainly mylonitized gneisses, augen gneisses, schists and granites constituting Munsiari formation (Agarwala 1973). The soil texture is sandy loam, light grey to brown in colour and acidic in nature with a pH range between 4 and 5 (Rai *et al.*, 2012a). In the higher reaches of Tungnath the snow cover lasts for about 4–5 months and melts during April–May that marks the arrival of favourable conditions for plant growth, which lasts for about 5–7 months. Mean Annual temperature at the Tungnath timberline ecotone (3300m) ranges between -8.91 (January) and +25.6°C (May) with an average of 6.65±0.68°C. Mean temperature of the warmest month was 12.56±1.23°C, in July. Annual precipitation was 2410.5±432.2 mm, of which 89.5%, recorded during June–September (Adhikari *et al.*, 2011). Forest types and vegetation according to Champion and Seth (1968) classification in the study area falls in sub-alpine forest and alpine scrubs.

Vegetation of the sub alpine forests is formed by *Abies pindrow, A. spectabilis, Betula utilis, Quercus semecarpifolia, Acer* spp., *Sorbus* spp. etc. Timberline in the study area ranges between 3250–3350 m, which is formed by *B. utilis* and *A. spectabilis* in the north to north-west facing slopes, while south to south west facing slopes are dominated by *Q. semecarpifolia* and *R. arboreum* (Rai *et al.*, 2012b). A list of dominant tree species in the study area is given in Table 1.

Table 1. Location and vegetation types of studied elevation transect of Chopta-Tungnath timberline

Site	Location	Elevation (m.asl.)	Aspect	Dominant forest vegetation
1	Mandal	2414	SE	*Q. semecarpfolia, Q. floribunda, Lyoina ovalifolia, R. arboreum, Ilex dipyrena, M. duethi*
2	Kachulakharak	2428	SE	*Q. semearpifolia, Alnus nepalnesis, R. arboreum, Litsea umbrosa*
3	Dhotidhar	2718	SE	*Rododendron arboreum, Q. semecarpifolia, A. nepalnesis, L. ovalifolia, Q. floribunda*
4	Pothiwasa	2107	NW	*Betula alnoides, A. nepalnesis, Q. floribunda*
5	Dugalbitta	2370	NW	*Betula alnoides, Abies pindrow, Aesculus indica, Acer sp, Machilus sp.*

Methods: Survey and assessment of lower group of plants (Pteridophyte, Bryophyte, and Lichens) was carried out by a group of 20 researchers from four regional organizations guided by experts (please see details in Workshop Proceedings) using a belt transect method (50m long and 10m wide) in the representative locations across six sites covering altitudinal interval (200m each), aspect (SE and NW) and forest vegetation type in Chopta-Tungnath timberline zone (Table 1). In each location, species richness, density and habitat specific details of Pteridophytes, Bryophytes, and Lichens were recorded, plant specimen were collected and preserved. The Bryophytes and Lichens were identified on the basis of morphological characters of thallus, reproductive structure, color, size and shape under the supervision of experts.

Diversity of Pteridophytes: Across the six sites, a total of 54 species of Pteridophytes were recorded and the species richness varied from 9-25 among these sites (Table 2). The maximum species richness (25) was found in Site I (Mandal) and minimum (9) at Site II (Kachulakharak). *Selaginella chrysocaulos* was the only species that occurred in all sites, however *Dryopteris panda, Oleandra wallichii, Lycopodium japonicum, Diplazium maximum, Aleuritopteris leptolepis, Araiostegia beddomei, Athyrium atkinsonii, Dryopteris khullarii, Drynaria mollis, Pichisermollia quasidivaricata, Pichisermollia stewartii, Polystichum nepalense* were present only at higher elevation sites (Dhotidhar/ Chopta). Among all the species *Dryopteris chrysocoma* and *Dryopteris juxtaposita* were present in five sites across the studied transects. Some of the prominent Pteridophytes are given in Fig. 1.

Fig. 1. Pteridophyte species of Chopta- Tungnath timberline zone

Table 2. List of Pteridophytes recorded from Chopta-Tungnath Timberline zone

S. No	Species	Site I	Site II	Site III	Site IV	Site V	Site VI
1.	*Adiantum venustum*	-	+	-	-	-	-
2.	*Aleuritopteris leptolepis*	-	-	-	-	-	+
3.	*Araiostegia beddomei*	-	-	-	-	-	+
4.	*Araiostegia pulchra*	+	-	-	+	+	+
5.	*Arthromeris wallichiana*	-	-	-	+	-	-
6.	*Asplenium ensiforme*	-	-	-	-	+	-
7.	*Asplenium trichomanes*	-	-	-	-	+	-
8.	*Asplenium laciniatum*	+	-	-	-	-	-
9.	*Asplenium yoshinagae*	-	-	-	+	+	-
10.	*Athyrium atkinsonii*	-	-	-	-	-	+
11.	*Athyrium foliolosum*	+	-	+	-	-	-
12.	*Athyrium pectinatum*	+	-	-	-	-	-
13.	*Athyrium micropterum*	+	-	-	-	-	-
14.	*Athyrium schimperi*	-	-	-	+	-	-
15.	*Botrychium lanuginosum*	+	-	-	-	-	-
16.	*Coniogramme affinis*	+	-	+	-	+	+
17.	*Coniogramme intermedia*	-	-	-	+	-	-
18.	*Deparia japonica*	+	-	-	+	-	-
19.	*Deparia subsimilis*	-	+	-	-	+	-
20.	*Diplazium maximum*	+	-	+	-	-	-
21.	*Dryopteris chrysocoma*	+	+	+	-	+	+
22.	*Dryopteris juxtaposita*	+	+	+	+	-	+
23.	*Dryopteris panda*	-	-	+	-	-	+
24.	*Dryopteris khullarii*	-	-	+	-	-	-
25.	*Dryopteris wallichiana*	+	-	+	-	+	+
26.	*Drynaria mollis*	-	-	-	-	-	+
27.	*Goniophlebium argutum*	-	-	-	+	-	-
28.	*Lepisorus mehrae*	+	+	-	-	+	-
29.	*Lepisorus sesquipedalis*	+	-	-	+	+	-
30.	*Lepisorus thunbergianus*	-	-	-	+	-	-
31.	*Loxogramme involuta*	-	-	-	+	-	-
32.	*Lycopodium japonica.*	-	-	+	-	-	+
33.	*Oleandra wallichii*	-	-	+	-	-	+
34.	*Osmunda claytoniana*	-	-	-	-	+	-
35.	*Onychium cryptogrammoides*	-	+	-	-	-	+
36.	*Pichisermollia quasidivaricata*	-	-	-	-	-	+
37.	*Pichisermollia stewartii*	-	-	-	-	-	+
38.	*Polypodiodes lachnopus*	+	-	-	+	-	+
39.	*Polypodiodes amoena*	-	-	-	+	+	-
40.	*Polystichum nepalense*	-	-	-	-	-	+
41.	*Polystichum squarrosum*	+	-	-	+	-	-
42.	*Polystichum stimulans*	+	-	-		-	-
43.	*Polystichum piceopaleaceum*	-	-	-	+	-	-
44.	*Polystichum manmeiense*	+	-	-	-	-	-
45.	*Pteris aspericaulis*	+	-	-	-	-	+
46.	*Pteris cretica*	+	-	-	-	-	+
47.	*Pteris terminalis*	-	-	-	-	+	-
48.	*Pteris wallichiana*	+	-	-	-	-	+
49.	*Pyrrosia porosa*	+	-	-	-	+	-
50.	*Pyrrosia flocculosa*	-	-	-	+	-	-
51.	*Selaginella chrysocaulos*	+	+	+	+	+	+
52.	*Thelypteris erubescens*	+	-	-	-	-	+
53.	*Thelypteris pyrrhorhachis*	+	+	+	-	+	-
54.	*Woodsia lanosa*	-	+	-	-	-	-

Diversity of Lichens: Across the six sites a total of 27 Lichen species were recorded. The species richness of Lichens varied from 5-14 among the sites, having maximum (14) at Pothivasa dense broadleaf forest (Site IV) and least (5) species at Site (I and VI). Most of the species belong to the foliose category of lichens. Based on the substrate type these species were categorized as corticolous (growing on bark) and saxicolous (growing on rock). *Heterodermia diademata, Lepraria* sp. and *Cladonia* sp. were recorded across maximum sites, whereas species such as *Bulbothrix* sp., *Dermatocarpon* sp, *Porpidia* sp, *Stereocaulon* sp. were confined to higher elevation zone. Similarly, *Phaeophyscia hispidula* and *Usnea longissima* were confined to low elevation sites only (Table 3). Some photographs of prominent Lichens are given in Fig. 2.

Table 3. List of Lichens recorded from Chopta-Tungnath timberline zone, Garhwal Himalaya (*Corti= Corticolous, Sexi= Sexicolous)

S. No	Species	Growth forms	Substrate	Site I	Site II	Site III	Site IV	Site V	Site VI
1	*Heterodermia sp.*	Foliose	Sexi.	-	-	-	-	+	-
2	*Heterodermia diademata*	Foliose	Sexi.	+	+	+	+	+	-
3	*Heterodermia boryi*	Foliose	Sexi.	-	+	-	-	+	-
4	*Parmotrema sp.*	Foliose	Sexi.	-	+	+	+	-	-
5	*Parmotrema reticulatum*	Foliose	Sexi.	-	-	-	-	+	+
6	*Caloplaca sp.*	Crustose	Sexi.	-	+	+	+	-	-
7	*Lepraria sp.*	Leprose	Sexi.	+	+	+	+	+	-
8	*Pyxine sp.*	Foliose	Sexi.	-	+	-	-	-	-
9	*Pertusaria sp.*	Crustose	Sexi.	-	+	-	-	-	-
10	*Bulbothrix sp.*	Foliose	Sexi.	-	-	+	-	-	-
11	*Dermatocarpon sp.*	Crustose	Sexi.	-	-	+	-	-	-
12	*Phaeophyscia hispidula*	Foliose	Sexi.	-	-	-	+	-	-
13	*Porpidia sp.*	Crustose	Sexi.	-	-	-	-	-	+
14	*Usnea sp.*	Fruticose	Cort.	-	+	-	-	-	-
15	*Usnea longissima*	Fruticose	Cort.	-	-	-	+	-	-
16	*Everniastrum sp.*	Foliose	Cort.	-	+	-	+	+	+
17	*Ramalina conduplicans*	Fruticose	Cort.	-	+	-	-	-	-
18	*Flavoparmelia caperata*	Fruticose	Cort.	-	-	-	+	-	-
19	*Punctelia sp.*	Foliose	Cort.	-	-	-	+	-	-
20	*Chrysothrix sp.*	Foliose	Cort.	-	-	-	+	-	-
21	*Flavopuncteia sp.*	Foliose	Cort.	-	-	-	+	-	-
22	*Canoparmelia sp.*	Foliose	Cort.	-	-	-	+	+	-

23	*Parmotrema tinctorum*	Foliose	Cort.	+	-	-	-	-	-
24	*Phaeophyscia sp.*	Foliose	Cort.	-	-	-	+	+	+
25	*Cladonia sp.*	Foliose	Cort.	+	+	-	+	+	-
26	*Stereocaulon sp.*	Foliose	Cort.	-	-	-	-	-	+
27	*Graphis scripta*	Foliose	Cort.	+	-	-	-	-	-

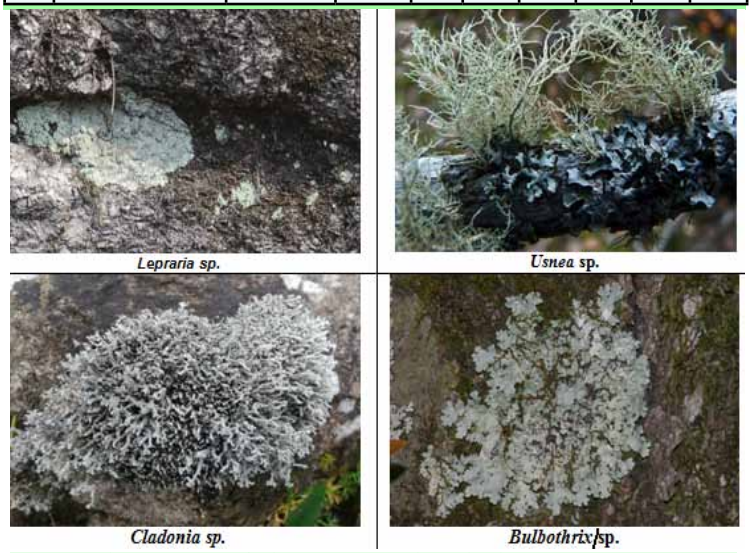

Fig. 2. Lichens species of Chopta-Tungnath timberline zone

Diversity of Bryophytes: Across the six sites a total of 51 species of Bryophytes, including 17 liverworts, 2 hornworts and 32 moss were recorded in the field (Table 4). Maximum species (43 species) were recorded along the Kachulakharak site that presented congenial landscape for the spread of bryophytes species and communities. 20 species (*Atrichum* sp, *Bryum* sp, *Dicranum* sp, *Entodon* sp, *Funaria* sp, *Herpetineuron* sp, *Mnium* sp, *Plagiothecium* sp, *Pogonatum* sp, *Thuidium* sp, *Anomodon* sp, *Chiloscyphus* sp, *Frullania* sp, *Heteroscyphus* sp, *Plagiochilla* sp, *Scapania* sp, *Pellia* sp, *Cyathodium* sp, *Conocephalum conicum*, *Marchantia polymorpha* were found common almost in all the study sites. Bryotaxa restricted to higher elevation sites were species of mosses viz., *Actinothuidium*, *Bryum*, *Rhacomitrium*, *Grimmia*, *Pogonatum* and hepatic like *Sauchia*, *Scapania*, *Bazzania*, *Plagiochilla* and *Herbertus* spp. Some photographs of prominent Bryophytes are given in Fig. 3.

Fig. 3. Bryophytes of Chopta-Tungnath timberline zone, Garhwal Himalaya

Discussion: Species richness of the lower plants did not have a definite trend with altitude, however the lower altitude recorded greater number of species than the higher elevations (60 vs. 50) (Table 5). With increasing elevation up to timber line, the bryophytes' richness and luxuriance increased tremendously. Thalloid liverworts population occupied open exposed sites. However, with increasing altitude leafy liverworts and mosses dominate on diverse habitats. Due to prevalence of more or less similar habitat conditions above timberline, only alpine adapted bryotaxa dominated. Certain observations of Bryoflora made during the field work were: (i) The tree trunk and branches were loaded with the epiphytic hanging mosses; (ii) Fruiting population of a hair cap moss (*Pogonatum* sp.) adorned the rocky ledges almost in all the study sites; (iii) Fruiting population of one of the unique rare, monotypic, endemic, liverwort *Stephensoniella brevipedunculata* Kash. was recorded from limestone dominated rocky ledges on way to Dhotidhar to Shaukharak (2718-3025 m). Based on our current observations, it is interesting to highlight the occurrence and spread of *S. brevipeduculata* at higher altitudinal range up to 3000 m is a sharp indication of changing climatic condition as this eco-sensitive red list taxa earlier known to grow at an altitudinal range of 2000-2400m (Kashyap,1929; Pant and Tewari,1995).

Table 5. Pattern of lower plants across altitudinal gradients

Sites	Altitude (m. asl)	Pteridophytes	Lichens	Bryophytes	Total
Pothivasa	2107	17	14	34	65
Dugalbitta	2370	16	9	34	59
Mandal	2414	25	5	34	64
Kachulakharak	2428	9	11	43	63
Dhotidhar	2728	12	6	34	52
Chopta	2844	22	5	35	62

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Table 4. List of Bryophytes recorded from Chopta-Tungnath, timber line zone

S. No	Species Name	Habitat	Site I	Site II	Site III	Site IV	Site V	Site VI
1	*Actinothuidium hookerii (Mitt.)Broth.*	Sopes	-	-	+	-	-	-
2	*Anomodon minor (Hedw.)Lindb.*	Tree trunk	+	+	+	+	+	+
3	*Atrichum undulatum (Mull.Hal.) A.Jaeger*	Moist soil	+	+	+	+	+	+
4	*Brachythecium buchananii (Hook.) A. Jaeger.*	Stone	+	+	-	+	+	+
5	*Brothera leana(Sull.)Mull.Hal*	Rotten fallen log	-	+	+	+	+	+
6	*Bryum argenteum Hedw.*	Slopes, stone	+	+	+	+	+	+
7	*Bryum capillare Hedw.*	Tree bark	-	+	-	-	-	-
8	*Dicranum sp.*	Stone & bark	+	+	+	+	+	+
9	*Ditrichum heteromallum (Hedw.)Britt.*	Fallen logs	+	+	-	+	+	+
10	*Ectropothecium cyperoides (Hook. & Harv.) A. Jaeger*	Fallen logs	+	+	-	-	-	-
11	*Entodon plicatus Mull. Hal.*	Stone & bark	+	+	+	+	+	+
12	*Fissidens bryoides Hedw.*	Fallen logs	+	+	+	+	+	+
13	*Fissidens grandiforms Brid.*	Slopes	-	-	+	-	-	-
14	*Funaria hygrometrica Hedw.*	Retaining walls	+	+	+	+	+	+
15	*Grimmia sp.*	Rocks	-	-	+	+	+	+
16	*Herpetineuron toccoae (Sull.&Lesq.) Cardot*	Bark, tree trunk	+	+	+	+	+	+
17	*Neckera crenulata Harv.*	Tree bark	-	+	-	-	-	-
18	*Leucodon secundus (Harv.)Mitt.*	Tree bark	+	+	-	+	+	+
19	*Macromitrium moorcroftii (Hook.& Grev.) Schwagr.*	Fallen twigs & tree branches	+	+	-	+	+	+
20	*Meteorium buchananii (Brid.)Broth.*	Fallen twigs & tree branches	+	+	-	+	+	+
21	*Mnium integrum Bosch & Sande Lac.*	Tree base	+	+	+	+	+	+
22	*Philonotis sp.*	Moist rock	-	-	+	-	-	-
23	*Plagiothecium denticulatum (Hedw.) Schimp.*	Moist stone and sloppy soil	+	+	+	+	+	+
24	*Pogonatum microstomum (R.Br. & Schwagr.)Brid.*	Rocks boulders	+	+	+	+	+	+
25	*Pohlia camptotrachela (Renauld & Cardot)Broth.*	Slopes	+	-	+	-	+	-
26	*Racomitirium himalayanum (Mitt.)A.Jaeger.*	Rocks	-	-	+	+	+	+
27	*Rhodobryum roseum (Hedw.)Limpr.*	Tree bark	-	-	+	-	-	-
28	*Taxiphyllum taxirameum (Mitt.) M.Fleisch.*	Stone	+	+	-	+	+	+
29	*Thamnobryum fruticosum (Mitt.) Gangulee*	Tree bark	+	+	-	-	-	-
30	*Thuidium cymbifolium (Dozy & Molk.) Dozy & Molk.*	Forest floor, stone	+	+	+	+	+	+
31	*Trachypodopsis crispatula (P.Beauv.) M.Fleisch*	Tree bark	+	+	-	+	+	+
32	*Trematodon longicollis Michx.*	Rocks	-	+	-	+	+	+
Hornwort								
33	*Anthoceros himalayensis Kashyap*	Moist soil	-	+	+	+	-	-
34	*Anthoceros erectus Kashyap*	Moist soil	-	-	+	-	-	-
Liverworts								
35	*Asterella wallichiana Beauv.*	Rock & soil	-	+	-	+	+	+
35	*Cyathodium tuberosum Kash.*	Tree bark	+	+	+	+	+	+
37	*Conocephalum conicum (L.) Lindb.*	Slopes	+	+	+	+	+	+
38	*Marchantia polymorpha L.*	Retaining walls	+	+	+	+	+	+
39	*Plagiochasma appendiculatum Lehm. & Lindenb.*	Retaining walls	+	+	+	-	-	-
40	*Reboulia hemisphaerica (L.)Raddi.*	Slopes	+	+	+	-	-	-
41	*Stephnensoniella brevipedunculata Kash.*	Rocks	-	-	+	-	-	-
42	*Targionia hypophylla L.*	Slopes	+	+	+	-	-	-
42	*Apometzeria pubescens (Schrank)Kuwah.*	Slopes	+	+	-	-	-	-
44	*Pellia endiviifolia (Dicks)Dum.*	Slopes	+	+	+	+	+	+
45	*Chiloscyphus polyanthus (L.)Corda.*	Moist soil	+	+	+	+	+	+
46	*Frullania dilatata (L.) Dumort.*	Bark & rocks	+	+	+	+	+	+
47	*Heteroscyphus sp.*	Soil	+	+	+	+	+	+
48	*Plagiochilla spinulosa (Dicks) Dumort.*	Slopes, bark & boulder	+	+	+	+	+	+
49	*Porella denticulata (Kashyap & R.S.Chopra) J.X.Luo*	Tree bark	-	+	-	+	+	+
50	*Scapania sp.*	Tree bark & tree base	+	+	+	+	+	+
51	*Radulla complanata (L.) Dumort.*	Bushy branches	+	+	-	+	+	-

Reduced Anthropogenic Activities and Sightings of Rare Wildlife During A COVID-19 Lockdown Period in Tungnath

This Field Note is based on my visit to Chopta-Tungnath area during the IHTP field work 16-19 June 2020 (Covid-19 lockdown period). The findings of present article are based on a comparison between observations made during 2017-2019 (the field work of IHTP; Singh 2018), and after Covid-19 lockdown in June, 2020 following about three months of the absence of humans and their migratory livestock to Chopta-Tungnath trek to reach Tungnath temple beyond timberline (2500-3500 m asl). In this trek pilgrimage tourism activity is very high during May-June, as Chopta is on the way to Kedarnath shrine, which was visited by 7,31,991 tourists in 2018. Apart from biomass (fuelwood, fodder, NTFPs) collection by local communities, tourists, and those who run roadside restaurants to cater to the needs of travelers, livestock herders (goats, sheep and cattle) make this trek very busy and crowded during summer season. However, because of the pandemic, almost all the above activities stopped in 2020 since March, and even after lifting the lockdown, tourism did not start again and local people generally kept away from the Tungnath temple and the adjoining timberline areas. In the Covid-19 year pilgrims were almost absent in Tungnath temple, which in earlier years was visited by about 1000-1500 pilgrims during the summer. Similarly, only 3 tea shops/restaurants with only 10 workers were open in the Covid-19 year as compared to 43 shops/ restaurants with 60-65 workers during the normal years to cater to the visitors in the Chopta-Tungnath trek and temple complex. Also, number of local labourers was reduced to 8-10 from 30-40 in normal years. Collection/harvesting of fuelwood/fodder from the Tungnath timberline was drastically reduced as shepherds also avoided migratory grazing this year. In the Covid-19 year, only three livestock herds were present, that too only after June beginning, in place of 7-10 herds in normal years. Tourists and trekkers were almost absent, and forests were much greener than the normal years because of the absence of fuelwood and fodder collection. While surveying the Tungnath timberline in the Covid-19 year, it struck me by the presence of wild animals in a larger number at lower elevations than in normal years. Wild animals such as Thar (*Hemitragus jemlahicus*) occurred in a larger number and at a lower elevation (Fig. 4). Pit vipers (*Crotalus horridus*) were sighted in open areas near treeline, instead of among tall grasses and small crevices as in normal years. It can be pointed out that these wild animals center their activities in high mountains during non-Covid years not for cooler temperatures, but to escape from human disturbances and competition with livestock herds grazing in lower altitude localities. Blue sheep (bharal, *Ovis aries*, closer to goats than sheep) is reported to be under stress in Johar valley of Uttarakhand because of the presence of pastoralists and livestock grazing which overlaps with blue sheep, pushing the sheep to harsh environment of rugged areas (Bhattacharya *et al.,* 2020). Since the blue sheep have to keep distance from both pastoralism and predators, they are left with a limited space and sub-optimal habitats. In Ladakh wild ass (locally called kiang, *Equus kiang*) is reported to suffer in a similar way in Chnagthang rangeland where herding of pashmina goats (*Capra aegagrushircus*), sheep and yak is widespread (Bhatnagar *et al.,* 2006). So, tourism, pastoralism and day-to-day biomass collection have forced wildlife to move up and live in a stressful condition where foraging space may be sub-optimal and temperatures uncomfortable. This is one of the reasons why even seemingly healthy forests in lower Himalayas are generally devoid of abundance of wildlife. The pre-monsoon in Himalayas is a particularly critical time when so many abiotic and biotic processes and anthropogenic activities occur, resulting in a persistently stressful condition for wildlife and other natural biota. This observation during the Covid-19 lockdown indicates that tourism and movement of local people in the timberline zone for migratory grazing and other purposes severely interferes with foraging behavior of wild animals. Upward shift of wildlife to higher sites could be a strategy to avoid human disturbance, rather than a matter of temperature choice. Upward movement of plants and animals in mountains under the influence of global warming is a worldwide phenomenon (Becker *et al.,* 2007). However, this present observation in field suggest that all the sightings of wild animals in higher elevations than their normal elevational ranges are not because of climatic warming. They might have moved upward because of severe and persistent anthropogenic pressure. Climate change is a critical overarching factor of change in mountains, but its impacts need to be carefully detected, they may get mixed with those of local anthropogenic factors.

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Fig. 4. A herd of Himalayan blue sheep (Ovisaries) and a pit viper(Crotalushorridus) along Tungnath Treeline Transect (TTT) in COVID-19 year (2020). The elevations at which they were sighted were lower than in normal years

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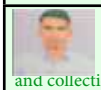
Annexure 1. List of Participants

Name / Affiliation / Contact Details/Feedback
 **Ms. Surabhi Gumber** SPF, CHEA, (surabhigumber19@gmailcom) This training will help me for identification of lower plant groups (i.e. bryophytes, lichens and pteridophytes)
 **Mr. Ripu Daman Singh** SPF, CHEA (ripuds4777@gmail.com) This workshop helped me to enhance my knowledge about the lower plant groups and to know about the coll ection and identification methods of lichens, bryophytes and pteridophytes
 **Mr. Rahul Kumar** SPF, WII (rkbrks0071@gmail.com) It was a good refresher course and I found it helpful in identification of lower plant groups
 **Ms. Khashti Dasila** SPF, GPB-NIHE(khashti.dasila@yahoo.com) This training helped me to understand the floristic elements and lichens in particular
 **Ms. Disha Upreti** JPF, GPB-NIHE(upretidisha97@gmail.com) This training helped me in field collection methods and identification of high altitude plants and lower plant groups i.e. Bryophytes, Pteridophytes and Lichens which occur in these altitudinal zones
 **Mr. Anand Kumar** JPF GPB-NIHE(anand9167@gmail.com) Alpine meadows and forest assessment was the most interesting and useful part of this workshop
 **Mr. Pramod Joshi** JPF, GPB-NIHE This training will help me for vegetation assessment and identification of plant species
 **Mr. Prashant Kumar Chauhan** JPF, GPB-NIHE(pkchauhan36@gmail.com) I collected sunphotometer and ozonometer data during this workshop at different And I also learned about lichens, ferns, bryophytes and quadrat sampling which I found very useful
 **Mr. Ram Lakhan Yadav** JPF, GPB-NIHE(pkchauhan36@gmail.com) It was a helpful training program. I learnt the species name and their identification and collection method
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 **Ms. Deeksha Bohra** RS, D.S.B Campus, Nainital(deekshabohra2@gmail.com) This workshop helped me to understand the changes in the higher altitude of Himalaya and cleared my concepts of climate change with respect to Himalaya
 **Ms. Sapna Pant** RS, I.P.G.G.P.G Haldwani (sapanapant2017@gmail.com) This training will help in collection, identification and documentation of lower plant groups. I learned quadrate sampling method which will be very helpful for my future research work.
 **Ms.GeetanUpadhyay** RS, D.S.B Campus, Nainital(geetanjaliupadhyay795@gmail.com) This is helpful in preparing my synopsis. This workshop covers a wide area from lower plant groups to higher angiosperm plants which provided in-depth knowledge
 **Ms. Bhawana Negi** RS, D.S.B Campus, Nainital(negibhawna20@gmail.com) This training will help in field work (vegetation assessment and soil sampling) as well ary things to keep in mind while collecting data
 **Ms. Kavita Khatri** RS, D.S.B Campus, Nainital(kabitakhatri000@gmail.com) The training was very helpful in vegetation assessment of higher and lower groups of plants and collection and identification of plants. Vegetation sampling taught in this workshop will help me in my field work
 **Ms. Riya Gupta** RS, D.S.B Campus, Nainital (riyagupta15june@gmail.com) It helped in improving my knowledge in taxonomy and phytosociological work
 **Ms. Harshita Joshi** JPF, CHEA (joshiharshita452@gmail.com) This training taught various methods of collection of lower plants (i.e; bryophytes, pteridophytes and lichens) as well as their identification, phytosociology of forest and timberline phenology which is helpful for my Ph.D. thesis

Bryophytes En-Route to Tungnath

In spite of, rich and diversified bryophyte species flourishing on a variety of habitats the bryoflora of Tungnath and surroundings so far have not been explored and documented thoroughly. The bryophytic diversity and luxuriance enroute to tungnath area was reported to be very high. During our filed work in September-October 2019 we recorded 85 bryophyte species belonging to 45 families from which were 11 thalloid, 23 leafy liverworts and 51 mosses (20 Acrocarps and 31 Pleurocarps). Although some of the specimens collected are yet to be identified. At lower elevation (2100 m), up to timber line areas (3700 m) the tree trunks and branches were found loaded with festoons of mosses and liverworts. Also, the fallen logs, twigs, stumps, exposed rocks, boulders, stones were found matted with luxuriant growth of both liverworts and mosses. Above timber line area (> 3700 m), the bryophytic species composition presented different picture, where leafy liverworts and acrocarpous mosses were dominant, while in lower elevation thalloid liverworts and pleurocarpous mosses were abundant. Another interesting observation was related with the spread of lower elevation terricolous liverworts namely *Cyathodium tuberosum and Reboulia hemispherica* colonizing the bark of oak tree spreading up to the middle of the trunk. This pattern was observed throughout the oak tree trunks up to the timber line areas and was also found common in almost all those sites where the forest has been cut/lopped providing suitable substrates/ habitats conditions suitable for these terricolous species.

Shifting of many of the lower elevational bryotaxa like species of liverworts viz., Asterella, Cyathodium, Plagiochasma, Reboulia, Herbertus, Ptychanthus, Porella, Plagiochilla, Scapania, and amongst mosses viz., *Barbula, Bartramia, Brachythecium, Bryum, Entodon, Philonotis, Pogonatum, Racomitrium*, etc. to higher elevational range particularly above timber line areas is indicating the early melting of snow due to the climate change causing increase in temperature seems to support the growth of hardy species of liverworts and mosses. An extremely threatened rare, monotypic, endemic red list taxa Sauchia spongiosa kash., an above timber line native hepatic, was found restricted to certain pockets. Its spread was observed to be very poor as the timber line is shifting. Consequently, the original habitats of this hepatic species is receding that is again a signal of increasing temperature due to climate change.

It is noteworthy that the extension of these two lower elevational hardy liverwort/hepatics reaching above timberline areas upto 3600m indicating the sign of climate change.

R. cruciata

Marchantia polymorpha

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टिम्बर लाईन परियोजना के अर्न्तगत तुगनाथ में पांच दिवसीय कार्यशाला का शुभारम्भ

न्यूज प्रिन्ट ब्यूरो

नैनीताल। उक्त कार्यशाला का उद्घाटन संस्थान के निदेशक डा0 आर0 एस0 रावत ने विषय विशेषज्ञों एवं उत्तराखण्ड के 5 विभिन्न संस्थानों/विश्वविद्यालय से आये हुए 20 शोधार्थियों का स्वागत करते हुए किया गया। संस्थान के निदेशक डा0 रावत ने अपने सम्बोधन में सभी प्रतिभागियों को इस विषय विशेषज्ञों के ज्ञान का अधिक से अधिक लाभ लेने का आवाहन किया। तत्पश्चात टिम्बरलाईन परियोजना के नोडल पर्सन डा0 जी.सी.एस. नेगी ने नेशनल मिशन ऑन हिमालयन

स्टडीज के अन्तर्गत वर्ष 2016 से चल रहे इस परियोजना को भारतीय हिमालयी क्षेत्र के सिगयोम (कश्मीर), तुंगनाथ (उत्तराखण्ड) एवं याकसुम जोंगरी (सिक्किम) में टिम्बरलाईन के विविध आयामों वनस्पतियों का विवरण बर्फ पिघलने का वानस्पतियों के फूल निकलने का समय, टिम्बरलाईन में जलवायु सम्बन्धी आकड़ों का एकत्रीकरण, वृक्षों की आयु का ड्रेन्ड्रोक्लोमोली से आकलन, टिम्बर लाईन का समाज से सम्बन्ध पर यह परियोजना आधारित है। इस कार्यशाला का मुख्य उद्देश्य टिम्बरलाईन के ग्लोबल वार्मिंग के साथ ऊँचाई की ओर खिसकने की धारणा को शोध के माध्यम से अध्ययन करना है।

इस कार्यशाला में वनस्पतियों के टेरिडोफाईट, लाईकेन एवं ब्रायोफाईट समूह का विशेष अध्ययन किया जायेगा। इन वनस्पतियों के बारे में अभी भी बहुत सीमित ज्ञान है। अतः भारतीय वनस्पति सर्वेक्षण के डा0 खोलिया, कुमाँउ विश्वविद्यालय, अल्मोड़ा के डा0 मनीष एवं महिला विश्वविद्यालय रुड़की की डा0 मनीषा द्वारा शोधार्थीयों को तुंगनाथ के आस-पास के जंगलों में प्रशिक्षण दिया जायेगा। इन आयोजन में संस्थान के वरिष्ठ शोधार्थी डा0 प्रदीप एवं रेनु रावल आदि उपस्थित थे।

टिम्बर लाइन पर कार्यशाला का शुभारंभ

शाह टाइम्स संवाददाता

नैनीताल। टिम्बर लाईन परियोजना के अर्न्तगत तुगनाथ (चमोली) में पांच दिवसीय कार्यशाला का शुभारम्भ हो गया है। कार्यशाला का उद्घाटन संस्थान के निदेशक डा. आरएस रावत ने विषय विशेषज्ञों एवं उत्तराखण्ड के पांच

विभिन्न संस्थानों व विश्वविद्यालय से आये हुए 20 शोधार्थीयों का स्वागत करते हुए किया गया। संस्थान के निदेशक डा. रावल ने अपने सम्बोधन में सभी प्रतिभागियों को इस विषय विशेषज्ञों के ज्ञान का अधिक से अधिक लाभ लेने का आवाहन किया। तत्पश्चात टिम्बर लाईन परियोजना के नोडल पर्सन डा. जीसीएस नेगी ने नेशनल मिशन ऑन हिमालयन स्टडीज के अन्तर्गत वर्ष 2016 से चल रहे इस परियोजना को भारतीय हिमालयी क्षेत्र के सिगयोम (कश्मीर), तुंगनाथ (उत्तराखण्ड) एवं याकसुमजोंगरी (सिक्किम) सेटिम्बर लाईन के विविध आयामों वनस्पतियों का विवरण बर्फ पिघलने का वानस्पतियों के फूल निकलने का समय टिम्बर लाइन में जलवायु सम्बन्धी आकड़ों का एकत्रीकरण, वृक्षों की आयु का ड्रेन्ड्रोक्लोमोली से आकलन, टिम्बर लाईन का समाज से सम्बन्ध पर यह परियोजना आधारित है। इस कार्यशाला का मुख्य उद्देश्य टिम्बर लाईन के ग्लोबल वार्मिंग के साथ ऊँचाई की ओर खिसकने की धारणा को शोध के माध्यम से अध्ययन करना है। इस कार्यशाला में वनस्पतियों के टेरिडोफाईट, लाईकेन एवं ब्रायोफाईट समूह का विशेष अध्ययन किया जायेगा। इन वनस्पतियों के बारे में अभी भी बहुत सीमित ज्ञान है। अतः भारतीय वनस्पति सर्वेक्षण के डा. खोलिया, कुमाँउ विश्वविद्यालय अल्मोड़ा के डा. मनीष एवं महिला विश्वविद्यालय रुड़की की डा. मनीषा द्वारा शोधार्थियों को तुंगनाथ के आस-पास के जंगलों में प्रशिक्षण दिया जायेगा।

सूचना

सूचित किया जाता है कि सीबीएसई द्वारा जारी मुख्य माध्यमिक परीक्षा वर्ष 2018 (अनुक्रमांक 5322791) उत्तीर्ण करने से सम्बन्धित मेरा मूल प्रमाण पत्र चालक में कहीं खो गया है।

दिव्यांश कालरा
निवासी: 328 डी-टीएम कालोनी, फरीदपुर, बरेली (उत्तर प्रदेश)

टिंबरलाइन के खिसकने की धारणा का होगा अध्ययन

शोधार्थियों को तुंगनाथ के आस-पास के जंगलों में प्रशिक्षण दिया जाएगा

संवाद न्यूज एजेंसी

अल्मोड़ा। जीबी पंत पर्यावरण विकास संस्थान कोसी कटारमल में हुई कार्यशाला में ग्लोबल वार्मिंग के कारण टिंबर लाइन के ऊंचाई की ओर खिसकने की धारणा का शोध के माध्यम से अध्ययन करने पर जोर दिया गया। कार्यशाला में वक्ताओं ने कहा कि वनस्पतियों के टेरिडोफाइट, लाइकेन और ब्रायोफाइट समूह का विशेष अध्ययन किया जाएगा।

कार्यशाला का शुभारंभ करते हुए संस्थान के निदेशक डॉ. आरएस रावत ने विषय विशेषज्ञों

जीबी पंत पर्यावरण विकास संस्थान कोसी कटारमल में कार्यशाला आयोजित

और उत्तराखंड के पांच विभिन्न संस्थानों, विश्वविद्यालय से आए 20 शोधार्थियों का स्वागत किया। डॉ. रावत ने सभी प्रतिभागियों से विषय विशेषज्ञों के ज्ञान का अधिकाधिक से अधिक लाभ उठाने का आह्वान किया। टिंबर लाइन परियोजना के नोडल पर्सन डॉ. जीसीएस नेगी ने बताया कि नेशनल मिशन ऑन हिमालयन स्टडीज के तहत 2016 से यह परियोजना चल रही है। उन्होंने भारतीय हिमालयी क्षेत्र के सिगयोम (कश्मीर), तुंगनाथ (उत्तराखंड) और याकसुम जोंगरी (सिक्किम) में टिंबर लाइन के विविध आयामों के आकलन की जानकारी दी। इस मौके पर बताया गया कि कार्यशाला का मुख्य उद्देश्य टिंबर लाइन के ग्लोबल वार्मिंग के साथ ऊंचाई की ओर खिसकने की धारणा का शोध के माध्यम से अध्ययन करना है। यहां संस्थान के वरिष्ठ शोधार्थी डॉ. प्रदीप, रेनू रावत आदि थे।

Quercus semecarpifolia mature trees at Tungnath timbrline Photo Credit: Dr. GCS Negi, Scientist-G

चमोली, 21 सितंबर 2020

टिम्बर लाईन परियोजना के अंतर्गत तुंगनाथ, चमोली में 5 दिवसीय कार्यशाला का सोमवार यानि आज से शुभारंभ हो गया है. इस कार्यालाय में उत्तराखंड के विभिन्न संस्थानों व विश्वविद्यालय से 20 शोधार्थी हिस्सा ले रहे है.

कार्यशाला का उद्घाटन गोविन्द बल्लभ पंत राष्ट्रीय हिमालयी पर्यावरण संस्थान, कोसी अल्मोड़ा के निदेशक डॉ.आरएस रावल ने किया.

डॉ. रावल ने कार्यशाला में प्रतिभाग कर रहे सभी विषय विशेषज्ञों एवं विभिन्न संस्थानों/विश्वविद्यालय से आये हुए 20 शोधार्थीयों का स्वागत करते हुए सभी प्रतिभागियों से विषय विशेषज्ञों के ज्ञान का अधिक से अधिक लाभ लेने का आहवान किया.

टिम्बरलाईन परियोजना के नोडल पर्सन डॉ. जीसीएस नेगी ने कहा कि 'नेशनल मिशन आन हिमालयन स्टडीज' के अन्तर्गत वर्ष 2016 से चल रहे इस परियोजना को भारतीय हिमालयी क्षेत्र के सिगयोम (कश्मीर), तुंगनाथ (उत्तराखण्ड) एवं याकसुम जोंगरी (सिक्किम) में टिम्बरलाईन के विविध आयामों वनस्पतियों का विवरण बर्फ पिघलने का वनस्पतियों के फूल निकलने का समय, टिम्बरलाईन में जलवायु सम्बन्धी आकड़ों का एकत्रीकरण, वृक्षों की आयु का ड्रेन्ड्रोक्लोमोली से आकलन, टिम्बर लाईन का समाज से सम्बन्ध पर यह परियोजना आधारित है.

इस कार्यशाला का मुख्य उद्देश्य टिम्बरलाईन के ग्लोबल वार्मिंग के साथ ऊँचाई की ओर खिसकने की धारणा को शोध के माध्यम से अध्ययन करना है.

इस कार्यशाला में वनस्पतियों के टेरिडोफाईट, लाईकेन एवं ब्रायोफाईट समूह का विशेष अध्ययन किया जायेगा. इन वनस्पतियों के बारे में अभी भी बहुत सीमित ज्ञान है.

भारतीय वनस्पति सर्वेक्षण के डॉ. खोलिया, कुमाउं विश्वविद्यालय के डॉ. मनीष एवं महिला विश्वविद्यालय रुड़की की डॉ. मनीषा द्वारा शोधार्थीयों को तुंगनाथ के आस-पास के जंगलों में प्रशिक्षण दिया जायेगा. इस आयोजन में संस्थान के वरिष्ठ शोधार्थी डॉ. प्रदीप एवं रेनू रावल आदि उपस्थित थे.