PROCEEDINGS OF

CAPACITY BUILDING PROGRAMME ON CLIMATE CHANGE AND PLANT BIODIVERSITY

Date: 26th November 2021 (Friday), 7:30 PM to 9:30 PM

Mode: Zoom Online Meeting

Organized by: Mizoram State Climate Change Cell, Mizoram Science, Technology & Innovation Council (MISTIC), Directorate of Science & Technology, Govt. of Mizoram and Department of Botany, Government Serchhip College.

BACKGROUND AND OBJECTIVE

As one of the activities for the proposed project based on the objectives which aims to meet the requirements of the underlying objectives of the National Mission for Sustaining the Himalayan Ecosystem (NMSHE), the programme was conducted with an aim to sensitize and build the capacity of research and academic circle of the state institutions with regard to the scope and prospects of research in climate change. The capacity building programme emphasize on Climate change and plant diversity.

Faculties, students, research scholars from concerned thematic departments from different institutions, colleges, Mizoram University were invited to participate in the programme. A total 82 participants from such institutions attended the programme. E-certificates were issued to participants who completed the programme.

Detail programme/agenda and screenshots of the programme is attached at the annexure.

INAUGRAL PROGRAMME

Dr. Lalremsiami Hrahsel, Asst. Prof., Department of Botany, Govt. Serchhip College was the host for the webinar. Pu H. Lalsawmliana, CSO & Member Secy. MISTIC, gave the welcome address where he welcomed all the participants and gave a brief introduction to the creation, objectives and activities the State Climate Change Cell.

TECHNICAL SESSION

During the technical session of the webinar, two eminent speakers made their presentations. A brief record of presentations and discussions are summarized as below:

1. **Earth 2100: A glimpse into the future. From the climate change perspective –** Dr. Bharat Pradhan, Scientific/ Technical Associate, Sikkim Biodiversity Board, Forest and Environment Department, Govt. of Sikkim.

   A brief introduction on climate change was given in which the global average temperature from 1850-2020 was presented. The different impact of climate change was also briefly highlighted.

   Climate crisis and the climate refugees: Under this topic it was mentioned that, 80 million people in South East Asia alone moved to Europe, Middle East and North America. Between 2008-2015, 21.5 million and in 2017, 68.5 million people were displaced. As per IOM, there could be as many as 200 million climate refugees by 2050 out of which 143 million would be from of Sub-Saharan Africa, Latin America and South Asia.

   Our future Our Earth Report: It was mentioned that 2011-20, was the hottest decade and in some parts of the world, the temperature crossed 50^{o}C. 2020 was confirmed as the hottest year by WMO. The average temperature in 2020 was about 14.9 ^{o}C, 1.2(±0.1) ^{o}C above the pre-industrial (1850-1990) level.

   It was also mentioned that according to European Space Agency, 4 million sq. km of earth's land is affected by forest fire each year.

   The world is facing unprecedented level of droughts. About 5340 Gt of ice is lost over the last two decades and the total loss is accelerating at the rate of 48 Gt per year.

   Worldwide flood list: A total of 124 flood events across 385 locations in more than 20 countries was recorded by Flood list.

   Root Cause of Climate Change: Global warming was mentioned as the root cause of climate change and the cause of global warming is the unsustainable human activities. The increase in human population results in deforestation, industrialization and exploitation of natural resources which all lead to release of greenhouse gases leading to global warming and the depletion of ozone layer.

Earth 2100-A glimpse into the future: The following points were discussed under this topic-

- The number of climate refugee will triple
- Lung condition and respiratory diseases would worsen due to air pollution.
- More than half of the world's population may not have adequate access to water.
- The types of fish we eat could become extinct.
- Millions could be without food.
- The rain forest could face total annihilation
- Superbugs could kill 10 million people each year
- Diseases will spread with ease
- The number of people living with dementia will likely triple
- Hurricanes could become more frequent and severe
- Sandstorm, dust storm, thunderstorm could become more frequent
- Large scale blackouts could become common
- All coastal areas including Shanghai (China), Tokyo, Bangladesh, and India (West Bengal, Orissa, Kerala, Karnataka, Goa, Maharashtra, etc.) will get submerged.

The Himalayas would witness the havoc due to climate change. Flash flood have become common in the Himalayan states like Sikkim and Uttarakhand. It was also mentioned that avalanche in Mustang, Nepal was due to climate change. The glaciers are turning black due to pollutants released from industries and vehicles contribute to the melting of glaciers.

It was also pointed out that Mussoorie and Darjeeling are among 13 Himalayan towns that are facing water crisis. It was pointed out that CoP26 was a total failure as the pledge to "phase out" coal was changed to "phase down". The effort to curb the impact of climate change like covering the Swiss glaciers with white blanket and installation of carbon scrubbers was mentioned. It was also mentioned that the best solution is restoration of ecosystem. The different points which we can do on our part to combat climate change was also mentioned.

The presentation was ended with the words "Let us join hand in making this planet a beautiful place to live in for us and our future generation."

2. **Impacts of climate on Himalayan plant diversity in past present and future** - Dr. Manish Kumar, Asst. Professor, Department of Environmental Studies, Dr. BR Ambedkar College, Delhi University.

The presentation was started with tectonic backdrop explaining how the Himalayan was formed. The Himalayan has a rich plant biodiversity and about 4000 endemic species. It was mentioned that some of these species have affinities towards South-east Asian region and some towards Temperate regions of Europe. The different research questions during the research period that were still unanswered was mentioned.

The study design adopted for the research on Himalayan Plant Diversity Past was highlighted. The steps of the study design were mentioned-

- Collection of endemic species occurrence data through primary field surveys (Indian Himalaya) and online databases (outside Indian Himalaya).
- Classification of species into two categories based on occurrence-Eastern Himalayan Endemic (EHE) and Western Himalayan endemic (WHE).
- Preparation of calibrated phylogenetic supertrees for both EHE and WHE using Phylomatic ver. 4.2 and R ver. 2.14.0
- Reconstruction of ancestral area was done on calibrated phylogenetic super trees using Bayesian Binary MCMC method in RASP ver. 3.2

The total of 132 sites were studied in the Indian Himalayas during the research period. Two kinds of design to sample the vegetation was employed. The method used was Nested Quadrant method. Sampling was done across the entire range of ecosystem- Tropical, Sub-tropical, Sub-alpine and alpine. For data collection outside the Indian Himalaya, published information was used. Software was used for the construction of the phylogenetic tree and recorded the diversification family wise. Result showing the endemic plant family diversification patterns was discussed. It was found that both in the Western and Eastern Himalaya, maximum species have diversified during 35-20 million years ago and from available literature 35-20 million years ago was the time when monsoon originated in the Himalayas. So that means that plant diversity is a result of the monsoon in the Himalaya. When Monsoon started, there was soil erosion, rivers were formed that transformed the continuous Himalayan habitat into a series of

dissected valley that promoted species diversification. Ancestral state reconstructions of Eastern and Western Himalayan endemics was done and phylogenetic trees obtained. The conclusion that was made were given as follows:

- Monsoon played the most important role in the evolutionary diversification of plant endemics in the Himalayas
- Diversification rates and patterns show narrow range of vegetation in the Eastern Himalayas than the Western Himalayas.
- In the Eastern Himalayas, majority of the endemics diversified from taxa which immigrated from SE Asian, SE Chinese and Sino-Japanese regions.
- In the Western Himalayas, majority of the endemics diversified from taxa which immigrated from SE Chinese, Sino-Japanese, Irano-Turanian and Central-asiatic regions.

The research on Himalayan Plant Diversity Present was then highlighted and the same methods as before were followed. The study area chosen was Sikkim and it was advantageous to the research since maximum of the sites were already sampled so data was readily available for a period of 5 years. The data was then used to analyze the present-day structure of the vegetation in the Himalaya. The entire gradation of ecosystem from Tropical to Alpine regions can be covered within 100 km. The same sampling method was employed. The different growth forms that were sampled was then highlighted. The result obtained was that every life form has their own pattern along the elevation gradient. It was mentioned the mistake that earlier studies did was that they arrive at a cumulative form. Since the life forms behave in a different manner in the Himalayas, it is not advised to arrive at a general picture. It was mentioned that the entire gradient of elevation should be sampled if we want to arrive at a more correct pattern. The drivers for species richness pattern were discussed and it was found that out of all the climatic and geographic variables, mean temperature was the main variable. This directly relates to climate change. In a related study, it was found that maximum of the species was found at the middle portion. Maximum number of primitive species were also found in the middle elevation and the reason for this could be that species in the lower elevations have become extinct due to anthropogenic activities and these species do not have the chance to colonize the higher elevation. Since the middle elevation has the largest number of primitive

species, it can be said that it is the area that has been diversifying for the most amount of time. It was mentioned that test of phylogenetic clustering and over-dispersal along elevational gradient was also conducted. The result of this study was summarized as below:

- Species richness patterns in the Himalaya vary according to endemism, growth form and scale
- Phylogenetic richness is conserved in the Himalayan species
- Ecological altering determines species composition at high elevations and interspecific competition at mid-elevations
- Mid-elevation regions in the Himalaya are rich in species richness, diversity and ancestral taxa.

The next objective of the research was to study the future and for this ecological modelling where species distribution modelling was adopted. The same study area and field sampling technique was used. GIS platform was used for to locate where specific species are found. The data from WorldClim as well as software called MAXENT (Species distribution software) can be used to predict the future location of specific species. It was found that for *Rhododendron wightii* in the future scenario the species are moving up in the Himalaya and are also experiencing loss of habitat. Wide ranged endemics occupy a wide amount of habitat and it can be seen that in the future the species are moving upwards and at the same time they are losing their habitat. For narrow ranged species, they occupy only small area in the alpine region, these species will also move further up but will have no area to occupy in the future. These are the species in the fringe area will be the ones that will likely go extinct. The future will be that there will be a dominance of shrubs and most of the herbs will go extinct in the Himalayan region. Changes in geographic area occupancy of different life forms in the future was also shown. The test of phylogenetic control was done where it was found that all the species are moving upwards and that all the species are losing their habitat and they are all responding the same way to climate change. Conservation priorities in current and future climates was also discussed. The result of this study was summarized as:

- Prominent northward shift of every endemic species towards higher elevation
- Shrublands will replace herbaceous meadows in coming future

- Extinction of narrow ranged endemics occupying topmost elevation
- There is a trend to redefine conservation priorities in the Himalayas

The presentation was ended with the lines from Jamaican Kincaid-“ And my difficulties were these: I found each plant, each new turn in the road, each new turn in the weather, from cold to hot and then back again, each new set of boulders so absorbing, so new, and the newness so absorbing, and I was so in need of an explanation for each thing, that I was often in tears, troubling myself with questions, such as what am I and what is the thing in front of me.”

INTERACTION SESSION

An interaction session was opened briefly by the host Dr. Lalremsiami Hrahsel where the participants actively asked the resource person questions related to their presentations and research work.

CONCLUDING SESSION

The session ended with a concluding remark given by Pu Samuel Lalmalsawma, Senior Scientific Officer, MISTIC. He gave a short comment on the presentation given by Dr. Bharat Pradhan and Dr. Manish Kumar. He thanked the resource person and all the participants of the webinar.

Annexure I

CAPACITY BUILDING PROGRAMME ON CLIMATE CHANGE AND PLANT BIODIVERSITY

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&
Government Serchhip College

TIME	PROGRAMME DETAILS
Host	Dr. Lalremsiami Hrahsel, Asst. Professor, Department of Botany, Government Serchhip College.
07:30 PM to 07:40 PM	**Welcome Address**: Pu H. Lalsawmliana, Chief Scientific Officer & Member Secretary, MISTIC, DST, Govt. of Mizoram.
07:40 AM to 8:20 PM	**Presentation by –** Dr. Bharat Pradhan, Scientific/ Technical Associate, Sikkim Biodiversity Board, Forest and Environment Department, Govt. of Sikkim
08:20 PM to 09:00 PM	**Presentation by** Dr. Manish Kumar, Asst. Professor, Department of Environmental Studies, Dr. BR Ambedkar College, Delhi University.
09:00 AM to 09:15 PM	**Interaction**
09:15 PM to 09:20 PM	**Concluding Remarks** by Pu Samuel Lalmalsawma, Senior Scientific Officer, MISTIC

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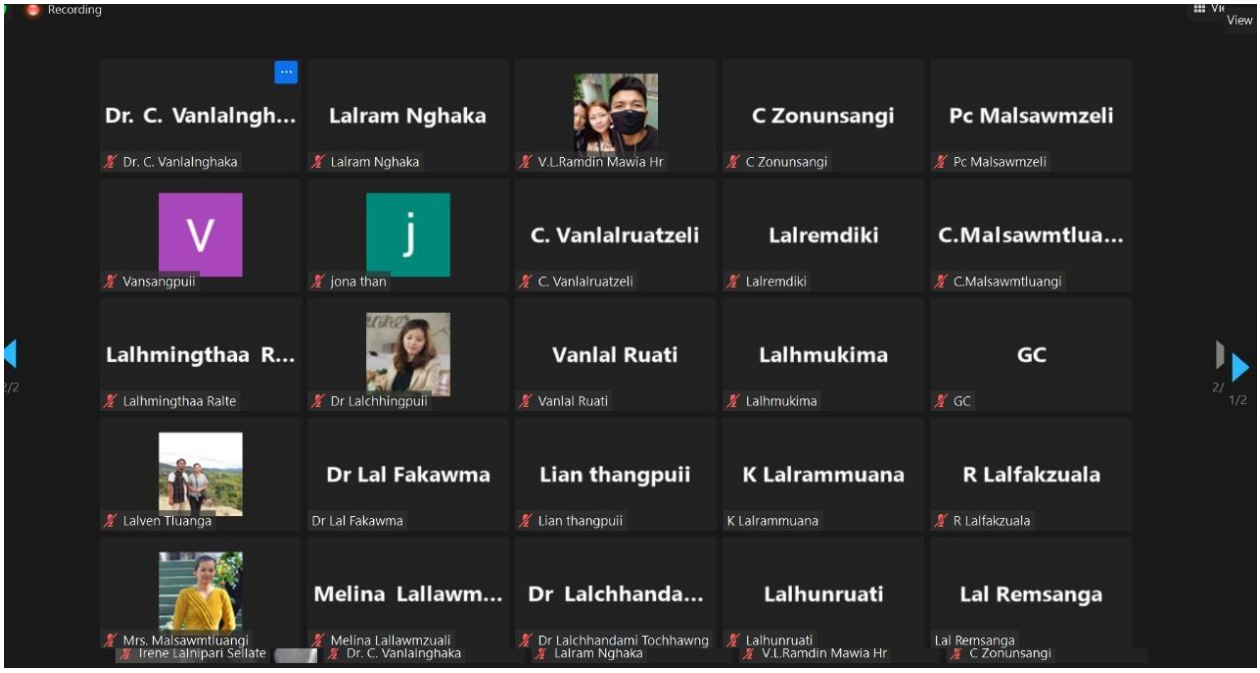
Annexure II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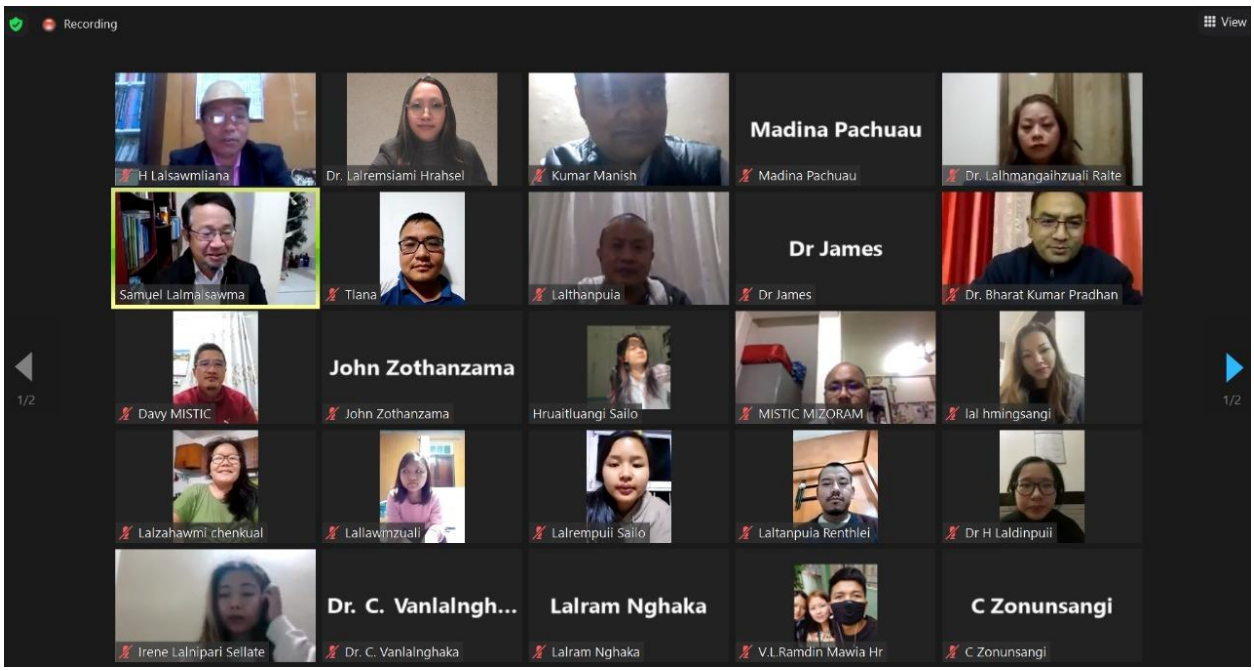
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Dr. Lalremsiami Hrahsel
Kumar Manish
Madina Pachuau
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Dr. Lalhmangaihzuali Ralte
Samuel Lalma sawma
Tlana
Lalthanpuia
Dr James
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Dr. Bharat Kumar Pradhan
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EARTH 2100

A glimpse into the future

From the climate change perspective

Dr. Bharat Kumar Pradhan
***Member**: IUCN WCPA*
Community Leader
(Friends For Future International, Germany)
Sikkim Biodiversity Board
Forest and Environment Department

Impacts of climate on Himalayan plant diversity in past, present and future

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