2022-2023

Annual Report

Centre for Ecology Development and Research

814, Indira Nagar, Dehradun
248006, Uttarakhand, India

01352 763403 | info@cedarhimalaya.org | www.cedarhimalaya.org

CEDAR CONTINUES TO PLAY A PIVOTAL ROLE IN STRENGTHENING THE LINKAGES BETWEEN RESEARCH AND SOCIETY THROUGH KNOWLEDGE TRANSFER AND ADVOCACY FOR IMPROVED ENVIRONMENT DECISIONS IN THE HIMALAYAN REGION.

Picture Courtesy: Team CEDAR

Address: 814 Indira Nagar, Dehradun-248006,
Uttarakhand, India
Contact No.: 01352 763403
Email: info@cedarhimalaya.org
Website: www.cedarhimalaya.org

CENTRE FOR ECOLOGY DEVELOPMENT AND RESEARCH

Contents

MESSAGE FROM **THE CHAIRMAN**

This year marks the completion of seventeen years of successful work by the Centre for Ecology and Development Research (CEDAR). CEDAR was founded in 2006 by a group of academics and development practitioners who recognizing the pressing need to harmonize applied research with real-world interventions had a strong commitment to balance theory and practice in the development sector. It has made significant progress in bridging the gap between theory and practice in the field of sustainable development and has formed important partnerships in this process.
The approach of CEDAR involves learning from the invaluable knowledge of those who inhabit the Himalayan environment, blending their wisdom with scientific evidence, and disseminating this vital information to a wider audience for inclusive and informed decision-making.

The Annual Report of for 2022-2023 provides an overview of the work accomplished by the organisation during the year. During the year eight projects were successfully completed. Many of these were undertaken in collaboration with well-known partners. Some notable projects included assessing the impact of plantation on carbon biodiversity and livelihoods, creating climate-resilient communities in the mid hills of Uttarakhand, studying air pollution exposure in Dehradun city, and assessing biodiversity and carbon sequestration in Van Panchayats of Uttarakhand.

These projects not only advanced our understanding of critical issues but also allowed us to make a meaningful impact in the form of valuable knowledge products, publication of scientific papers in esteemed international journals, and facilitated state and national-level impactful workshops. These accomplishments have furthered our commitment to engage with environmental and development issues, involve stakeholders and policymakers, and forge innovative pathways for the sustainable management of natural resources in the Himalayas.

The work continues in the current year as well. CEDAR is at present actively engaged in six projects, each aimed at addressing pressing environmental and developmental challenges. One of the key projects, funded by the Ministry of Jal Shakti, focuses on the hydro-geological assessment and socio-economic implications of depleting water resources in Nainital. The work involves collaboration with important institutions like IIT Roorkee and the Forest Research Institute to better understand the impact of anthropogenic pressures on Nainital Lake. CEDAR is also working with reputed universities across the world including Northen Arizona University, the University of Minnesota, Cornell University and The Swedish University of Agricultural Sciences. Citizen-science knowledge exchange and knowledge co-creation are integral components of this endeavour. A significant project, funded by George Washington University and Kalamazoo College, explores the pollination limitations affecting apple production in the Uttarakhand Himalayas, and seeks to understand the multifaceted impact of climate change, land use changes, and the declining pollinator population on this vital fruit crop.

CEDAR remains dedicated to its mission and looks forward to the continued support and trust of its partners, supporters, collaborators and the communities it seeks to serve. We extend our grateful thanks to all of them.

B.K. Joshi
Chairman, CEDAR

ABOUT US

CEDAR is a not-for-profit organization registered in 2006 under the Societies Act of 1860. The registered office is located in Delhi, while the chief operations office is based in Dehradun. CEDAR was established when a group of academics and development practitioners came together to bridge the gap between applied research and field-based interventions or, to put it differently, 'balance theory and practice'. We are committed to informing environmental and development issues, reaching out to stakeholders and policymakers, and creating novel pathways for sustainable management of natural resources in the Himalayas.

CEDAR is recognized as a Scientific and Industrial Research Organization (SIRO) by the Department of Science and Industrial Research (DSIR), Ministry of Science and Technology, Government of India (GoI).

VISION

CEDAR envisions itself as the bridge between research and practice to facilitate socially just and equitable natural resource management in the Himalaya

MISSION

Our mission is to foster awareness and understanding of the Himalayan ecosystem through trans-disciplinary knowledge generation and dissemination.

With 17 years of experience on working at the interface of science and society, CEDAR is dedicated towards collaborative efforts to popularize knowledge and bring together science in policy and praxis.

GOVERNING BOARD

PROF. B. K. JOSHI
(CHAIRMAN) EX VICE CHANCELLOR, KUMAUN UNIVERSITY NAINITAL, FORMERLY DIRECTOR, DOON LIBRARY, DEHRADUN

DR. RAJESH THADANI
VICE CHAIRMAN
SENIOR FELLOW, CENTRE FOR ECOLOGY DEVELOPMENT AND RESEARCH, DEHRADUN

MR. S.T.S. LEPCHA
(MEMBER)
IFS, FORMER MANAGING DIRECTOR FOREST CORPORATION, DEHRADUN

DR. ASHISH TEWARI
ASSOCIATE PROFESSOR,
KUMAUN UNIVERSITY NAINITAL.

DR. VISHAL SINGH, EX-OFFICIO
EXECUTIVE DIRECTOR,
CENTRE FOR ECOLOGY DEVELOPMENT AND RESEARCH, DEHRADUN

RESEARCH ADVISORY BOARD

Prof. K. Shivaramakrishnan
India & South Asia Studies,
Anthropology; School of Forestry &
Environmental Studies, Yale University

Prof. Bhaskar Vira
Department of Geography,
Cambridge University,
United Kingdom

Prof. J.S. Singh
FNA, FNASc, FASc, FTWA,
Professor Emeritus Department of
Botany,
Banaras Hindu University

Dr. Meg Lowman
Ph.D. Director of Global Initiatives &
Senior Scientist in Plant Conservation
California, Academy of Sciences

Dr. Ann M. Fraser
Ph. D. Professor and Chair of Biology
Kalamazoo College, Michigan, USA

Dr. Himanshu Kulkarni
Director, ACWADAM
Pune

TEAM

RESEARCH TEAM

Dr. Rajesh Thadani
Senior Fellow

Dr. Mohit Chaturvedi
Senior Fellow

Dr. Vijay Ramprasad
Senior Fellow

Dr. Vishal Singh
(Senior Fellow)
Executive Director

Dr. Hemant R Ojha
Senior Fellow (Honorary)

Dr. Pushpendra Rana
Senior Fellow (Honorary)

Dr. Pia Sethi
Senior Fellow

Mr. Chetan Agarwal
Senior Fellow

Dr. Anvita Pandey (Fellow)
Coordinator

Dr. Nidhi Singh
Fellow

Dr. Renu Suyal
Senior Research Associate

Miss. Swati Singh
Research Associate
(Till December, 2022)

Mr. Anmol Ratna
Research Assistant

Ms. Ankita Rawat
Research Assistant

FINANCE TEAM

Mr. Anil Tyagi
Finance Officer

Mr. Dharmendra Singh
Assistant Accountant

FIELD STAFF

Mr. Narendra Singh Raikwal
Sr. Field Assistant

Mr. Bhaskar Singh Raikwal
Field Assistant

THEMATIC AREAS

01

Forest and Humans

We are actively researching the topics of human disturbance, the impact of climate change and more sustainable management practices in Himalayan forests.

Urbanization and Water

02

We have been systematically researching urban water management, demographic patterns, and urban development in small and medium towns of Western and Central Himalaya.

03

Climate Change Adaptation

Conducting research to understand the impacts of climate change in the Himalaya and strengthening the capacities of communities through collaborations with grassroots organizations.

Gender and Social inclusion is an essential elements of CEDAR's research across thematic areas.

Completed Projects

1. Planning Plantation: Past learning, toward triple wins in carbon, biodiversity and livelihoods

2. Creating Climate- resilient communities in mid-hills of Uttarakhand: Interventions towards forest and water

3. Creating evidence for forest-based resilience during COVID-19

4. Impact of the COVID-19 Pandemic on forest resources use by rural communities in India

5. Establishing a low- cost sensors network for air quality monitoring in Gurgaon

6. Stakeholder Consultations for Integrated Management Planning of Renuka and Pong Ramsar Sites in Himachal Pradesh

7. Cities study on exposure and impact of air pollution in the Hindu Kush Himalaya (HKH) region

8. Biodiversity and carbon assessment of Manar Van Panchayat in Champawat district of Uttarakhand

Planning Plantation: Past learning, toward triple wins in carbon, biodiversity and livelihoods

Donor/Funding Agency: Partnerships for Enhanced Engagement in Research (PEER) Cycle 8
Field Site: Kangra District, Himachal Pradesh
Duration: November 2019 - August 2022
Project Investigator: Dr Rajesh Thadani

The PEER programme (Partnerships for Enhanced Engagement in Research) is managed by the National Academy of Sciences, USA. CEDAR has a PEER grant in collaboration with the Department of Forest Resources, University of Minnesota. The objective of this study was to understand the impact of plantations on land cover and livelihoods of forest dependent people in Himachal Pradesh. Under this project, CEDAR measured forest carbon stored in above ground biomass (AGB) after measuring tree diameters in over 40 large plots (1500 m^2) using already existing allometric equations. Smaller plots were set up to assess mycorrhizal diversity, as evidenced by mushroom sporocarps monitored during the monsoon season. These studies were carried out in plantation areas in Kangra district of Himachal Pradesh. Soil carbon measurements were made for each of these plantations at the CEDAR soil laboratory.

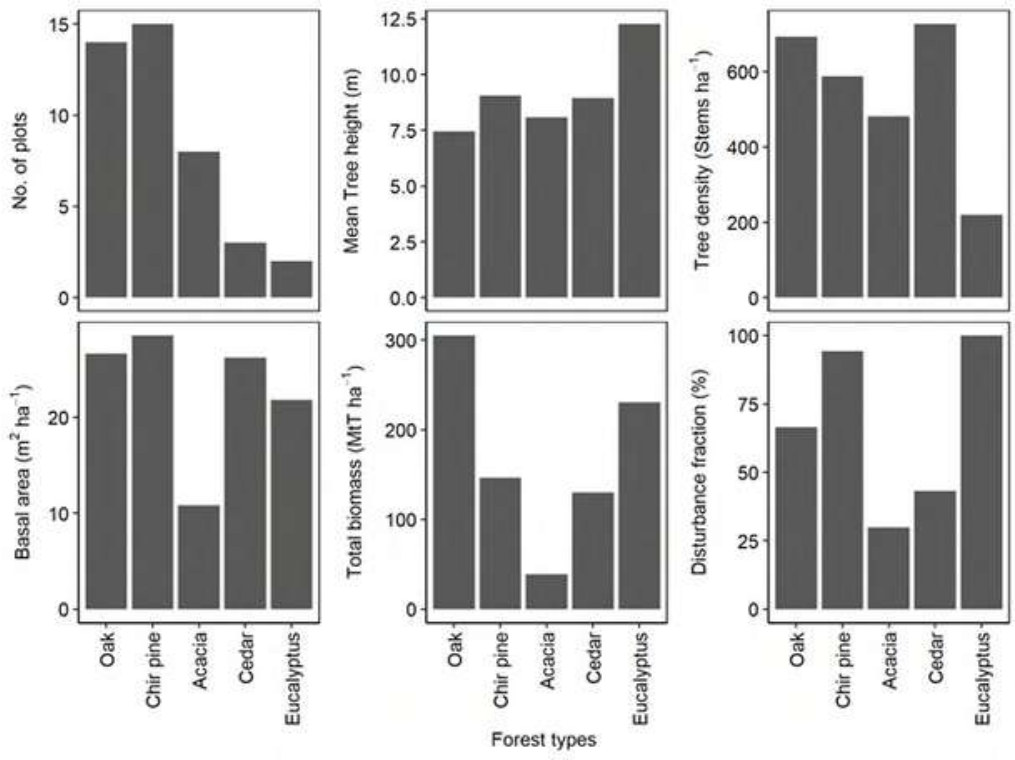
The project aims to evaluate when and how afforestation projects achieve the triple win of storing more carbon, protecting biodiversity, and enhancing rural livelihoods, more fully accounting for the potential benefits and costs of plantations in the Himalayas. Envisaged as a one-year project, Covid -19 related interruptions in field work, led to the project going into no cost extensions to complete the field studies.

Findings and achievements

While plantations help provide focus and give a reason for forest protection, forests regenerate well naturally. Old plantations, established in the 1980's and 1990's were in some cases indistinguishable from natural forests. If protection from human disturbance had been good, not just the planted seedlings and saplings, but all forms of natural regeneration had helped bring degraded areas back under good forest cover. This can be seen in the graphs which show basal areas and biomass in different plantations that are in the same range as natural forests. The majority of plantations also showed good mycorrhizal diversity with a wealth of mushroom fruiting bodies that resemble a natural forest. But this is not to say plantations were wholly successful.

Many plantations where the communities were excluded were affected by forest fires leading to poor regeneration. The value of old plantations, especially of chir pine (*Pinus roxburghii*) that dominated aforestation efforts in the 1980's and 1990's was also questionable. The species is of low importance to local communities and the ban on green felling locks up timber value preventing benefits from coming to local communities.

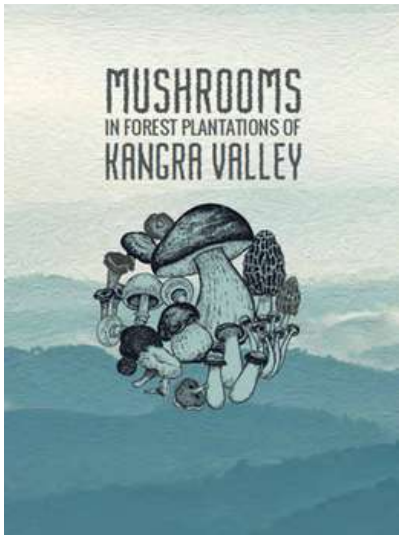
The study could not be performed in its full potential due to COVID restrictions. However, this allowed us to learn that data collection could be done effectively by local communities if proper training, consultative and capacity building is done. two workshops were conducted under the project viz. (1) Restoration of forest ecosystems linking theories and practices and (2) forest fire in western Himalayas: building Science, Technology and Traditional Knowledge.



Graph showing the biomass, basal area, tree density, and disturbance index for different species

Outreach

Knowledge product



An identification manual "Mushrooms in forest plantations of Kangra Valley" was published which aims to help bring to life the diversity of beneficial fungi in different forest types and enhance an understanding of forest functioning and diversity among a general audience.
Link: https://cedarhimalaya.org/images/pdf/masrooms.pdf

Training of field staff on mushroom identification and carbon estimation techniques were carried out.

Workshop

1. **Restoration of Forest Ecosystems Linking Theories and Practice**

Keeping the grand global challenges in mind and the restoration targets of India by 2030, CEDAR in partnership with HPFD (Himachal Pradesh Forest Department) organized a workshop on 2 April 2022 in Barog, Solan (Himachal Pradesh) with a selected group of individuals from the Himachal Pradesh Forest Department, researchers from different parts of the country and civil society to develop a common understanding on framework around forest restoration activities in the State of Himachal Pradesh in particular and Western Himalaya in general.
The workshop was a part of an ongoing study “Planning plantations: Past learning, toward triple wins in carbon, biodiversity and livelihoods” under the PEER program funded by USAID. On this occasion a publication as part of the project “Mushrooms in forest plantations of Kangra Valley” was also released, Dr. Anvita Pandey being the lead author.

2. Forest Fires in Western Himalayas; Blending Science, Technology and Traditional Knowledge"

A consultation workshop was organized by CEDAR on 17 August, 2022 at Manthan Hall 85, Rajpur Road, Dehradun to engage experts from different fields to develop a common understanding of the management and mitigation of forest fires in the Western Himalayan region. The workshop focused on understanding science and technological advancements in the field of forest fire but most importantly identify the drivers of forest fire in the region.

The workshop was attended by eminent ecologists, historians, civil society leaders, representatives of national level agencies which study forest fires such as Forest Survey of India (FSI), Forest Research Institute (FRI), Indian Institute of Remote Sensing (IIRS), forest officers from Uttarakhand and Himachal Pradesh, representatives of local NGO's, think tanks and concerned citizen.

Outcome of workshop

Doon Declaration on Forest Fires

Forest fires are increasing across the world, posing a serious threat to forest and associated terrestrial ecosystems and society. In the Himalayan region, forest fire regimes are changing due to climate change and prevalent management practices. Longer drought periods, an increase in the length of fire season, heatwaves, and management practices that encourage burning are likely to pose serious challenges for forest managers and communities in the future apart from the increase in the climate resilience building costs exponentially.

The above trends are clearly visible in the Himalayan region with the rapid increase in incidents of forest fires. As per SFR 2021, between the eight-month period (November 2020 and June 2021), nearly 21,000 forest fire incidents were reported for the state of Uttarakhand and 4,200 for Himachal Pradesh through the SNPP-VIIRS satellite sensor. 2016 is considered to be the worst fire year in recent times with approximately 4500 hectares of forest affected by fires in the state of Uttarakhand, causing 9 deaths and 17 serious fire injuries. Damage to biodiversity through such fires is largely unknown (e.g., wildlife, rare plants, soil fauna etc.).

Against this backdrop, a call for action was issued by participants of the "Workshop on Forest Fires in the Western Himalaya", held on August 17, 2022, which included eminent ecologists, historians, civil society leaders, representatives of national-level agencies which study forest fires such as Forest Survey of India (FSI), Forest Research Institute (FRI), Indian Institute of Remote Sensing (IIRS), forest officers from Uttarakhand and Himachal Pradesh, representatives of local NGOs, think-tanks and concerned citizens. The Doon Declaration is a summary of the day's proceedings and is put forth keeping in mind the importance of Himalayan forests on a global scale, and the global environmental commitments made by India towards climate mitigation.

Creating Climate- resilient communities in mid-hills of Uttarakhand: Interventions towards forest and water

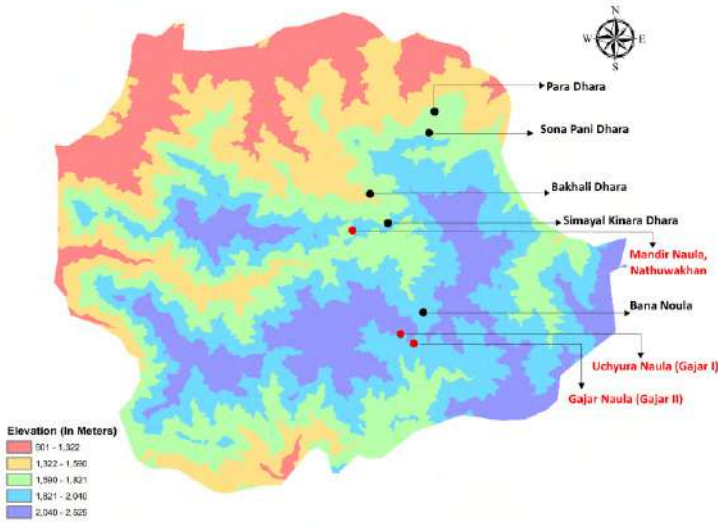
Donor/Funding Agency: National Mission on Himalayan Studies (NMHS), Govt. of India
Field Site: Ramgarh clusture, Nainital, Uttarakhand
Duration: February 2019 - September 2022
Project Investigator: Dr. Vishal Singh
Co Investigators: Dr. Ghazala Shahabuddin; Dr. Badrish Mehra; Dr. Anvita Pandey

Mountain springs are the primary source of water for both rural and urban populations of the Himalayan region. A vast majority of the population depends on springs, the primary and only source of water. As per a rough estimate, there are five million springs across India, out of which nearly 3 million are in the IHR alone. Despite the key role that they play, springs have not received their due attention, and many are drying up. The State Governments, Civil Society Organizations (CSOs), and NGOs are actively contributing towards programs to promote awareness of the importance of springs and to build capacities to protect, develop and manage "spring sheds" across the country.

CEDAR and CHIRAG had come forward in this initiative through NMHS to revive the Himalayan Springs and through field-based interventions and derive policy recommendations on the same. This collaboration looks at the Spring-shed Management techniques in a 9-step approach that CHIRAG has developed for spring rejuvenation and developing climate-resilient communities. The main focus of the study was to strengthen the forest-water-community interlinkages by involving interaction amongst biophysical, social, and economic component, understanding the ground realities through participatory socio- hydrogeological research and exploring solutions in consultation with community leaders and other stakeholders.

Findings and Achievements

- The study was able to create an inventory of 8 springs in the Ramgarh Cluster of Uttarakhand, out of which 3 springs were selected for intervention based on a variety of factors viz. the need, dependency of the community, stakeholders, willingness to participate, and the scope to carry out the spring recharge activities.
- 53 household surveys were conducted which included 156 men, 133 women and 148 children. Of the total 355 beneficiaries, 32 belonged to the Scheduled Caste category.



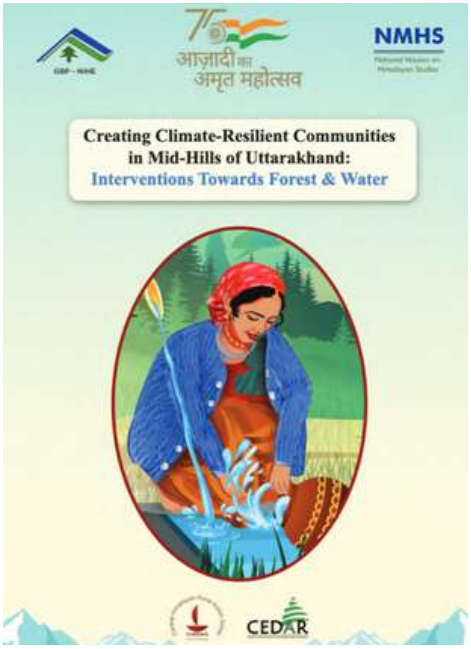
Map of eight springs; red dots showing location of selected 03 springs

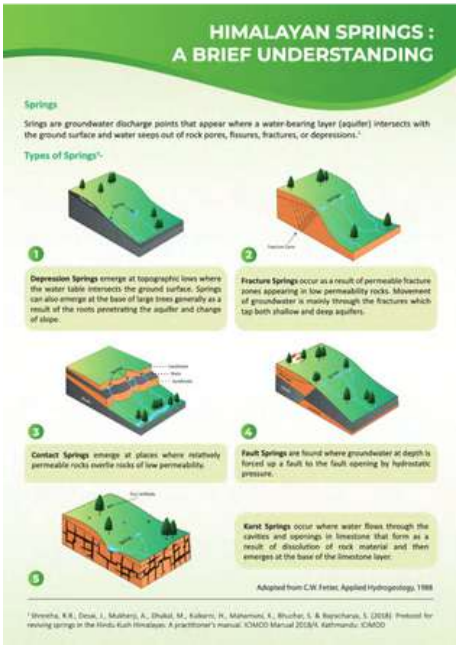
- Water user committees were created, and village-level training workshops provided to address pressure on springs.
- Vegetation cover was promoted in 4 ha of land through 2,500 plantations and direct seed Sowing. Additionally, 6 ha of afforestation activity was done in the catchment of the springs through 3750 plantations. The area was affected by fire hence, through community participation 6 ha of the area was afforested.
- 10 Para hydrogeologists have been trained for implementation purpose and long-term data monitoring. 6 Youth leaders were trained, 1 centralized capacity-building for the identified para-hydrogeologists on spring discharge, monitoring, geo-hydrology and water quality testing was successfully completed.
- 2 Trainings cum Exposure visits were organized for the identified para hydrogeologists, youth leaders and water user committee members to understand the on-ground spring recharge work and its impact.
- The data from the baseline survey was triangulated with the spring discharge data to come up with a Village Water Security Plan for each village where other sources of water such as rooftop rainwater harvesting were also suggested to the locals in order to meet demand side.
- Structures of rooftop rainwater harvesting were also constructed in the houses of some of the beneficiaries as demonstration models.
- Automatic Weather Station installed on site.

Outreach

Knowledge products

- A training manual developed for para- para-paradrogeologists.
- A booklet “Creating Climate-Resilient Communities in Mid-Hills of Uttarakhand: Interventions Towards Forest & Water” and a brochure “ Himalayan Springs: A Brief Understanding” has been published and released during the workshop “Springshed Management; Learnings and Way Forward” on 29 September 2022.
- Video documentary on project outcomes and field interventions has been released.





Workshop

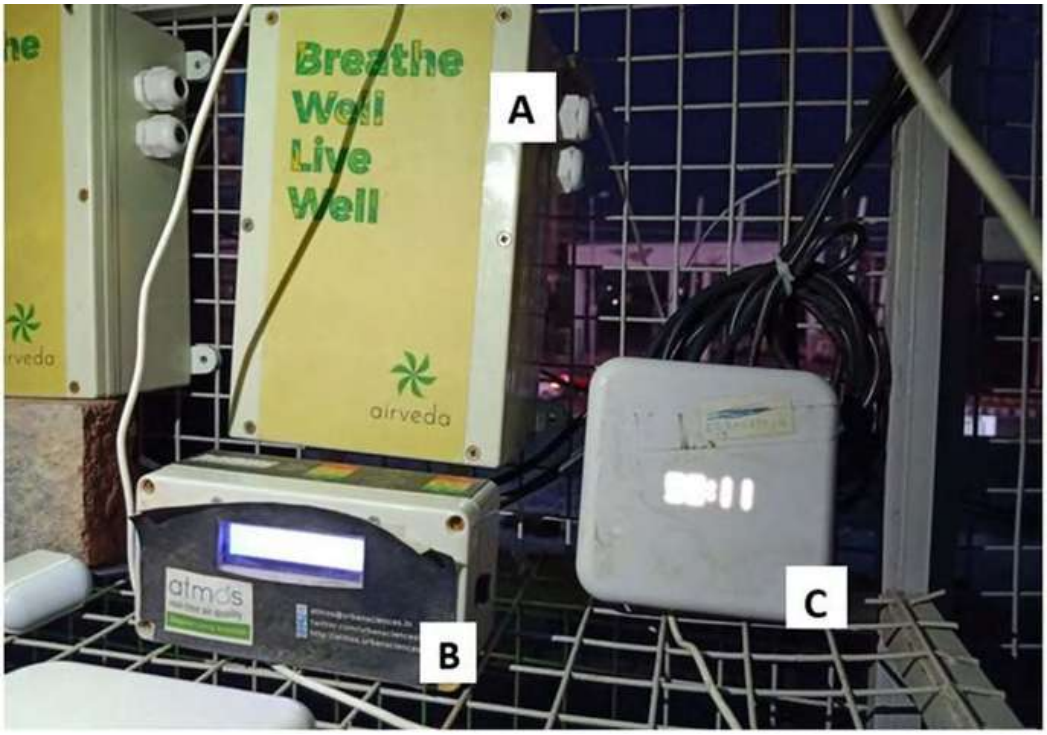
Springshed Management; Learnings and Way Forward

A consultation workshop was jointly organized by the Centre for Ecology Development and Research (CEDAR), Dehradun and the Central Himalayan Rural Action Group (CHIRAG), Nainital on 29 September 2022 at Hotel Pacific, Subhash Road, Dehradun as part of the project "Creating Climate-Resilient Communities in the Mid-Hills of Uttarakhand: Interventions towards Forest and Water" funded by the National Mission on Himalayan Studies. This workshop brought together scientists, academicians, civil society members, and representatives from important government bodies in Uttarakhand to present the findings of the NMHS-funded project, but more importantly to develop a common understanding of spring-shed management, initiatives currently underway, identify gaps, and develop a strategic plan to further expand our understanding of spring-shed management.

Establishing a Low-Cost Sensors Net work for Air Quality Monitoring in Gurgaon India

Donor/Funding Agency: Clean Air Fund (CAF)
Field Site: Gurgaon, Haryana, India
Duration: December 2020 - February 2023
Project Investigator: Mr. Chetan Agrawal

Gurgaon city has poor air quality, along with Delhi and other cities in the Indo-Gangetic plains. This project aims to support the expansion of Gurgaon's low-cost sensor air quality network, to complement the regulatory air quality monitoring stations of the state, and generate more reliable air quality data within Gurgaon; improve the understanding of air pollution hotspots in Gurgaon, both geographically and temporally, and make available air quality information for evidence-based policy decisions that catalyse interventions to reduce air pollution. The project will contribute to the understanding of functioning of low-cost sensor in Indian conditions. It will involve scoping the most effective low-cost sensors with low margins of error and evaluating the same by co-locating them with a reference grade monitor. Study will also focus on expanding the low-cost sensor network in Gurgaon according to specified criteria, and facilitating the installing and calibration of the sensors. This will help assess the efficacy of low-cost sensors to play an informative role in supplement to reference grade monitors and also culminate in a publicly accessible database of air quality of the local authorities.



Low cost air quality monitoring sensors: A-Airveda; B-Atmos; C-Prana Air

Findings and Achievements

1. Low cost sensors are good enough and can play an important role in 'non regulatory' and 'informational' monitoring and supplement the high quality and high cost reference grade sensors.
2. Relative humidity has a significant impact on sensor performance and for periods with RH>90%, the R2 with the reference monitor drops drastically.
3. Four units of sensors were installed in three locations in the periphery of the city in forest areas.
4. Existing sensors were upgraded (new sensing elements, expanded battery backup, solar panels), tested, further upgraded (further additional battery backup for seamless power), additional sensors added as preferred by GMDA (for rain, noise, etc), and deployed in the forested areas in the city.
5. Low-cost sensors were more accurate in measuring PM 2.5 then PM 10.
6. The data resulting from the sensors allows an evaluation of their effectiveness within the Gurgaon context, providing a greater understanding of their effectiveness in the Indian Climate.
7. The data is accessed through dashboard and is being evaluated for following parameters such as standard deviation, coefficient of variation, correlation, trend analysis and sensor validation through regression, slope and intercept and errors (RMSE & NRMSE).
8. The result of this study have helped to identify two reasonably reliable and accurate sensors and this will help generate trustworthy data that will be shared in a citizen friendly way.

Creating Evidence for Forest Based Resilience During COVID-19

(In collaboration with Swedish University of Agricultural Sciences Uppsala, Northen Arizona University, United States of America)

Donor/Funding Agency: FORMAS- Swedish Research Council
Field Site: India (Assam, Himachal Pradesh, and Madhya Pradesh)
Duration: January 2021 - December 2022
Project Investigator: Dr. Harry Fischer
Project Co-Lead: Dr. Alark Saxena (NAU, Forestry Expert/Research Advisor), Dr. Vishal Singh (CEDAR)

Forest products play a critical role in household responses to many kinds of livelihood shocks, particularly in rural areas of low-income countries. However, increased forest use-driven by declining off-farm employment and widespread urban to rural migration in the wake of COVID-19-risks degradation, which may threaten longer-term human welfare and environmental objectives. This project studies the role of forests in contributing to livelihood security at a time of unprecedented distress to help build more secure and sustainable human-environment system. Through a mixture of qualitative enquiry, household surveys, and remote sensing analysis, we assess the role of forests in household coping strategies, study the impacts of changing forest use on forest structure, and identify policies associated with greater socioecological resilience. Our research will contribute critical knowledge to building more sustainable livelihood systems in the face of COVID-19, climate change, and a wide range of shocks, with direct relevance for policy in many countries around the world

Findings and Achievements

1. The role of forest as a safety net during the time of COVID has been different in the three different states. It appears that the availability of forest resources depended upon the landscape, ecology, historical use, and seasonality associated with the landscapes.
2. In Madhya Pradesh, it appears that there was no significant increase in the use of forest resources during COVID-19.
3. In Assam, the increased use of forest resources was observed. There was an increase in the use of garden vegetables that were available to the households. There was also an increase in the use of ferns and other non-timber forest products from the forest.
4. The local public distribution systems- maintained continuity and supplied enough that could support the rural communities. However, there was a struggle in getting household rations due to limited timings of operations.

5. The National Rural Employment Guarantee Scheme did not appear to be working within the forest-dependent communities in Madhya Pradesh– the result from other states is under analysis.

6. In Madhya Pradesh, farmers /forest-dependent communities were unable to get a fair price for their agriculture and forest produces. They often sold their produce for half the market price. At the same time, the rural communities had to buy items of daily use at two to four times the price in the market.

Discussion with local field experts

Impacts of the COVID-19 Pandemic on Forest Resource Use by Rural Communities in India

(In collaboration with Swedish University of Agricultural Sciences, Texas A & M University ISB, Hyderabad and University of Minnesota, US)

Donor/Funding Agency: FORMAS- Swedish Research Council
Field Site: Himachal Pradesh
Duration: January 2021 - December 2022
Project Investigator: Dr. Harry Fischer
Project Co-Lead: Dr. Vijay Ramprasad, Dr. Vishal Singh (CEDAR)

The current COVID-19 pandemic increases the likelihood of food insecurity in many regions worldwide (Dev, 2020; Harvey, 2020; Food Security Information Network (FSIN), 2020). Forest products and other local natural resources play a critical role in household responses to many kinds of livelihood shocks (Pramova et al., 2012; Angelsen et al., 2014; Sunderlin et al., 2005). The present moment offers an unprecedented opportunity to examine relationships among forests, livelihood shocks, and public policy. We propose to build on an existing dataset that documents forest cover, forest use by forest-fringe communities, and public-policy interventions to improve forest cover to examine the ways in which a major livelihood shock resulting from COVID-19 alters relationships between forests and people.

We will use a combination of remote sensing, household surveys, and systems modelling to build on existing data to answer five questions: 1) How do people change their use of forest products in reaction to livelihood shocks?; 2) How do livelihood shock-driven uses of forests change land cover?; 3) How do public policies aimed at improving forest and other land cover affect the ability of people to sustain their livelihoods from 27 sustainable forest management in the face of livelihood shocks?; 4) How effective are innovative algorithms at extracting useful forest-use/land-change information from remotely-sensed imagery under challenging circumstances; and 5) How can a socio-ecological systems model aid in synthesizing information about how the pandemic has altered interactions among people and forest plantations?

Findings and Achievements

- Completed the collection of a panel dataset of plantations, communities and households that were sampled as part of a larger project funded by NASA in 2017.
- This panel data set includes revisits to: 153 plantations, 26 communities (panchayats), and 720 households.
- Data has been entered in Qualtrics software; cleaning, processing, and analysis is underway.
- Additionally, 200 household-level interviews were conducted; data entry of 110 is completed so far.

- Completed a qualitative study of participation in plantation-based forest restoration programs. Analysis of remotely sensed information is underway.
- We trained or re-trained 10 field staff in panel data collection and qualitative data collection.
- Field visit and team meeting were conducted in Nov 2021.
- Two engagement meetings (Vijay Ramprasad, Hal Fischer) with Forest Department officials were organised in Himachal Pradesh.
- Preliminary results were presented in virtual conferences of FOCALI (Forest, Climate, and Livelihood research network) and the bi-annual meeting of IASC (International Association for the Study of the Commons).

Stakeholder Consultations for Integrated Management Planning of Renuka and Pong Ramsar Sites in Himachal Pradesh

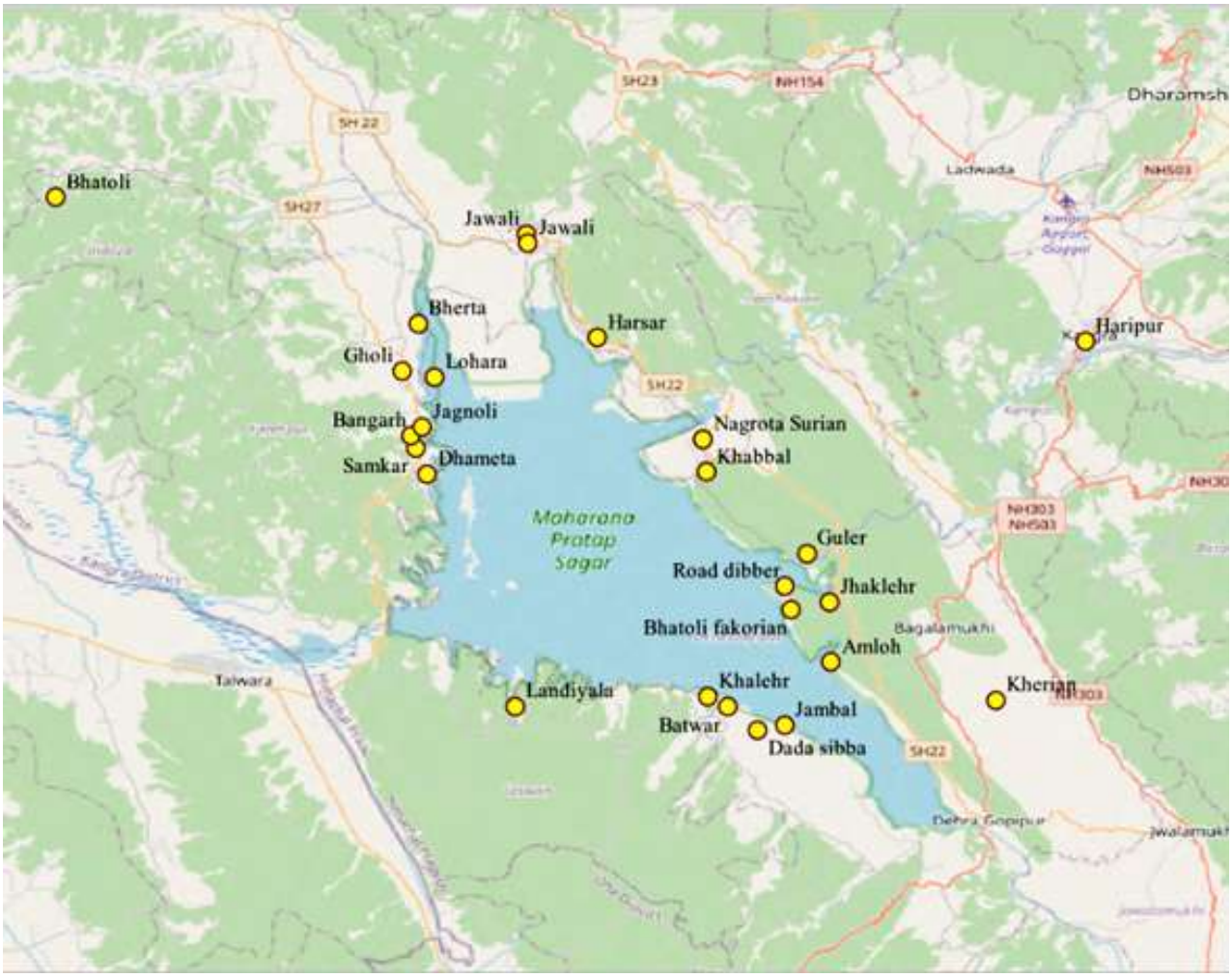
Donor/Funding Agency: Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ), India
Field Site: Pong Dam Lake Ramsar SIte, Kangra District, Himachal Pradesh
Duration: January 2022 - September 2022
Project Investigator: Dr. Vishal Singh
Project Lead: Dr. Renu Suyal and Dr. Anvita Pandey

Pong Dam Lake wetland, also called Maharana Pratap Sagar, is a man-made wetland built across the Beas River in 1974. Apart from providing irrigation water, it also generates hydropower, regulates floods, provides livelihoods to fishermen, and support immense diversity of waterfowl. The entire area of Pong Dam reservoir is also notified as a wildlife sanctuary. It's also been declared a Ramsar site in 2002 as it plays host to a variety of migratory birds coming from the Trans Himalayan zone during the winter season. Pong Dam wetlands with its large catchment is vulnerable to several climate-induced risk such as floods, increased siltation, reduced storage capacity and habitat changes, and affected fish bio-diversity. There are threats to sustainable fish production due to erratic climatic parameters, inconsistent stocking patterns and the presence of large predatory fishes. Overlapping interests has led to conflicts between stakeholder on issues such as drawdown cultivation and grazing.

Pong Dam Lake Wetland- Designated Ramsar site of International Importance

The MoEF&CC - GIZ technical cooperation project "Wetlands Management for Biodiversity and Climate Protection", being implemented jointly in Himachal Pradesh with Himachal Pradesh State Wetland Authority (HPSWA), Wildlife Division (Himachal Pradesh Forest Department) and Wetlands International South Asia (WISA), have prepared an integrated management plan (IMP) for Pong Dam Lake, one of the three Ramsar sites in Himachal Pradesh. The project was led by People's Science Institute (PSI) in collaboration with Centre for Ecology Development and Research (CEDAR), Dehradun. PSI was responsible for Renuka Wetland while CEDAR looked upon Pong Dam Lake Wetland.

The aim of the study was to conduct stakeholders' consultations to support integrated management planning for the Pong Ramsar Site and to facilitate intensive stakeholders' dialogues to discuss various aspects of the wetland management.



Villages covered during stakeholder consultations in Pong Dam Lake Wetland

Findings and Achievements

18 stakeholders' consultation were conducted across four blocks (Dhera, Nagrota Surian, Fatehpur and Pragpur) of Kangra District. 228 participants from 24 villages participated in different stakeholder meetings including 135 male and 93 females. These stakeholder groups include Panchayat members (Office bearers, farmers, grazers), regional water sports centre, Pong dam, fisheries (15 fisheries cooperatives and fisheries officers), Mahila Mangal Dals, youth clubs, etc.

Dr. Renu Suyal of CEDAR presented an introductory session on ecosystem services provided by the Pong Dam, need for the development of an integrated management plan (IMP), extant of rules and regulations.

Pong wetland provide key habitat for Bar Headed Goose- Winter migratory bird. Photo by Gagan Bedi

Threats and drivers of change pertaining to Pong Dam Lake wetland

The main threats to Pong Dam Lake wetlands as identified by different stakeholders were: increased sediment deposition, decrease in the number of migratory birds, grazing, tourism activities, climate change, deteriorating water quality, lack of livelihood opportunities, and lack of coordination among or between departments and other stakeholders. The main drivers of change includes illegal mining, inflow of debris through khads into lakes, use of loose nylon thread nets/reflecting objects in field may lead to decrease in species diversity, use of undersized nets, solid waste dumping by tourists, increased water temperature and erratic rainfall, delayed or no off-season cum compensatory financial relief.

Possible solutions, challenges and training support required

Possible solutions

- The forest department should prepare guidelines for sustainable agriculture practices and remove the ban on cultivation in drawdown areas
- Engagement of local community in maintenance of key habitat of migratory birds
- Protection of breeding sites of water birds
- Promotion of eco-tourism activities in the wetland
- Promotion of native fish breeding and training of fishermen for the same
- The sale of undersized nets should be completely banned and periodic patrolling should be done by the fishery department to ensure fishing malpractice
- The fishermen also mentioned that the compensation for the period when the lake is closed should be increased. They also mentioned that stocking should be increased by the department and transparency should be maintained in the stocking process.

Challenges

- Getting permission from the BBMB
- Shortage of staff
- Conflict among locals, lack of interest and awareness
- Lack of alternative area for grazing
- Monetary support to locals to ensure their participation in the management of wetland
- Despite being a Ramsar site, tourism has not been promoted in the region, due to which, the locals are not really exposed to tourism-related activities.
- Due lack of proper stay, food, and infrastructure facilities hinders the promotion of eco-tourism.

Training Support required

- Training and educating the fishers on stocking practices to maintain fish population along with monitoring of illegal activities
- Eco tourism is an opportunity to support livelihood within the wetland
- Training in water safety and rescue operations They would be interested in training relating to tourism such as training for tourist guides, homestays, etc. They even mentioned that promoting tourism in the region would help improve income and employment opportunities in the region.
- Different fairs held in and around the wetland needs wide publicity, so people may have handsome income through vending and other recreational activities.

Outreach

Workshop

Multi-Stakeholder Workshop for Integrated Management of Pong Dam Lake Ramsar Site

A multistakeholder workshop was organized on 24 August 2022 at the Office of the Deputy Commissioner Kangra, Meeting Hall (Room 823), Dharamshala, Himachal Pradesh to discuss inter-departmental convergence to identify relevant actors for the implementation of management measures and monitoring as guided by the Integrated Management Plan prepared for Pong Dam Lake, a Ramsar site in the district of Kangra. Mr. Rohit Rathour H.A.S., Addl. District Magistrate (ADM) Kangra, chaired the workshop and delivered an opening address highlighting the need for inter-departmental convergence at the district level for integrated management of Pong Dam Lake Ramsar Site.

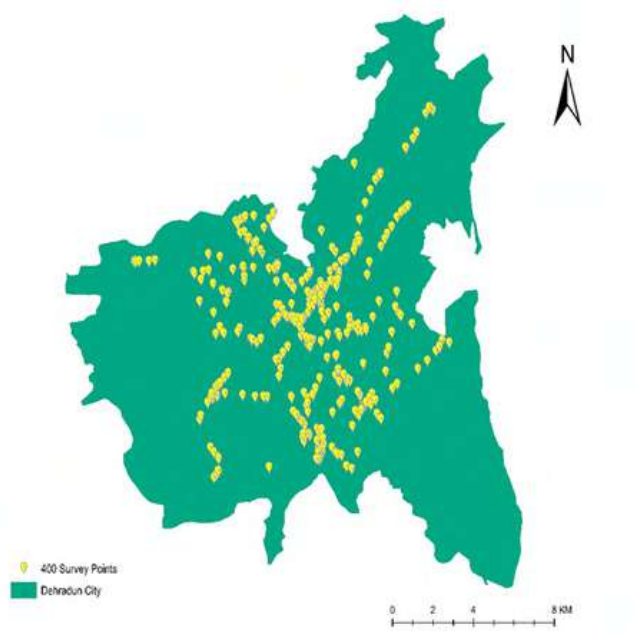
Dr. Renu Suyal from the Centre for Ecology Development and Research (CEDAR) Dehradun shared the outcome from the first phase of community-level stakeholder consultations for Pong IMP. A total of 35 participants participated in the workshop representing different government departments.

Study on Exposure and Impact of Air Pollution in the Growing Cities in the Hindu Kush Himalaya (HKH) Region

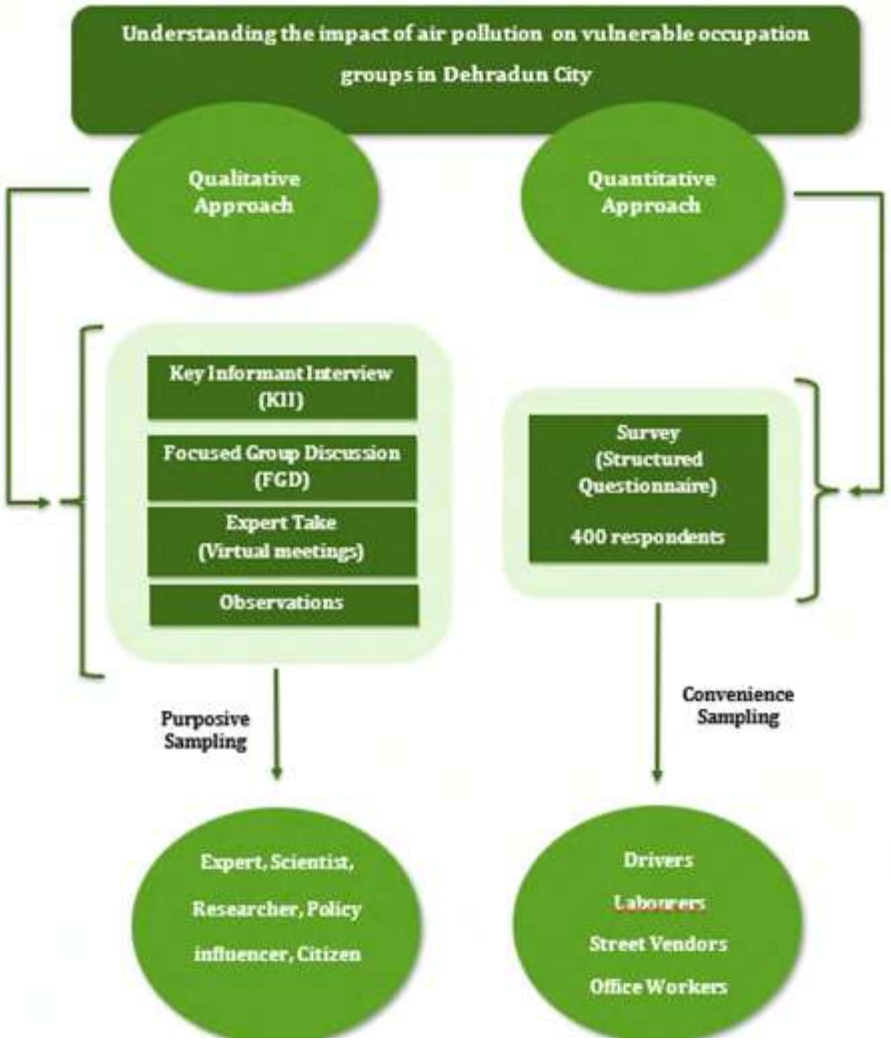
Donor/Funding Agency: International Centre for Integrated Mountain Development (ICIMOD), Nepal
Field Site: Dehradun, Uttarakhand
Duration: February 2022 - December 2022
Project Investigator: Dr. Vishal Singh
Project Lead: Dr. Nidhi Singh

Over the past decades, the Hindu Kush Himalaya (HKH) has been affected by rising emissions of air pollutants from urban, industrial, and rural sources. Poor air quality is a major health and well-being concern in the towns and cities in the HKH region. It has raised concerns about deteriorating air quality and its impacts on human health. There is a need to understand why people continue to expose themselves to high air pollution levels, especially those working in vulnerable occupations such as drivers, street vendors, labourers etc. To understand the ground realities, International Centre for Integrated Mountain Development (ICIMOD), a regional intergovernmental learning and knowledge sharing centre, has started working with key national organisations, under the umbrella of Atmospheric Watch Initiative. Apart from measuring air quality, this initiative consists of working on the exposure and impacts of air quality on human life and livelihoods.

CEDAR in collaboration with ICIMOD is conducting this study in Dehradun, India. The main objectives of the study are - To assess the impact of air pollution on the vulnerable occupation groups in the form of taxi drivers, street vendors and labourers; To collect adequate quantitative data and assess the status of adaptation to air pollution from behavioural (social) response perspective and, to unpack complex issues in relation to exposure and impact of air pollution at the household level.



GIS map of survey points in Dehradun city



Applied approach to conduct the air pollution study in Dehradun city

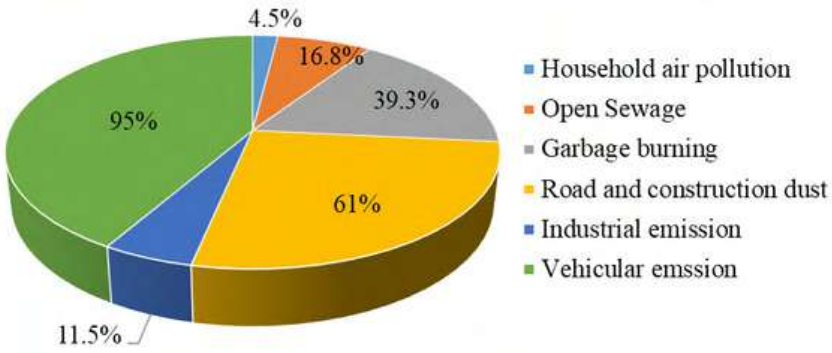
Findings and Achievements

1. Study faced the gender imbalance challenge. No female candidate was found in the driver group, there were only 91(22.75%) female participants.

Sociodemographic details of the respondents

S. No.	Characteristics	Variables	Number	Percentage (%)
1.	**Reach of the survey** n=400	Residence location (Total number of wards = 100)	81	81
2.	**Demographic variables (Age & Gender)** n=400	**Age**		
		(18-30 years)	139	34.75
		(31-50 years)	213	53.25
		(More than 50 years)	48	12
		Gender		
		Male	309	77.25
		Female	91	22.75
3.	**Occupation** n=400	Labourer	100	25
		Driver	100	25
		Vendor	100	25
		Office worker	100	25
4.	**Migration** n=400	Total Migrant Respondents	196	49
		(n = 196) Labourer	54	27.55
		Driver	40	20.40
		Vendor	53	27.04
		Office worker	49	25.00

2. All the participants viewed vehicular emission, resuspended dust particles and garbage burning as three main possible sources of air pollution in the city, respectively.



Perception of respondents in %

Perception of air pollution sources in Dehradun city

3. Outdoor exposure was found to be one of the most important factors associated with the air pollution of Dehradun. It was observed that drivers work for an average 12 hours, street vendors for 11 hours and construction laborers for 8 hours in outdoor conditions at the busiest places in the city. On that basis, drivers (vikram, auto, bus and e-rickshaw drivers) and vendors (street vendors) were found to be relatively more exposed to air pollutants than other respondents.

4. 96.5% respondents perceived that in the last 10 years, air pollution has increased in Dehradun city but when asked about the current air quality of the city, 44% of respondents replied that the current air quality of the city is fair.

5. As far as occupational air pollution is concerned, we found that maximum office workers did not see air pollution at their workplace as a problem, while laborers, drivers and vendors rated this between moderate and slightly serious.

6. Among 400 respondents only 41% perceived that change in normal daily behaviour could lead to avoid air pollution impacts.

7. It is reflecting from the study that vulnerable occupational groups located in Dehradun city were somewhere not able to resist the risk. Despite being involved in vulnerable occupations, 71.25% participants said that they did not feel any symptoms of air pollution during work. This shows that the vulnerable population of Dehradun city is able to perceive air pollution as a health risk and also feel vulnerable to it but is somehow unable to detect the health symptom associated with it.

Outreach

Workshop

Science Policy Dialogue -Air Pollution in HKH region- Insights and Knowledge Exchange

As part of the study, a workshop on "Science Policy Dialogue -Air Pollution in HKH region- Insights and Knowledge Exchange" was organized on the 5th of December 2022 in Dehradun. The participants included Government representatives, academics, scientists, civil society leaders, social workers, psychologists, representatives of national-level agencies representatives of local NGOs (Non-Governmental Organizations), national-level think tanks, concerned citizens of Dehradun and representatives of national and local media. The choice of participants was strategically determined, keeping in mind diversity, inclusion, policy influence, and advocacy. The Member Secretary, of Uttarakhand Pollution Control Board (UKPCB) Shri S P Subudhi, IFS chaired the meeting.

Training About Digital Data Collection and Analysis

Three-day training/ workshop was organized by ICIMOD, Kathmandu, Nepal with an aim to enhance the capacity of participants to use KoBoToolbox – a digital data collection tool for quantitative surveys. The training was supervised by Mr. Sugat Bajracharya, Socioeconomic Survey and Data Analyst, ICIMOD. Dr. Nidhi Singh, Ms. Swati Singh and Ms. Ankita Rawat of CEDAR participated in the workshop.

Day one began with an Introduction to digital data collection: KoboToolbox/setting up KoBo account, with activities like - Building forms with KoBo followed by deployment of forms/dummy data collection exercises/troubleshooting on issues. The second day of the workshop was about Data Visualization in KoBo. Participants trained about exporting data to perform data analysis/structure of data, Tabulations/analysis of data exported from KoBo. On the last day, there was sessions related to Environmental Justice: Protecting the vulnerable from air pollution and Just transition: Ensuring inclusive benefits and reducing unintended negative consequences on vulnerable groups by Dr. Amina Maharjan, Interim Theme Leader and Senior Specialist Livelihoods and Migration, ICIMOD).

Biodiversity and Carbon Assessment of Manar Van Panchayat in Champawat District of Uttarakhand

Donor/Funding Agency: BAIF Development and Research Foundation, Pune
Field Site: Manar Van Panchayat, Khetikhan, Champawat, Uttarakhand
Duration: October 2022 - December 2022
Project Investigator: Dr. Vishal Singh
Project Lead: Dr. Renu Suyal

View of Manar Van Panchayat, Photo by BAIF

Forests play an important role in the global carbon (c) budget. Forest ecosystem carbon content is the result of the interaction between climate, soil moisture, soil temperature, plant species, nutrient availability, soil texture, and disturbance regimes. These vast reservoirs of carbon provide several critical ecosystem services to humankind including water regulation, biodiversity and non-timber forest produce, and intrinsic values. The rate at which forest degradation is taking place in IHR warrants immediate conservation initiatives without compromising community deeds.

With the above backdrop, CEDAR proposed a study that assessed the biomass and biodiversity status of an 11-hectare Van Panchayat in Manar village, Champawat. The Van Panchayat is claimed to be doing well from a carbon and biodiversity point of view however robust shreds of evidence to claim the same are missing.

In order to upscale such a model elsewhere, we conducted a robust evidence-collection exercise to make accurate claims by assessing biomass and carbon stocks, soil and realize the biodiversity status of the Van Panchayat along with setting of permanent plots for repeated measures of temporal changes.

Permanent sample plots distributed in a base map

Approach

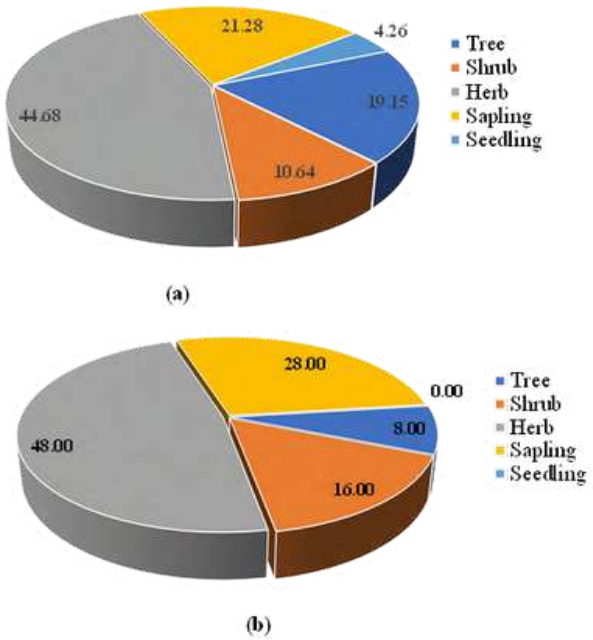
To gather quantitative data of different forest layers (tree, shrub, and herbs) standard phytosociological methods were followed. 20 circular plots, each 400 m² (radius 11.29 m) were laid down inside the Van panchayat and 06 plots outside the VP to assess forest diversity. The Circumference at breast height (CBH) of each individual tree species were measured at 1.37 m from ground surface. Soil samples were collected at 30 cm depths from each permanent plots (n=26) and Bulk density, soil carbon was measured at CEDAR laboratory. Biomass was calculated using regression equation of allometric methods (Annexure 1).

Findings and Achievements

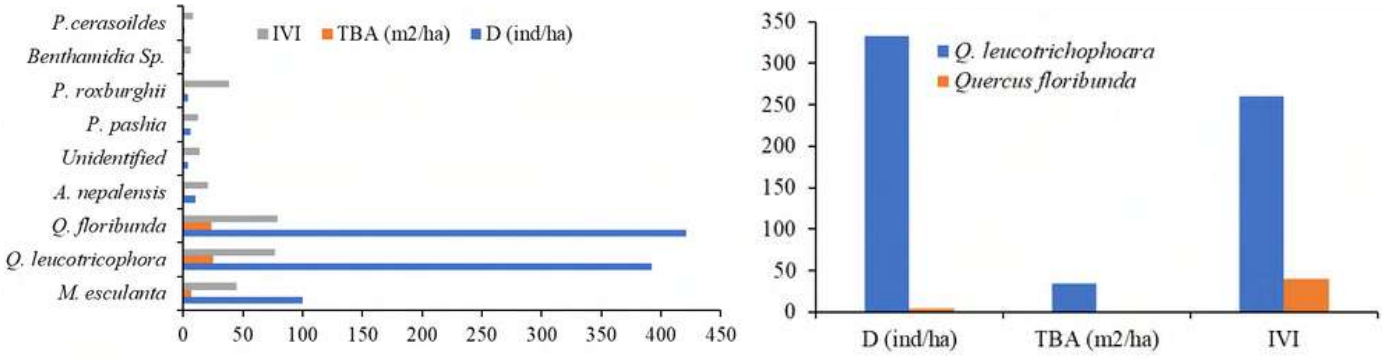
1. **Compositional features of representative VP**

The results of field-based study revealed a total of 47 plant species (21 family) including 9 trees (9; 19.15%), shrubs (5; 10.64%); herbs (21; 44.68%), Saplings (10; 21.28%) and seedlings (2; 4.26%) in the studied VP. In sites outside the VP), a total of 25 plant species (12 family) were recorded, with a greater proportion of herbs (12; 48%) followed by saplings (7; 28%), shrubs (4; 16%) and trees (2; 8%).

In VP, maximum tree density was recorded for *Quercus floribunda* (421 individual/hectare), total basal area (TBA) was recorded maximum for (24.74 metre^{2}ha^{-1}) for *Q. leucotrichophora*, followed by *Q. floribunda* (23.19 m^2 ha^{-1}). Importance value index (IVI) ranges between 79.06 (*Q. floribunda*), followed by 77 (*Q. leucotrichophora*) to 6.22 (Benthamidia sp.).



Floristic diversity distribution (%) across life forms in the study area (a) VP and (b) outside the VP

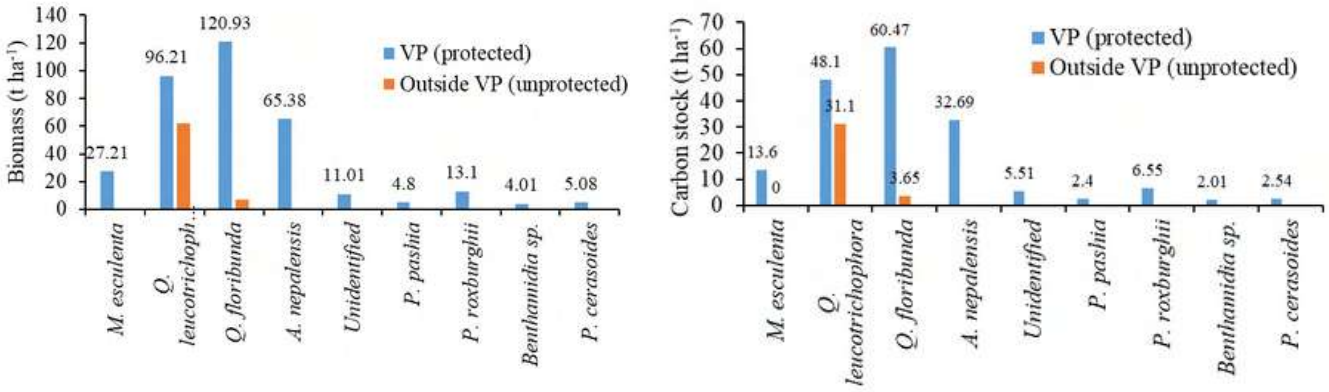


Graph showing tree density, basal area and IVI in Van panchayat plots and outside van panchayat plots

The total biomass stock of Manar VP includes 347.73 t ha^{-1} of which 86.9% (302.27 t ha^{-1}) of biomass was above ground and remaining 13.1% (45.46 t ha^{-1}) was belowground. The dominant tree species i.e., *Q. floribunda* (120.93 t ha^{-1}) and *Q. leucotrichophora* (96.21 t ha^{-1}) contributed 62% of total biomass.

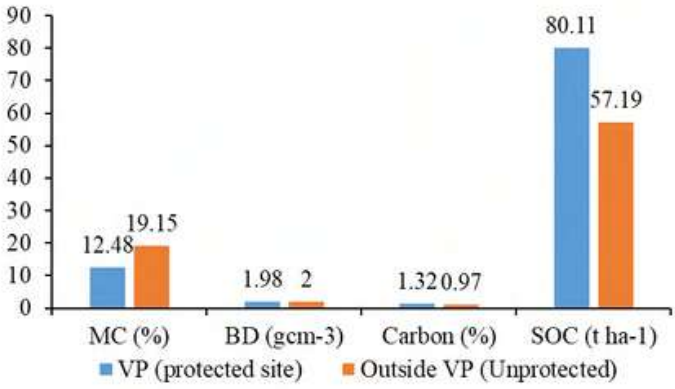
The total carbon stock for the studied VP was 173.87 t ha^{-1}. Maximum carbon stock was recorded for *Q. floribunda* (60.47 t ha^{-1}) and *Q. leucotrichophora* (48.10 t ha^{-1}). Outside VP, the total carbon stock was 34.75 t ha^{-1}.

2.Biomass and carbon stocks



Biomass and carbon stock recorded in VP and outside VP

3. Bulk density, moisture content and carbon



Soil moisture content was estimated to be 12.48% for VP and 19.15% outside VP, bulk density ranges from 1.98 g cm-3 (VP) to 2.0 g cm-3 (outside VP). Mean soil carbon (%) recorded maximum (1.32) for VP and minimum (0.97) for outside VP respectively

4. Dependence for subsistence on Van panchayat

- Household Surveys were done in 20 households across Mannar Village using KoBo Toolbox
- The questions were directed to the members who are largely involved in forest-related activities.
- 85% of the respondents were female.
- The average household income in the village is Rs. 11750/- per month, with the major sources of income came from private Jobs (for 45%) and animal husbandry (for 35% of households)

Dependency for fodder and fuelwood

- The average cost of purchased fodder is about Rs. 1194/- per month
- The majority of the households (90%) collect fodder on their own; 60% also purchase the fodder from their local dairy or fodder shops
- Women reported carrying 20 kilograms head load fodder in one trip, *Q. leucotrichophora* was the most popular and commonly used species for fodder collection followed by *Q. floribunda*
- Majority of the respondents reported lopping the trees to meet their fodder needs
- Major sources of cooking in the village are fuelwood and LPG
- In most cases, fuelwood collection takes place on a daily basis, while some keep stock of fuelwood in their homes
- While 25% of the respondents reported collecting fuelwood throughout the year, 60% informed that they collect fuelwood only during the winter months
- It takes them between 1 – 2 trips daily to fulfill their fuelwood requirements
- On an average, in each trip, they carried around 23.5 kg of fuelwood, and the average daily requirement of fuelwood is around 17.3 kg.

Recommendations

- Regular and long-term interventions are required in order to capture the impact of conservation in a more holistic manner. The permanent plots developed under the study would be useful in this exercise.
- Looking at the fuelwood and fodder demand of the villagers there is a dire need to explore options of alternate energy in the region. However, the lack of LPG use should be investigated through a proper study.
- In order to fulfil the gap between demand and supply of fodder, fodder grasses such as napier (Pennisetum purpureum), thysanolaena and other grasses could be introduced in degraded lands and agriculture bunds in consultation with experts.
- One of the major concerns coming out of this study is women drudgery. Such issues need more attention by decision makers, project developers, implementors at all levels.
- Such efforts of community carbon conservation need to be showcase across state and national parameters more value addition to such efforts could come through meaningful social inclusion and long-term community involvement.

Ongoing Projects

1. Pollination Limitation in apples in the Uttarakhand Himalayas
2. Hydro-Geological Assessment and Socio-Economic Implications of Depleting water Resources in Nainital
3. Baseline Forest Monitoring of the Ghata Bandh in Gurgaon
4. Security ecosystem services of forests and hydrology in Mangar Bani and Surrounding Aravallis

Pollination Limitation in apples in the Uttarakhand Himalayas

Donor/Funding Agency: The George Washington University (GW), USA
Field Site: Ramgarh block, Uttarakhand
Duration: November 2022 - July 2023
Project Investigator: Dr. Vishal Singh

Thousands of farmers in the Indian Western and Central Himalayas depend on apple cultivation for their livelihoods. Apples are highly pollinator-dependent crop. Over the past few decades, the productivity of apples has been declining due to climate change. Climate change is impacting the phenology of apples and pollinators, potentially leading to temporal mismatches when apple trees bloom and the availability of sufficient pollinators. These issues remain unexamined in the Indian context. To examine these issues, the project will be conducted in four phases. In the first phase, we will conduct landscape characteristics surrounding the orchards, in preparation for a study exploring the extent of and variation in pollination limitation along an altitudinal gradient in the Mukteshwar region of Uttarakhand. The first phase will focus on collecting data on the exclusion experiment. The second phase of the project involves training farmers to grow mustard plants for the pollination exclusion experiment and collecting pollinator samples from 15 orchards selected based on the data collected in the first phase. The third phase involves conducting the pollination exclusion experiment and the fourth phase involves identifying the specimens collected from pan-trap sampling. CEDAR in collaboration with Kalamazoo University, the George Washington University, USA and Flame University, Pune is conducting this study in Ramgarh block, Uttarakhand.

Findings and Achievements

- Field survey was completed and a total of 30 orchards were selected. The surveyor gathered information on altitude, location, boundaries of the orchard, number and type of apple trees and apple pollinizer trees, number and types of managed bee hives on the farm, frequency and timing of pesticide used, and characteristics of the immediate landscape surrounding the selected orchards (forest, farm, pastures, etc.).
- 15 orchards for the second phase has been selected based on the analysis of surveyed data.
- Data collection and farmers training dairy was developed by CEDAR in collaboration with other collaborators.
- Researchers from CEDAR visited the selected 15 orchards and carried out the first sample collection and simultaneously trained the farmers on sampling pollinators using bee bowls and vane traps and also filling the farmer's dairy.
- In March 2023 researchers from CEDAR, Dehradun, Kalamazoo University, the George Washington University, USA, and Flame University, Pune, aka Apples and Bees team, indulged in a 15-day research trip to Ramgarh block and conducted extensive pollination experiments in selected apple orchards.
- Pollinator samples collected by the researchers and farmers were processed with the assistance of the Apples and Bees International research team.
- A total of 1396 pollinators were recorded. Butterflies were not pinned or pointed but their numbers were recorded.
- Pollination exclusion experiments were conducted in the selected orchards.

Researcher from CEDAR explaining farmer sample collection technique

Prof. Ann Frasher, showing farmers hand pollination techniques

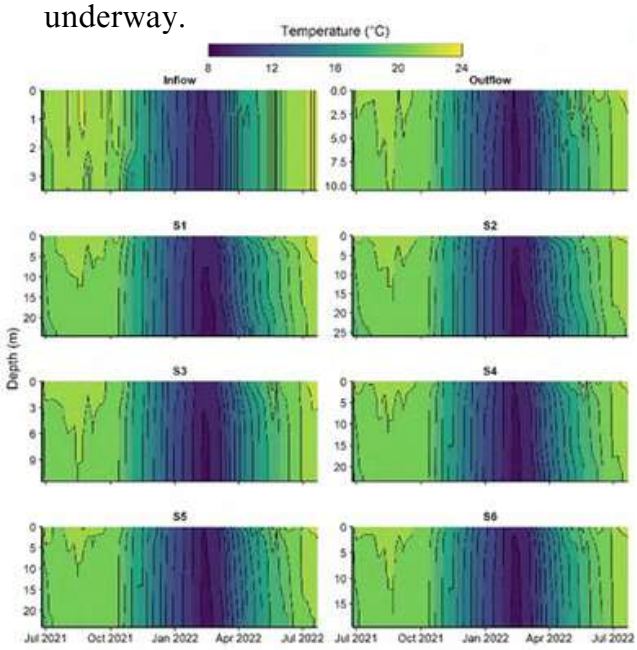
Hydro-Geological Assessment and Socio-Economic Implications of Depleting Water Resources in Tourist Towns of Uttarakhand

Donor/Funding Agency: Ministry of Jal Shakti, Department of Water Resources, River Development (RD) and Ganga Rejuvenation (GR)
Field Site: Nainital, Uttarakhand
Duration: January 2020 - December 2023
Project Investigator: Dr. Vishal Singh
Co Investigators: Dr. Rajeev Pandey (FRI, Dehradun); Dr. Sumit Sen; Dr. Sumit Sen (IIT, Roorkee)

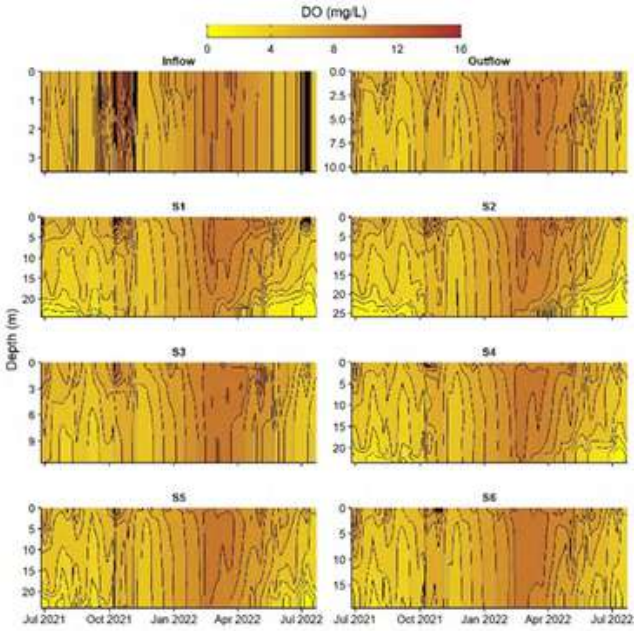
Project is commissioned to CEDAR in partnership with Indian Institute of Technology, Roorkee (IITR) and Forest Research Institute, Dehradun (FRI) by Ministry of Jal Shakti, Department of Water Resources, RD and GR. The study aims to examine the drivers for the altered regimes of water supply in the lake town Nainital and the mechanism to deal with it along with the objectives, include social, ecological, and technical and policy components for better water governance and awareness. CEDAR is mainly focusing on devising citizen science initiatives on long term monitoring, collecting data and compiling long term records which will reflect trends and changes, while IIT, Roorkee is assessing the hydrological balance of the lake. The FRI, Dehradun is looking at the water vulnerability of stakeholders within the municipal confines of Nainital.

Findings and Achievements

1. Monitoring of lake system: Through the weekly vertical profiling of lake at 8 points the Isotherm analysis reveals that very little variation in temperature from surface to bottom in the lake system in summers and mixed throughout the year, which attribute to the ongoing aeration in the lake since 2007. While Isopleth analysis shows that the bottom layers of lake system exhibit hypoxia in summers. Lake is thoroughly mixed from November through February and exhibits stratification and hypoxia in summers despite the aeration program underway.



Isothermal analysis



Isopleth analysis

2. Citizen science: Study supports the crowd sourced data collection. In the same context, baseline data collection based on avian diversity in and around the Naini lake catchment was done with the help of citizen of Nainital. Keeping the fact in mind that number and variety of birds are good indicator of environment, in addition to this initiative, pictures and related details of birds, commonly find in Nainital municipal boundary were collected from the citizens. Through this data collection and discussion with professional birders and experts we found that the number of bird species are slowly decreasing which indicates the bad environmental condition of Naini lake as well as the town.

3. Installation of Automated Weather Stations (AWS): One Automated Weather Station has been set up in the lake catchment, while the location for other two AWS has been finalized to monitor the meteorological parameters.

4. Nainital oriented website: The making of Nainital oriented website has been started. The only reason behind developing this website is that the public should also have the access of information related to Nainital.

Baseline Forest Monitoring of the Ghata Bandh in Gurgaon

Donor/Funding Agency: Iamgurgaon
Field Site: Ghata Bandh, Gurgaon
Duration: January 2023- March 2025
Project Investigator: Mr. Chetan Agrawal

The Ghata Bandh is an earthen bandh dating back from the late 19th century. Built in a gap in the Aravalli hills, the Bandh blocks the Kost nala and creates a submergence area known locally as the Ghata Jheel. The Ghata bandh is notified as a Protected Forest (PF) and managed by the Forest Department. Given the low forest cover (3.59%) in the state of Haryana, the lowest level in the country, and increasing concretization of Gurgaon city, conservation of the remnant forests in the Gurgaon is critical.

IAG is undertaking the restoration of the Ghata Bandh in collaboration with the Forest Department of Haryana for conservation of its flora to create opportunities for nature-based tourism for Gurgaon citizens. The Bandh area covers around 7-8 acres. Documentation of the forest vegetation and wildlife biodiversity, and hydrological functions of this protected forest is also needed. Preparation of a baseline of the ecosystem services of the area would form the basis for the ecologically sensitive planning for this protected forest and also provide a reference point for comparison in the future. The specific objective of this study is to undertake action-research in the above mentioned Ghata Bandh, to document the flora and fauna of this region through mapping, field surveys for vegetation and wildlife across the habitats in multiple seasons.

Location of Ghata Bandh in Aravalli's

Findings and Achievements

1. A baseline checklist of vegetation in the area – focused on trees and shrubs based on encounters in plots and walks is continuing.
2. Field surveys of mammals and plants to document and record the species and their distribution has started.

The zoom in view of the Ghata Bandh in Gurgaon

Security ecosystem services of forests and hydrology in Mangar Bani and Surrounding Aravalli's

Donor/Funding Agency: WIPRO Foundation
Field Site: Aravalli hill zones of Gurgaon and Faridabad
Duration: February 2023- January 2024
Project Investigator: Mr. Chetan Agrawal

The Mangar Bani sacred grove and the surrounding Aravalli's hills provide several ecosystem functions for the rapidly expanding cities of Gurgaon and Faridabad. These include ground water recharge, flood moderation, large scale forest cover, wildlife habitat and corridor, green lungs that moderate air pollution. The Mangar Bani Sacred Grove is an old growth forest in the Aravalli hills that straddles the border of Gurgaon- Faridabad and is also close to Delhi. This sacred grove is protected by the three adjacent villages that have protected it over many generations, but creeping urbanization, and changes in aspirations of the new generation raises questions about its protection in the future. The primary objective of this project is to increase understanding about the hydrological and forest ecosystem services of Aravalli's amongst the local communities and official stakeholders and identify and implement locally relevant actions that help improve the water security and other ecosystem of Gurgaon and neighbouring cities and villages.

Mangar Bani , a Sacred Grove at the boundary of Gurgaon and Faridabad district.
Photo by Pradip Krishsen,

Findings and Achievements

1. Enhanced forest hydrological ecosystem services provision in selected sub-catchments, with improved groundwater recharge.
2. Capacity building of local community stakeholders to undertake basic monitoring and identify and implement locally relevant groundwater recharge and watershed.
3. Increased appreciation of watershed services by local agencies and co-investments in the local implementations by the same.
4. Uptake of the project learning and forest watershed maps in local planning and management.
5. Awareness and appreciation about the flora and fauna of the Mangar Bani and the Aravalli's in the children in Mangar and other villages/schools.

Indian Porcupine spotted at Mangar Bani sacred grove. Photo by Sunil Harsana, Sanctuary Asia 2020

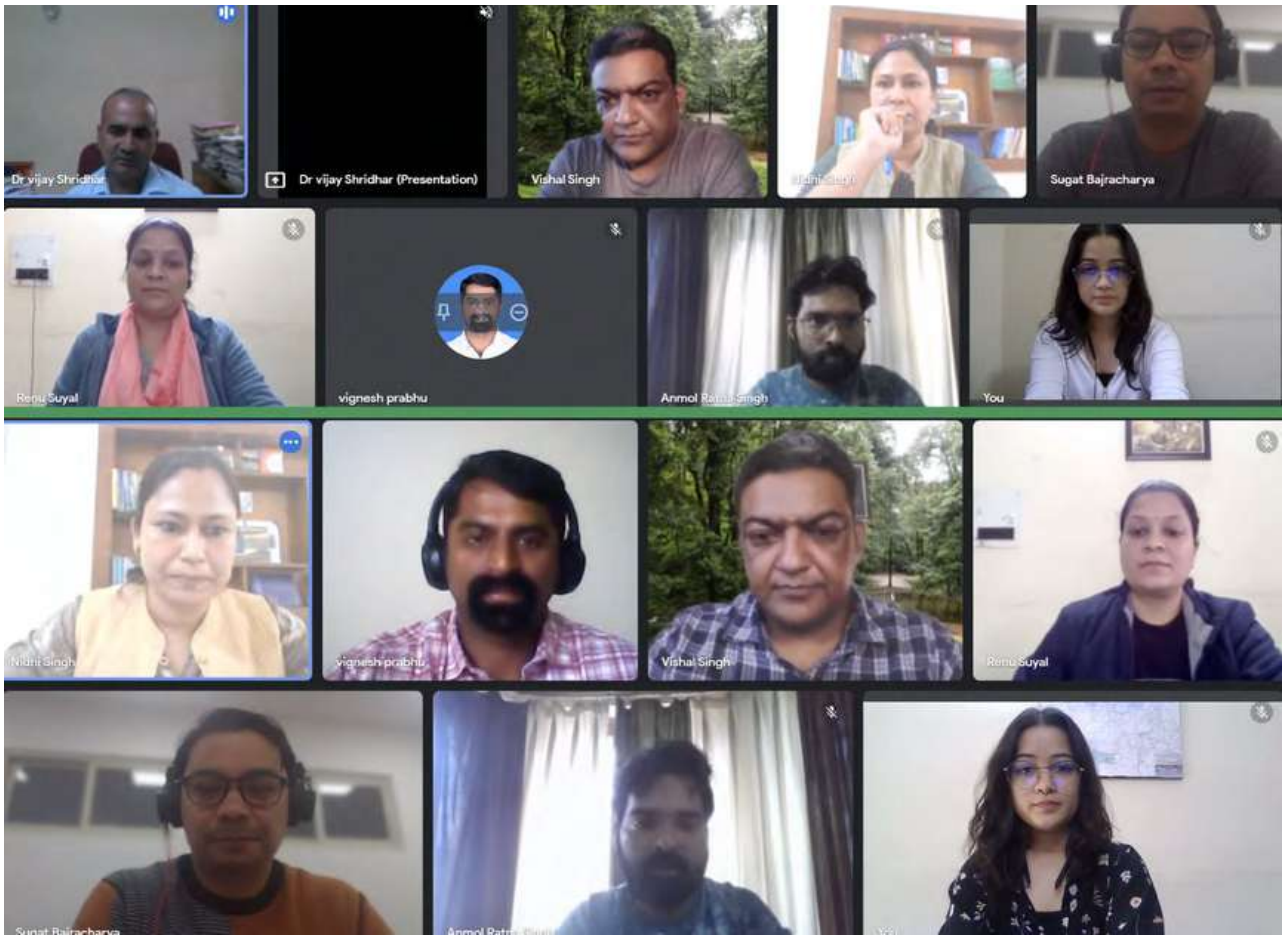
Capacity building of Children's of the Mangar Eco Club in Mangar Bani

CEDAR Knowledge Exchange Initiative

Date: 31 st October - 1st November, 2022

As part of the "CEDAR Knowledge Exchange Initiative" CEDAR invited Dr. Vijay Shridhar (SENR, Doon University) and Dr. Vignesh Prabhu (Senior Associate, CSTEP) leading academic in the field of Air Pollution in India to share his knowledge and expertise with regard to burgeoning problem of air pollution faced by HKH region. The talk was part of a collaborative and ongoing study on air pollution led by ICIMOD, Nepal.

Their talks highlighted issues related to air pollution in Dehradun, underpinning causes, concerns, and technological interventions. Dehradun, Rishikesh and Kashipur were listed as non-attainment city, since then several city and state level initiatives have been promoted to monitor air pollution in mountain cities of Uttarakhand. Dr. Shridhar emphasized on the Air Action Plan which is underway for consideration at a higher-level while, Dr. Prabhu shared the information related to the exposure and impact of air pollution on vulnerable people. Most importantly, their presentations were free of technical jargon and scientific complexities for a wider understanding and reach.



PUBLICATIONS

Scientific Publications

Habeeb, R., Ortlepp, R., & Wende, W. (2022). Evidences of Nature-Based Solutions for Urban Water Security: Global and Regional Opportunities for Cities. Available at SSRN.4034012. http://dx.doi.org/10.2139/ssrn.4034012.

Luthra, A., Cunningham, K., Fraser, A. M., **Pandey, A**., Rana, S., & **Singh, V.** (2023). Ecological livelihoods of farmers and pollinators in the Himalayas: Doing critical physical geography using citizen science. The Canadian Geographer/Le Géographe canadien, 67(1), 35-51.

Singh, V. (2023). We ignore water crises at own peril: The context of the Himalayas. World Water Policy, 9(1), 8-10.

Pandey, R., Rawat, M., **Singh, V**., Yousefpour, R., & Reshi, Z. A. (2023). Large-scale field-based evaluation of niche breadth, niche overlap and interspecific association of Western Himalayan temperate forest tree species. Ecological Indicators, 146, 109876. https://doi.org/10.1016/j.ecolind.2023.109876

Lofqvist, S., Kleinschroth, F., Bey, A., de Bremond, A., DeFries, R., Dong, J., Fleischman, F., Lele, S., Martin, D.A., Messerli, P., Meyfroidt, P., Pfeifer, M., Rakotonarivo, S.O., Ramankutty, N., **Ramprasad, V**., Rana, Pushpendra., Rhemtulla, J.M., Ryan, C.M., Vieira, I.C.G., Wells, G.J., & Garrett, R. D. (2023). How social considerations improve the equity and effectiveness of ecosystem restoration. BioScience, 73(2), 134-148. https://doi.org/10.1093/biosci/biac099

Fleischman, F., Coleman, E., Fischer, H., Kashwan, P., Pfeifer, M., **Ramprasad, V**., Solorzano, C.R., Veldman, J. W. (2022). Restoration prioritization must be informed by marginalized people. Nature, 607(7918), E5-E6. https://doi.org/10.1038/s41586-022-04733-x

Schultz, B., Brockington, D., Coleman, E. A., Djenontin, I., Fischer, H. W., Fleischman, F., Kashwan, P., Marquardt, K., Pfeifer, M., Pritchard, R., **Ramprasad, V**. (2022). Recognizing the equity implications of restoration priority maps. Environmental research letters, 17(11), 114019. https://doi.org/10.1088/1748-9326/ac9918

Rana, P., Fleischman, F., **Ramprasad, V**., & Lee, K. (2022). Predicting wasteful spending in tree planting programs in Indian Himalaya. World Development, 154, 105864. https://doi.org/10.1016/j.worlddev.2022.105864

Press Release

Singh V. (2022). Synergy and collaboration are key drivers in fighting forest fires and heatwaves
Link: https://www.hindustantimes.com/opinion/synergy-and-collaboration-are-key-drivers-in-fighting-forest-fires-and-heatwaves-101650982736418.html

Synergy and collaboration are key drivers in fighting forest fires and heatwaves

The regional fact sheet (Asia) of the sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) with a high degree of confidence projects an increase in heatwaves in the future. Delhi has already recorded the highest temperature in the first half of April since 1950. The India Meteorological Department (IMD) reported the highest average temperature since 1901 for March and a decline in long-term precipitation by 71%. Parts of India are likely to experience increased droughts and an extension of the forest fire season.

For the Himalayan region, heat stress and prolonged droughts will trigger a wide range of issues, and one of the most pressing is the struggle to mitigate forest fire events. In all likelihood, dry conditions and heatwaves will further exacerbate these.

The Uttarakhand state forest department (UKFD)'s data on forest fires (2000-2020) indicates that approximately 2,400 hectares of forest area gets affected by forest fires annually. Robust satellite-based technologies have been available with the forest department for about a decade-and-a-half, providing real-time accurate information on forest fire incidents.

Vishal Singh

as chir pine) a native conifer that has deeni nated the Himalayan slopes for thousands o years, and the rural communities who have time and again displayed their affinity to the forests through historic movements. The 191 protest against the opening up of forests for commercial exploitation by the British and the Chipko movement of the 1970s when mountain women and men put their bodies between the tree and the axe are among these

Chir pine is likely to spread further if poli cies remain unchecked. Although, false notions that Chir pine is the primary cause o forest fires require correction; 95% of fores fires in Uttarakhand are ignited due to human activities. Chir pine forest do not ignite fires on their own, the fault of the species lies in its incredi ble ability to tolerate fire and thrive post-fire events.

As for communities, evidence suggests that pre-monsoon burning results in a better flush of grass in the coming season. In a fodder-defi cit region, it is difficult to maintain livestock, which has been an integral part o rural households for centuries. The struggle for fodder is manifested by the fact that Uttar akhand is perhaps the only region in the world where women still have to climb trees

Dissertations

Title: Risk Evaluation and its Prioritization in the Lesser Himalaya City, Nainital
Name: Mr. Sachin Yadav
Institute: Forest Research Institute (Deemed To Be) University Dehradun, Uttarakhand, India
Date: 07/07/2022

Title: Identification of Ecosystem Services and Potential Threats of Pong Ramsar Site
Name: Mr. Vedant Hanwat
Institute: Forest Research Institute (Deemed To Be) University Dehradun, Uttarakhand, India
Date:14/07/2022

Title: Perception-based study of ambient air pollution in Dehradun city and validation of low-cost air quality sensor
Name: Ms. Ankita Rawat
Institute: School of Environment and Natural resources, Doon University, Dehradun
Date: 30/08/2022

Donors and Partners

Doners

Foreign Grants

- The Nature Conservancy (TNC), USA
- National Academy of Sciences, Washington,
- DC , PEER
- International Centre for Integrated
- Mountain Development (ICIMOD), Nepal
- Clean Air Fund (CAF)
- Deutsche Gesellschaft für Internationale
- Zusammenarbeit (GIZ)
- The Swedish University of Agricultural
- Science, Uppsala, Sweden

Government of India (GoI), Grants

- National Mission on Himalayan Studies
- (NMHS),
- Ministry of Jal Shakti, National Water
- Mission, Govt. of India

Institutional Donors

- Shree Guru Gobind Singh Tricentenary
- University, Gurugram
- People's Science Institute (PSI), Dehradun

Individual Grants

- K. J. Bhavnani, HUF

Philanthropy

- The Development Bank of Singapore Ltd.
- (DBS) Bank
- Pevibai Motiram Shahani Trust, Delh

Partners

- Himalayan Adaptation, Water and Resilience (HI-AWARE)
- University of Cambridge, Department of Geography, United Kingdom
- Yale Himalayan Initiative (YHI), Yale School of Forestry, USA
- South Asia Institute of Advanced Studies (SIAS), Kathmandu Nepal
- University of New South Wales (UNSW), Australia
- FLAME University, Pune
- Kalamazoo College, Minnesota, USA

Technical Partners

- The Energy Research Institute (TERI), New Delhi
- Tata Institute of Social Sciences (TISS), Mumbai
- Indian Institute of Technology (IIT),
- Roorkee
- Forest Research Institute (FRI), Dehradun

State Government Department

- Himachal Pradesh Forest Department

Implementation Partners

- Central Himalayan Rural Action Group
- (CHIRAG), Odakhan, Nainital
- The Mountain Institute (TMI), Sikkim,
- India Megh Payne Abhiyan (MPA), New Delhi
- Himalayan Nature and Adventure
- Foundation, Siliguri, India

Voluntary Compliance

We are in voluntary compliance with the norms of the Credibility Alliance, which has evolved minimum and desirable to promote better governance within the voluntary sector. While, CEDAR is not a member of the alliance, we declare this information voluntarily to promote accountability and transparency.

Governance

None of the Governing board members are related to each other or related to any of the senior salaried staff by blood or by marriage. None of the Governing Board members (including the Chairman) have received any salary, consultancy or other remuneration from CEDAR. Travel costs, as per actual ticket submitted that were budgeted into projects, were however reimbursed.

Annual General Meeting: 16th Annual General Meeting held on 30 September 2022
Time: 11:30 AM
Venue: 201/Phase I, Vasant Vihar, Dehradun

Salary

Maximum salary paid was of were Rs. 1,25,000/- per month.

Travel

- Maximum cost of any single rail ticket purchased was less than Rs 2000.
- International Travel: Maximum ticket was NIL

Statutory Auditor

Mr. R. Balasubramanian Partner, S. Ramanand Aiyar & Co. 708, Surya Kiran, Kasturba Gandhi Marg, New Delhi - 110001

Our Bankers

- Industrial Credit and Investment Corporation of India (ICICI) Bank,
- New Delhi State Bank of India (SBI), Delhi
- Indian Overseas Bank (IOB), Dehradun
- Axis Bank, Dehradun

Annexure 1

Equations for Biomass Estimation

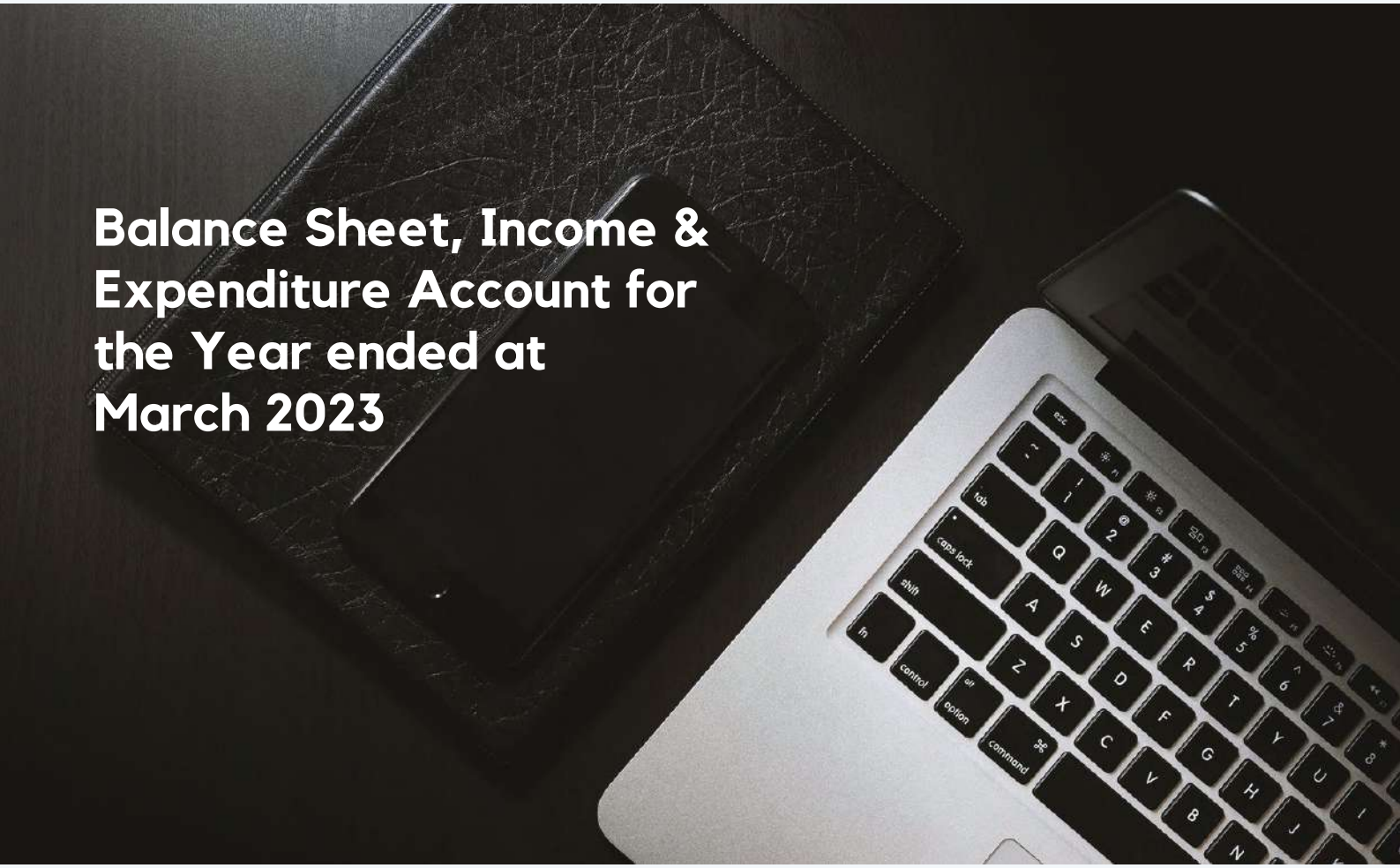
Biomass of different components (bole, branch, twig, foliage, stump root, and fine roots) for the were calculated using regression equation of allometric method (Rawat and Singh, 1988).

Y= a + b * ln X

Where, ln = natural log, Y= dry weight of component (kg), X= CBH (cm), a = the y intercept and b = slope of regression.

Biomass (Kg tree^{-1})	Intercept (a)	Slope (b)	R^2
Quercus leucotrichophora			
Bole	-0.523	1.367	0.994
Branch	-0.718	1.302	0.973
Twig	0.065	0.895	0.897
Foliage	-0.976	0.954	0.299
Total above-ground	0.685	1.254	0.988
Stump root	0.982	0.904	0.612
Lateral root	-0.312	0.809	0.569
Fine root	-1.326	0.502	0.487
Total below-ground	0.112	0.924	0.632
Quercus floribunda			
Bole	-1.109	1.518	0.910
Branch	-0.987	1.377	0.929
Twig	1.128	1.268	0.812
Leaf	-1.229	1.384.	0.789
Stamp root	0.246	1.106	0.798
Lateral root	1.590	1.004	0.712
Fine root	1.048	0.246	0.614
Rhododendron arboreum			
Bole	1.12	0.704	0.873
Branch	1.113	0.609	0.605
Twig	1.155	0.373	0.327
Foliage	1.194	0.17	0.101n.s
Total above-ground	1.176	0.8855	0.712
Stump root	-0.119	0.867	0.612
Lateral root	-1.752	0.984	0.601
Fine root	-1.009	0.407	0.568
Total below-ground	0.942	0.506	0.898
Pinus roxburghii			
Bole	-6.418	2.598	0.985
Branch	-9.833	2.978	0.979
Twig	-9.338	2.630	0.963
Leaf	-6.111	1.872	0.952
Stamp root	-7.220	2.448	0.978
Lateral root	-9.161	2.593	0.974
Fine root	-9.102	2.069	0.938
Interspecies			
Bole	-0.86	1.43	0.92
First order branch	-0.91	1.33	0.91
Other branches	-0.51	1.03	0.8
Leaf	-1.11	1.04	0.76
Stump root	-0.1	0.95	0.79
Lateral root	-2.25	1	0.72
Fine root	-2.07	0.53	0.72

Audited Financial Statement



CENTRE FOR ECOLOGY, DEVELOPMENT AND RESEARCH

BALANCE SHEET
As at March 31, 2023

PARTICULARS	CURRENT YEAR Rs.	PREVIOUS YEAR Rs.
LIABILITIES		
Corpus Fund	2,00,000	2,00,000
Reserve Fund		
As per last Balance Sheet	27,99,497	4,90,438
Add: Transferred from Income and Expenditure Account	(3,37,335)	23,09,059
	24,62,162	27,99,497
Current Liabilities		
Projects in Progress (Schedule - 1)	10,00,020	42,70,252
	36,62,182	**72,69,749**
ASSETS		
Fixed Assets (Schedule - 2)		
Gross Block	7,96,061	9,25,775
Less: Depreciation	1,72,696	2,12,019
Net Block	6,23,365	7,13,756
Current Assets, Loans and Advances		
Current Assets		
Bank Balances		
With Scheduled bank - In saving accounts	26,93,356	62,09,641
Tax Deducted at source	3,10,461	2,32,382
Advance to Others	-	78,970
Security Deposit	35,000	35,000
	36,62,182	**72,69,749**

Significant Accounting Policies and Notes - Schedule 4

Chairman

Vice Chairman

Executive Director

In terms of our report of even date annexed.

For S. Ramanand Aiyar & Co.
Chartered Accountants
Firm Registration No - 000990N

Puneet Jain
Partner
Membership No. 520928
Place: New Delhi
Date: 16-09-2023

S. RAMANAND AIYAR & CO. New Delhi Chartered Accountants

CENTRE FOR ECOLOGY, DEVELOPMENT AND RESEARCH		
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED MARCH 31, 2023		
PARTICULARS	CURRENT YEAR Rs.	PREVIOUS YEAR Rs.
INCOME		
Project Funding		
Receipts during the year		
Local Grants		
SERB :- Understanding the impacts of Climate change and Forest Degradation on carbon stock and population dynamics in the Oak zone of the Central Himalayas	-	6,07,993
NHMS :- (National Mission on Himalayan Studies): Creating Climate-resilient Communities in Mid-Hills of Uttarakhand: Interventions Towards Forest & Water	15,18,658	2,52,683
MOWR :- Hydro-geologocal assessment and socio economic implications of depleting water resources in Tourist Towns of	15,00,000	33,35,892
GIZ :- IConduct Scoping study and Screening of Best Practices for Forest Ecosystem Services Management at the project sites at UK and HP	-	10,70,823
GIZ :- Integrated Management Planning of Pong Ramsar Site Himachal Pradesh Supported by GIZ, India.	8,11,318	5,07,500
BAIF :- Carbon and Biodiversity Assessment in a Van Panchayat of Uttarakhand	5,73,980	-
WIPRO :- Security ecosystem services of forests and hydrology in Mangar Bani and Surrounding Aravallis	2,00,000	-
Iamgurgaon :- Baseline Forest Monitoring of the Ghata Bandh in Gurgaon	60,000	-
WWF :- Assessing Carbon Stocks in High-altitudinal Wetlends of Uttarakahnd	1,40,973	
Foreign Contribution		
IDRC :- Facilitating conducting research on water security issues in four mid-sized cities in india.	-	16,39,730
CAF :- Gurgaon Sensors Project	-	17,77,400
TNC : - Evaluation of potential for Forest Conservation based on Natural-based tourism in Western Himalaya	-	2,18,600
SUAS :- Impacts of the COVID-19 Pandemic on Forest Resource use by Rural Communities in India	5,92,622	37,95,236
SUAS :- Creating evidence for forest based resilience during Covid-19	20,48,729	20,46,837
ICIMOD :- Atmosphere, Study on exposure and impact of air pollution in the growing cities in the HKH region.	2,63,872	2,90,169
NAU :- Research Collaboration for Social-Ecological Research in india of forest-dependent communities in field sites for the school of forestry	11,75,250	-
Pollination Work :- Pollination Limitation in apples in the Uttarakhand Himalayas	9,95,097	-
	98,80,499	**1,55,42,863**
Projects in progress brought forward (brought forward from unutilised funds of last year)	42,70,252	62,11,310

S. RAMANAND AIYAR & CO. New Delhi Chartered Accountants

Other Receipts (Schedule 3)		
Donation	6,38,685	6,28,120
Administrative Cost Realised	13,07,556	33,57,167
Interest Income	1,34,129	2,34,713
Project Consultancy Received	-	6.83.000
Interest on income tax refund	9,688	5,630
FD Interest Received	-	860
	20,90,058	**49,09,490**
TOTAL INCOME	**1,62,40,809**	**2,66,63,663**

EXPENSE		
Expenditure on Projects		
Local Grants		
IGF :- To conduct a action research study on "Gurugram city state of environment: water" with the support of Gurugram metropolitan development authority.	1,87,200	-
NHMS :- (National Mission on Himalayan Studies): Creating Climate-resilient Communities in Mid-Hills of Uttarakhand: Interventions Towards Forest & Water	12,66,553	11,04,351
MOWR :- Hydro-geologocal assessment and socio economic implications of depleting water resources in Tourist Towns of Uttarakhand	16,80,464	43,82,334
TNC :- (The Nature Conservancy Centre) : Scoping and Prioritization of Assisted Natural Regeneration (ANR) opportunities in India	-	4,18,417
DBS Bank:- Promotion of Nature-Linked Ecotourism as a Rural Livelihood in Uttarakhand	-	3,07,500
MANGAR : - Conservation of mangar bani, surrounding forestsnad ecosystem services in the gurgaon aravallis	-	12,000
GIZ :- IConduct Scoping study and Screening of Best Practices for Forest Ecosystem Services Management at the project sites at UK and HP	-	10,70,823
GIZ :- Integrated Management Planning of Pong Ramsar Site HImachal Pradesh Supported by GIZ, India.	12,99,318	19,500
BAIF :- Carbon and Biodiversity Assessment in a Van Panchayat of Uttarakhand	5,73,980	-
WIPRO :- Security ecosystem services of forests and hydrology in Mangar Bani and Surrounding Aravallis	1,98,489	-
Iamgurgaon :- Baseline Forest Monitoring of the Ghata Bandh in Gurgaon	42,000	-
Foreign Contribution		
PEER :- Planning plantations: past learning, toward triple wins in carbon, biodiversity and livelihoods	9,39,227	7,78,522
CAF :- Gurgaon Sensors Project	13,82,866	24,75,610
IDRC :- Facilitating and Conductiing research on water security issues in four mid-sized cities in India.	-	12,17,771
TNC : - Evaluation of potential for Forest Conservation based on Natural-based tourism in Western Himalaya	-	2,22,000
SUAS :- Impacts of the COVID-19 Pandemic on Forest Resource use by Rural Communities in India	12,00,983	31,86,875
SUAS :- Creating evidence for forest based resilience during Covid-19	23,83,478	17,12,088
ICIMOD :- Atmosphere, Study on exposure and impact of air pollution in the growing cities in the HKH region.	5,03,605	-
NAU :- Research Collaboration for Social-Ecological Research in india of forest-dependent communities in field sites for the school of forestry	5,40,000	-
Pollination Work :- Pollination Limitation in apples in the Uttarakhand Himalayas	7,90,811	-
	1,29,88,974	**1,69,07,791**

S. RAMANAND AIYAR & CO. New Delhi Chartered Accountants

OTHER EXPENSES		
Communication Expenses	16,381	24,673
Consultancy and Honorarium	2,44,696	1,94,700
Balance Write Off (Schedule - 2)	31,448	1,09,839
Depreciation (Schedule - 2)	1,72,696	2,12,019
Employee Costs	12,47,950	18,21,233
Office Expenses	1,40,222	1,39,569
Insurance	21,676	20,409
Audit Fees	39,766	29,500
Printing and Stationery	2,715	700
Rent	4,76,500	4,66,400
Travel and Conveyance	1,30,817	92,432
Other Expenses	64,283	65,087
	25,89,150	**31,76,561**
TOTAL EXPENSE	**1,55,78,124**	**2,00,84,352**
Balance	**6,62,685**	**65,79,311**
Less: Transferred to Project in Progress (As per Schedule - 1)	10,00,020	42,70,252
Surplus transferred to Reserve Fund	**(3,37,335)**	**23,09,059**

Significant Accounting Policies and Notes - Schedule 4

Chairman

Vice Chairman

Executive Director

In terms of our report of even date annexed.

For S. Ramanand Aiyar & Co.
Chartered Accountants
Firm Registration No - 000990N

Puneet Jain
Partner
Membership No. 520928
Place: New Delhi
Date 16-09-2023

S. RAMANAND AIYAR & CO. New Delhi Chartered Accountants

Acknowledgements

CEDAR is extremely thankful to the donor organizations that have unwaveringly supported our work throughout the years. We owe our heartfelt gratitude to the National Mission on Himalayan Studies (NMHS), Government of India (GoI); Ministry of Jal Shakti, GoI; PEER program of USAID under the National Academics of Sciences (NAS), USA; GIZ India; International Centre for Integrated Mountain Development (ICIMOD), Nepal; Clean Air Fund (CAF); BAIF Development and Research Foundation, Pune; the George Washington University (GW), USA; Kalamazoo College, Michigan; IamGurgaon and WIPRO foundation.

CEDAR is immensely thankful to its partners viz., the Central Himalayan Rural Action Group (CHIRAG), Nainital; Forest Research Institute (FRI), Dehradun; Himmotthan Society, Dehradun; Indian Institute of Technology (IIT), Roorkee; Kalamazoo College, Michigan; People's Science Institute (PSI), Dehradun; George Washington University, USA; and the University of Minnesota, USA, who have been instrumental in our endeavours.

This acknowledgment would remain incomplete without recognizing the invaluable contributions of the many well-wishers of CEDAR. We extend our sincere thanks to each and every individual who has stood by our side and supported us tirelessly. The help received from Uttarakhand Forest Department and Himachal Pradesh Forest Department during fields and conducting workshops is gratefully appreciated.

Furthermore, we express our profound gratitude to the communities within CEDAR's research area. Who kept their faith in CEDAR, their unwavering support has been crucial in achieving the project's goals and outcomes.

Last but not the least, we express our gratitude to the members of the organization and the governing board for their unconditional support.