Annual Report 2023-2024

Centre for Ecology Development and Research

Sustaining Mountain Ecosystems

The action research conducted by CEDAR addresses the following Sustainable Development Goals (SDGs).

Picture Courtesy: Team CEDAR

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Foreword

It is a matter of great pleasure for me to present the Annual Report of CEDAR for the Financial Year 2023-2024. The report provides a detailed account of the activities and new initiatives undertaken by the organization during the year. This year has been one of resilience, innovation, and continued progress towards our core mission of harmonizing ecological research with practical development interventions in the Himalayan region.

Ever since it came into existence in 2006 CEDAR has remained committed to the goal of bridging the gap between scientific research and real-world problems. Its approach continues to draw learnings from the deep-rooted knowledge of the Himalayan communities and blending them with cutting-edge scientific advancements. By doing so, it strives to equip policymakers, practitioners, and local communities with the knowledge needed to make informed and inclusive decisions for sustainable Himalayan development.
Over the past year, CEDAR has successfully completed three projects in collaboration with national and international partners. These initiatives have broadened its understanding of crucial environmental and socio-economic challenges while generating actionable insights. A Hydro-geological assessment and socio-economic implications of depleting water resources in Nainital funded by Ministry of Jal Shakti, Government of India was conducted in collaboration with Indian Institute of Technology, Roorkee (IITR) and Forest Research Institute (FRI), Dehradun. This project remains pivotal in addressing water scarcity issues, with direct implications for both environmental management and socio-economic development.

CEDAR also continues to make strides in addressing the impact of climate change on agriculture, particularly in the Uttarakhand Himalayas, where its

research on pollination limitations in apple production has gained new momentum. Collaboration with George Washington University in this study seeks to deepen understanding of the declining pollinator populations and their impact on local livelihoods.

In addition to its research, CEDAR has organized multiple capacity-building workshops and knowledge-sharing events that have brought together experts, community stakeholders, and policymakers. It has developed a range of knowledge products and published findings in esteemed international journals, further contributing to the global discourse on sustainable development in mountain ecosystems.

Looking ahead, CEDAR is committed to furthering its research on pressing environmental issues, including air pollution, biodiversity conservation, and the sustainable management of natural resources. It is currently engaged in four active projects that hold great promise in shaping environmental policies and practices in the Himalayan region. It also remains dedicated to fostering citizen science initiatives and strengthening partnerships with leading institutions of the world.

On behalf of CEDAR, I extend my heartfelt gratitude to our partners, supporters, and the communities we work with for their continued support, trust and collaboration.

September, 2024

B. K. Joshi
Chairman

CONTENTS

Profile

CEDAR, a not-for-profit organization registered in 2006 under the Societies Act of 1860, aims to bridge the gap between applied research and field-based interventions. With its registered office in Delhi and chief operations office in Dehradun, CEDAR was founded by a group of academics and development practitioners to balance theory and practice in the development sector. The organization addresses the longstanding divide between theoreticians and practitioners, which has hindered continuous assessment and improvement in the sector.

CEDAR's mission is to learn from those living in the Himalayan environment, blend their knowledge with scientific evidence, and share it with a wider audience to inform inclusive and informed decision-making for sustainable development. We are dedicated to addressing environmental and development issues, engaging stakeholders and policymakers, and creating innovative pathways for sustainable natural resource management in the Himalayas.

Key Research Areas

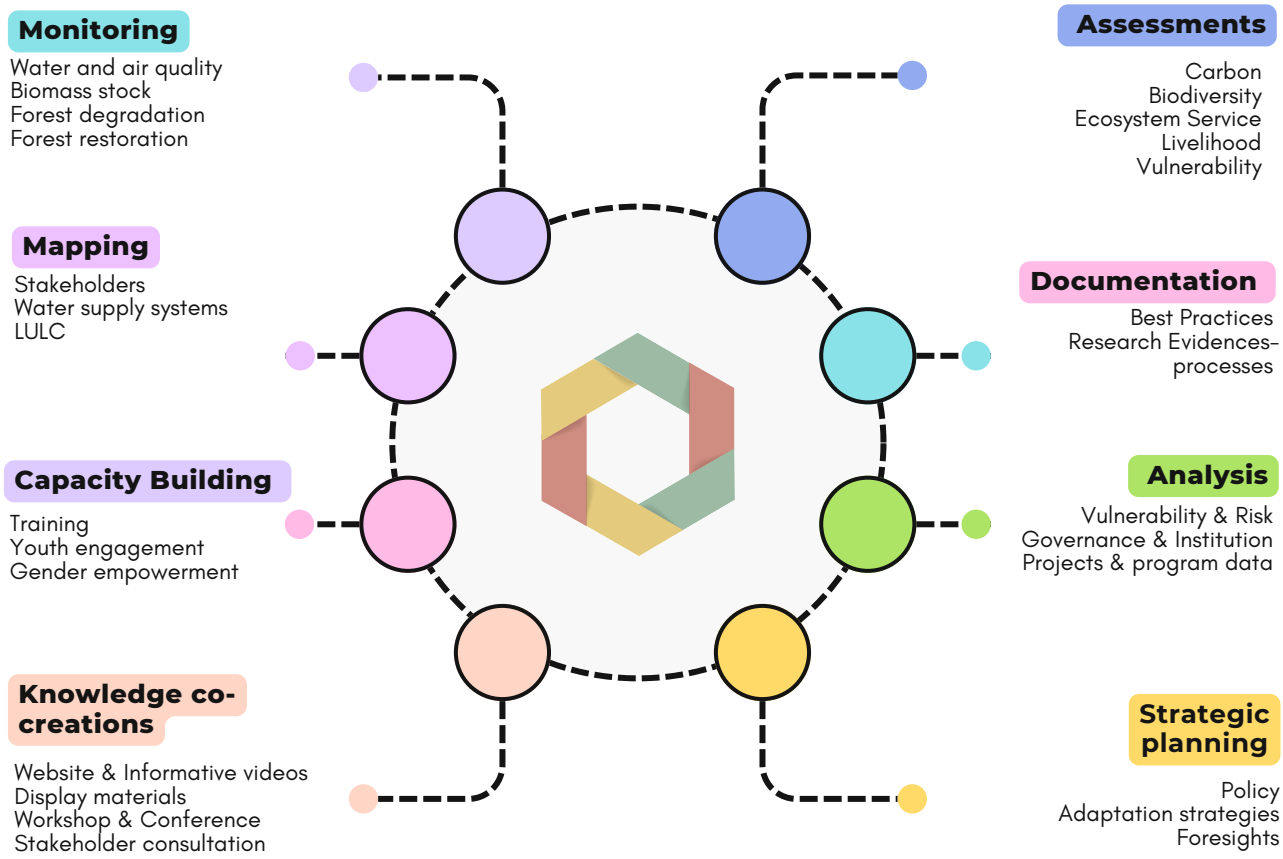
Since its inception, CEDAR has been committed to climate change research within the extensive areas of **Ecology, Development** and **Research**.

CEDAR actively promotes -

- **Gender Equality and Social Inclusion**
- **Citizen science**
- **Collaboration**
- **Nature base solution &**
- **Evidence based policy advocacy**

Competencies and Expertise

CEDAR's expertise encompasses assessment, monitoring and analysis of environmental factors, along with capacity building and documentation. The organization also excels in knowledge co-creation, strategic planning, and producing informative materials.



Ethical Practices

We are committed to creating a safe and respectful working environment for everyone associated with the organization. The organization does not tolerate any kind of sexual harassment reported by any employee during their tenure in CEDAR, towards any other person who is an employee, research partner, donor, vendor and contractor, applicable within the premises or elsewhere in India & abroad. Any kind of sexual harassment shall deal as per CEDAR POSH guidelines through Internal Complaints Committee (ICC).

Future Strategy

We aim to broaden our research horizon and maximize synergy between important sectors and critical elements of the environment and society.

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Head, Division of Forestry Statistics, ICFRE Dehradun, India

Team

Research Team

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Senior Fellow

Dr. Mohit Chaturvedi
Senior Fellow

Dr. Vijay Ramprasad
Senior Fellow

Dr. Hemant R Ojha
Senior Fellow (Honorary)

Dr. Pushpendra Rana
Senior Fellow (Honorary)

Dr. Pia Sethi
Senior Fellow

Mr. Chetan Agarwal
Senior Fellow

Dr. Vishal Singh
Executive Director

Dr. Anvita Pandey*
Coordinator

Dr. Nidhi Singh
Fellow

Dr. Renu Suyal
Senior Research Associate

Mr. Ayan Dutta
Research Associate

Mr. Akshat Pratap*
Research Assistant

Mr. Utkarsh Pandey
Project Associate

Mr. Anmol Ratan**
Research Assistant

Ms. Ankita Rawat***
Research Assistant

Management

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Administrative Assistant

Finance

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

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*Till March, 2024 **Till September, 2023
*** Till November, 2023 ****Till January, 2024

Completed Projects

- Hydro-geological assessment and socio-economic implications of depleting water resources in tourists towns in Uttarakhand

- Assessing ecosystem services and carbon stocks in high-altitudinal wetlands of Uttarakhand

- Pollination limitation in apples in the Uttarakhand Himalayas

Hydro-geological assessment and socio-economic implications of depleting water resources in tourists towns in Uttarakhand

Duration: December 2019-March 2024

Field Site
Nainital, Uttarakhand

Donor/Funding Agency – Ministry of Jal Shakti, Department of Water Resources, River Development (RD) and Ganga Rejuvenation(GR)

The project was commissioned to CEDAR in partnership with Indian Institute of Technology, Roorkee (IITR) and Forest Research Institute, Dehradun (FRI) by Ministry of Jal Shakti. The study aimed 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, technical and policy components for better water governance and awareness. CEDAR was mainly involved in devising citizen science initiatives on long term monitoring, collecting data and compiling long term records, while IIT, Roorkee assessed the hydrological balance of the lake focusing on water balance, trophic state, and isotopic analysis. On the other hand FRI, Dehradun looked into the water vulnerability within the municipal confines of Nainital.

Findings of the study

- From the analysis of the lake water profile, we observed that in summer the lake is thermally mixed with slight to negligible thermal gradients and due to aeration in the lake the lake remains in a degassed state for most part of the year.
- Despite a thermally mixed system, DO profiles revealed distinct hypoxic conditions in the bottom 5 m of the lake from June to August, especially in the northern sub-basin of the lake. Whereas the southern sub-basin depicts an intermittent emergence of hypoxic conditions between June and August. It shows the artificial aeration in the lake is not completely effective in avoiding the development of hypoxic state, particularly during summer months in the northern sub-basin. Prolonged hypoxia in lake bottom may adversely affect the ecosystem dynamics and fish habitats.
- From the analysis of Secchi disk data, Nainital Lake was found to be in Eutrophic state over the study period.
- A one-dimensional hydrodynamic model, General Lake Model (GLM) was developed for Nainital Lake using the observed datasets from the monitoring network. The model was calibrated and validated for lake water levels, continuous profiles of temperature at daily time steps (Fig. 1 & 2). The model simulations were used to compute lake water balance components.

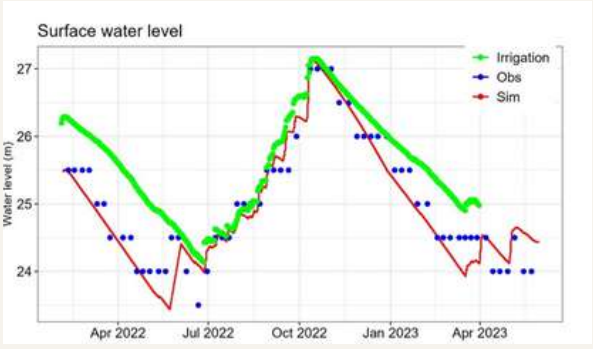


Fig. 1: Calibrated lake water levels by GLM lake model.

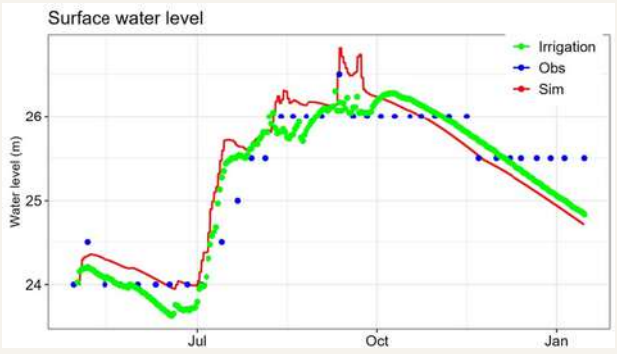


Fig. 2: Validated lake water levels by GLM lake model.

- The findings underscore the heavy reliance of community on Naini Lake for household consumption (55%) and commercial ventures (41.67%), underscoring its indispensable role in both economic and domestic realms. While a small percentage of respondents (3.33%) do not depend on Naini Lake, suggesting potential alternative water sources (springs) (Fig. 3).

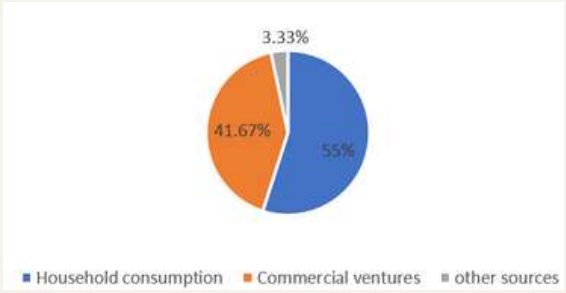


Fig. 3: Reliance on Naini lake as water source

- During the multi-risk assessment, a broad spectrum of stakeholders prioritized socio-economic risks, followed by natural risks, regulatory risks, and environmental risks. (This trend could be attributed to the timing of the survey, which took place shortly after the lockdown period.)
- In Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with stakeholders, it emerged that irregular water supply is not the sole issue concerning the water challenges in Nainital. Institutional overlapping emerged as a significant problem affecting water governance in the city, resulting in accountability gaps. Table 1 shows the roles and responsibilities of different institutions involved in water management in Nainital town.

Table 1: Roles and responsibilities of different institutions for water management in Nainital

	Institutions	Roles and responsibilities
1.	Water Management Authority	UJS - Water conservation measures, policy, laws, and tariff (in consultation with District Administration); use of efficient appliances; scheduling of water supply; public awareness; separating the rainwater from the sewer line of the houses located in the city and connecting it to the main drains etc. UJN – Construction and maintenance of tertiary level sewage treatment plants and disposal of the treatment effluent into the drains.
2.	Nainital Nagar Palika Parishad (NNPP)	Cleaning of lake; solid waste management; proper provision and management of public facilities; complete ban on disposal of domestic waste in drains and arrangement of its disposal.
3.	Irrigation Department	Work related to constructions and maintenance of 62 drains leading to Naini lake, Sukhatal and the regulating structure; lake water quality monitoring and display of water level; formulation of guidelines for outlet gate operation; disconnecting rainwater drains from sewers.
4.	Nainital Lake Region Special Area Development Authority (NLRSDA)	Check on unauthorized construction and prevention of disposal of construction debris into drains.
5.	Forest Department	Notification of wetland; Rain Water Harvesting plan in the catchment; catchment area treatment; checking soil erosion in the catchment.
6.	Public Works Department (PWD)	Work related to operation, maintenance and cleaning of road side drains and related structures; construction of parking lots (in consultation with the District Administration and Nagar Palika Parishad) .
7.	District Magistrate Office (DMO)	In case of Nainital, DMO provides legal permission to work on the lake. Any person or organization/civic society/institution must take permission of DM before starting any work related to the lake.

- The study identified 13 recharge zones and 9 springs within the area. Through the identification and geotagging of these springs and critical water zones, alongside acknowledging the importance of Nainital's drainage system, we gain insight into the availability of freshwater resources (maps of recharge zones & springs -Annexure - 1).
- Regarding water resources, the study identified three primary sources of drinking water in Nainital city: Naini Lake (through lake bank filtration), Sukhatal (through

groundwater abstraction), and springs. Analysis revealed that 76% of the total water supply is sourced from Naini Lake, 22% sourced from Sukhatal through groundwater pumping, and the remaining 2% is sourced from springs.

- Study aimed to share the research findings with diverse audiences, ranging from the scientific community to the general public. During the study multiple forms of communication were developed including research papers, popular articles, policy briefs, video documentaries, infographics, book, display materials, and a website to spread awareness about the hydrological dynamics of Nainital.
- Important maps and tables related to the objectives of the project are attached in Annexure - 1).

Awareness programs

CEDAR team took proactive steps to raise awareness and facilitate knowledge exchange by hosting multiple workshops in collaboration with stakeholders. These events served as platforms for fostering dialogue, sharing expertise, and formulating effective dissemination strategies.

Workshop 1

Expert consultation on knowledge exchange and research dissemination strategies

The deliberations and experts (leading government organizations, universities, civil society organizations, community leaders, subject experts) discussed and shared their insights on following action points for consideration. Key area of concern included: - Poor maintenance of drains; High institutional overlaps, hence lack of responsibility; Concern about feasibility of aeration; Lake pollution; Improvement of larger community for awareness (Schools and sports community); Car parking and pollution; Developing spring Janam patri; Jal police; Celebrate 18th September as clean the lake day; Promote 'Catch the rain' initiative and more focus on Nature Based Solution.

Glimpse of workshop conducted in Nainital

Workshop 2

Knowledge Dissemination workshop

The open discussions held during the workshop yielded several key insights and points for consideration. Key points of concern included -

1. Use previous study for bathymetry study to correlate the present information.
2. Study on carrying capacity of Himalayan towns should be done.
3. Concretizing the footpaths in Nainital should be regulated.
4. We should focus more on demand management issues.
5. Existing scientific information should be translated nicely for citizen use.
6. Need for more active and engaged citizens group.
7. Interdisciplinary research is important with a bottom down approach.
8. Drains are an important part of Nainital's hydrology. It should be managed properly.

Workshop 3

Sukhatal Rejuvenation Plan.

To influence decision makers and policy influencers a workshop was jointly organized by the Lake Development Authority (LDA) and CEDAR. MLA Nainital, Commissioner Kumaon, District Magistrate, Nainital, Secretary LDA and other officers of concerned departments with citizens participated in the workshop.

Assessing ecosystem services and carbon stocks in high-altitudinal wetlands of Uttarakhand

Duration: March 2023 - March 2024

Field Site
Uttarakhand

Donor/Funding Agency – World Wide Fund for Nature-India (WWF)

Wetlands are crucial for sustaining ecosystem services and preserving cultural heritage. India's diverse landscapes, including the High-Altitude Wetlands (HAWs) of the Himalayas, play a vital role in this regard. These wetlands, spanning approximately 126,253 hectares, offer essential ecosystem services but face threats from industrial expansion, urbanization, and climate change.

To address these issues, the Centre for Ecology Development and Research (CEDAR), with WWF India's support, conducted a study to assess carbon stock in HAWs. The study utilized literature review, spatial analysis, and community engagement, with a focus on stratified sampling for carbon assessment. Samples were collected from different points within each wetland, considering soil, water, plankton, peat, and macrophytes as separate strata.

Team member collecting soil and water samples

Socio-economic surveys and purposive sampling for ecosystem services highlighted tourism pressures, particularly in Sattal, emphasizing the need for conservation.

Cedar Team engaging in socio economic survey

Findings of the study

- The study enhances understanding of HAWs' carbon stock, emphasizing the need for conservation to preserve these ecosystems for current and future generations.
- Varied carbon storage potentials were observed across wetland complexes:
  -Dyara displayed the highest levels.
  -Sattal had the second highest levels.
  -Kalatal had the lowest levels (Fig. 4).
- Significant disparities in soil and water carbon content among the complexes underscored diverse ecosystem dynamics.

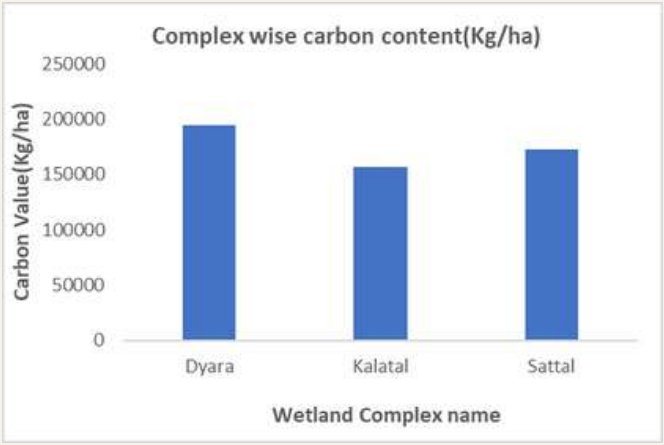


Fig. 4: Complex wise carbon content

- Socio-economic surveys highlighted tourism pressures and threats, particularly in Sattal, accentuating the urgency of conservation efforts.
- Human-wildlife conflicts, seasonal disasters, and natural diversity revealed the complex interplay of natural and anthropogenic factors in these wetland ecosystems. Conservation strategies should address these multifaceted challenges while promoting responsible tourism for sustained preservation of these invaluable landscapes.
- Despite Sattal exhibiting the lowest carbon storage, it provides the highest ecosystem services among the three complexes.
- List of Ecosystem Services provided by three high altitude wetlands (Sattal, Dyara and Kalatal) are presented in table 2.

Table 2: Ecosystem Services for three wetland complexes

Wetlands services	**Benefits to human well-being**		
Provisioning	**Sattal**	**Dyara**	**Kalatal**
Food	No	No	No
Fresh water*	Yes	Yes	Yes
Fiber and fuel	Yes	Yes	Yes
Biochemical	Yes	Yes	Yes
Genetic materials	NA	NA	NA
Regulating			
Climate regulation	NA	NA	NA
Water regulation (Hydrological flows)	Yes	NA	NA
Water purification and waste treatment	Yes	NA	NA
Erosion regulation	Yes	NA	NA
Natural hazard regulation	NA	NA	NA
Pollination	Yes	Yes	Yes
Cultural			
Spiritual and inspirational	Yes	Yes	Yes
Recreational	Yes	Yes	No
Aesthetic	Yes	Yes	Yes
Educational	Yes	Yes	Yes
Supporting			
Soil formation	Yes	NA	NA
Nutrient cycling	Yes	Yes	Yes

Overall, the study underscores the necessity for further comprehensive research to fully understand the dynamics of these ecosystems.

Pollination limitation in apples in the Uttarakhand Himalaya

Duration: November 2022-July 2023

Field Site
Ramgarh Block,Uttarakhand

Donor/Funding Agency – The George Washington University (GW), USA

Thousands of farmers in the Indian Western and Central Himalayas depend on apple cultivation for their livelihoods. Apples are a highly pollinator-dependent crop. Over the past few decades, the productivity of apples has declined due to climate change. Climate change has impacted the phenology of apples and pollinators, potentially leading to temporal mismatches between when apple trees bloom and the availability of sufficient pollinators. These issues have remained unexamined in the Indian context.

To address these issues, the project was conducted in four phases. In the first phase, landscape characteristics surrounding the orchards were analyzed in preparation for a study exploring the extent of and variation in pollination limitation along an altitudinal gradient in the Mukteshwar region of Uttarakhand. This phase focused on collecting data on the exclusion experiment.

The second phase of the project involved 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 involved conducting the pollination exclusion experiment, and the fourth phase focused on identifying the specimens collected from pan-trap sampling.
CEDAR, in collaboration with Kalamazoo University, George Washington University, USA, and Flame University, Pune, conducted this study in the Ramgarh block of Uttarakhand.

Findings of the study

- A total of 30 orchards were meticulously surveyed. Data collected included altitude, precise location, orchard boundaries, number and types of apple trees and pollinizer trees, managed bee hives on-site, pesticide application frequency and timing, and characteristics of the surrounding landscape (e.g., forest, farm, pastures). Based on comprehensive data analysis, 15 orchards were selected for the second phase of the project. CEDAR, in collaboration with other partners, developed a structured data collection framework and a tailored training module for farmers.
- The CEDAR research team conducted pan trap sampling in all 15 selected orchards. Additionally, farmers were trained on the proper methods for setting up pan traps, collecting and preserving pollinators from the traps, and maintaining farm diaries.
- 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.

Picture of Farm Diary, given to the farmers

- A total of 1,327 pollinators from 14 different species were recorded from the selected farms. The highest number of individuals were from the genus Lasioglossum (521), followed by Halictus (341), and Andrena (320).
- Pollination exclusion experiments were conducted in the selected orchards. On average, across different elevations, the fruit set in the pollinator exclusion treatment was only 6% of that observed under open pollination conditions (Odds ratio = 0.06, $P < 0.001$). While fruit set in the open pollination treatment decreased with elevation, it remained constant in the pollinator exclusion treatment across all elevation.
- Averaged across elevations, there was a significant increase (29%) in fruit set when open pollinated flowers received supplementary pollination (OH) compared to when they did not (OP). This demonstrates that apples experience pollination limitation in the study region.
- Format of report shared by farmers is presented in Annexure-II.

Ongoing Projects

- Transboundary rivers of South Asia (TROSA) Phase-2: Rivers, Rights and Resilience (T2:3R)

- Executing alternate energy source (Improved Cook Stoves) for climate mitigation, carbon credits and co-benefits in Uttarakhand

- Securing Ecosystem Services of forest and Hydrology in Mangar Bani and surrounding Aravallis

Transboundary rivers of South Asia (TROSA) Phase-2: Rivers, Rights and Resilience (T2:3R)

Duration - February 2024-March 2026

Field Site
Upper Mahakali Basin, Uttarakhand

Donor/Funding Agency – International Union For Conservation of Nature (IUCN), India)

The Mahakali River, which delineates the western border between Nepal and India, holds considerable socio-economic, political, and environmental significance. Historically, it has served as a crucial resource for communities dwelling along its banks, supporting activities such as irrigation, fishing, and domestic usage, thereby contributing significantly to local livelihoods. The socio-economic framework of the Mahakali River basin is predominantly agrarian, with the majority of the population reliant on agriculture and livestock rearing. However, the region grapples with several challenges, including water scarcity attributed to climate change, as well as conflicts concerning water distribution and the development of hydropower projects. Additionally, limited decision-making roles for women and marginalized individuals, along with transboundary water management challenges between Nepal and India, further complicate water resource management in the region.

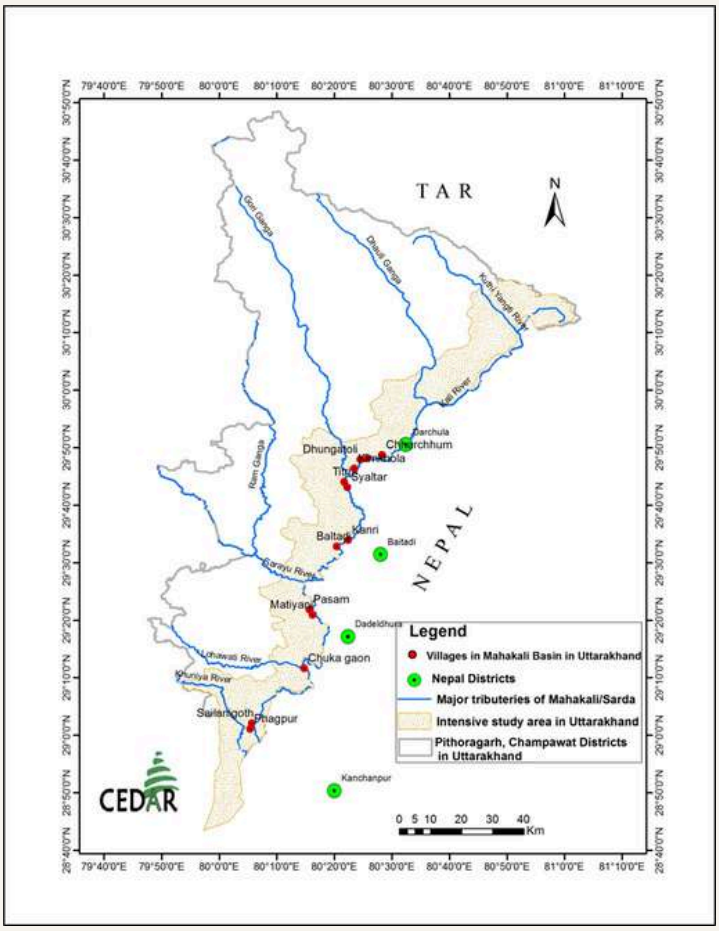
TROSA Phase-2 works to support climate-resilient livelihoods for vulnerable communities in the Ganges, Brahmaputra and Meghna (GBM) basins. In India, TROSA project is being carried out in Mahakali river basin covering areas of Uttarakhand (Pithoragarh and Champawat) and Uttar Pradesh.

The main goal of the project is “Improved cooperation in governing shared water resources, strengthening resilience to climate change of riparian communities in the transboundary Ganges-Brahmaputra-Meghna River basins” with following outcomes:

- Strengthening climate resilient livelihoods of communities living in the Mahakali basin.
- Improved and inclusive management of transboundary river ecosystems and biodiversity protection.
- Strengthened leadership of civil society, especially women, indigenous people, and youth, to influence government and private sector on water governance across the basin.
- Strengthen cooperation, collaboration, and accountability across and between the transboundary river basin.

Highlights of the study

- Conducted comprehensive research to identify potential villages that align with the project's objectives. Utilized various sources such as government databases and local authorities to create a list of candidate villages.
- Employed criteria such as accessibility, demographics, socioeconomic factors, and existing community infrastructure to shortlist suitable villages.
- Identified key stakeholders including governmental agencies, non-profit organizations, and private sector entities. Established strong partnerships with local leaders to facilitate community engagement and participation.



Selected villages for the study in Upper Mahakali Basin

- Organized meetings between Kind Being experts and local communities in Baluwakot and Kalika villages of the Upper Mahakali basin, Uttarakhand to gather qualitative data through Focus Group Discussions (FGDs) and Key Informant Interviews.
- 13 villages were shortlisted based on established criteria to ensure a diverse representation of communities. The research team conducted two field visits to these identified villages to discuss project objectives with the communities, perform a baseline assessment, and form flood early warning task force groups and volunteers/citizen scientist for water quality testing (Pani Samiti).

Team, engaging with community members of Matiyani village to discuss water-related issues

- The key challenges affecting water quality and management in the Mahakali basin, as discussed with riparian communities, include river pollution from agricultural runoff, waste dumping, and open defecation, which degrade water quality and threaten livelihoods. Climate change exacerbates these issues with altered precipitation patterns and extreme weather events impacting water availability and quality. Improper land use practices contribute to soil erosion and sedimentation in water bodies, while hydropower development disrupts natural river flow and aquatic ecosystems. Additionally, limited decision-making roles for women and marginalized individuals, along with transboundary water management challenges between Nepal and India, further complicate water resource management in the region.

Executing alternate energy source (Improved Cook Stoves) for climate mitigation, carbon credits and co-benefits in Uttarakhand

Duration - March 2024-November 2024

Field Site
Uttarakhand

Donor/Funding Agency – Capegemini Technology Services India, ltd.

Nearly half of the global populace relies on solid fuels for fundamental cooking and heating necessities, with India surpassing all other nations in fuel wood consumption. This confounding statistic equates to approximately 900 million individuals being exposed to indoor air pollution regularly. The present objectives associated with Improved Cooking Stoves (ICS) revolves around three essential cornerstones. Firstly, enhancing health and efficiency at the household level; secondly, conserving forests and their associated ecosystem services from a broader ecosystem perspective; and finally, mitigating emissions on a global scale. These pillars emphasize the multilayered benefits and principal goals of ICS initiatives.

This study is a collaborative effort, where CEDAR supervise the activities with CBED (Center for Business and Entrepreneurial Development) as a partner and Capgemini provided crucial funding support.

Additionally, INFINITY SOLUTIONS, the organization responsible for manufacturing the Improved Cooking Stoves (ICS), actively participated in the capacity building programs, providing valuable training and insights.

Highlights of the study

- Given the significance of Improved Cooking Stoves (ICS), a comprehensive three-day workshop focusing on their distribution to marginalized rural communities was organized from March 19 to March 21, 2024, at the CEDAR office in Dehradun.

Training of ground staff on improved cooking stoves first at CEDAR office and then on field

Overall, the workshop provided a comprehensive platform for participants to engage in meaningful discussions, exchange knowledge, and gain practical training, thereby advancing the collective efforts towards promoting the adoption of Improved Cooking Stoves in marginalized rural communities.

Securing Ecosystem Services of forest and Hydrology in Mangar Bani and surrounding Aravallis

Duration - April2023-March2024

Field Site-
Aravalli hill zones
Faridabad, Gurugram

Donor/Funding Agency – WIPRO Foundation

The Mangar Bani sacred grove and the surrounding Aravalli's hills provide several ecosystem functions for the rapidly expanding cities of Gurgaon (Gurugram) and Faridabad, as well as local Aravalli foothill villages. These include ground water recharge, flood moderation, large scale forest cover, wildlife habitat and corridor, and 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.

Highlights of the study

- Enhanced understanding of Aravalli hydrological ecosystem services provision in selected sub-catchments of Mangar and Badkhal, with plan for Managed Aquifer Recharge.
- Capacity building of local community stakeholders to undertake basic monitoring and identify and implement locally relevant groundwater recharge and watershed services – including soil moisture conservation works, pond (johar) restoration and bentonite lining to extend storage.
- Awareness and appreciation about the flora and fauna of the Mangar Bani and the Aravalli's in the children in Mangar and other local villages/schools, by capacity building of volunteer teachers of after-school centres of Laksh Foundation in 5 Aravalli villages.
- Capacity building of Children's of the Mangar Eco Club in Mangar Bani.
- Quantitative Forest Assessment of Mangar to ascertain the forest vegetation condition of Mangar Aravallis. Mapping the forest type and cover of natural Aravalli landscapes of Gurgaon including the Mangar Bani and its surrounding hills.

Capacity building program

Two trainings have conducted on environmental education with local volunteer teachers of after school centres of Aravalli villages of local partner Laksh Foundation.

Outreach

June, 2023
Plan-Adapt, Germany

Dr. Anvita Pandey (Coordinator) CEDAR, was selected as Fellow at Climate Co-Adaptation Lab, (Plan-Adapt) Berlin, Germany. The independent global network fosters knowledge services supporting effective, economically just and inclusive climate change adaptation climate risk management worldwide.

July, 2023
IPSI-9, Japan

Dr. Renu Suyal, Senior Research Fellow at CEDAR participated in the 9th IPSI Global Conference of International Partnership for the Satoyama Initiative in Akita, Japan. The initiative aims to build on mutually beneficial human-nature relationships, aligns with natural processes.

September, 2023
ICIMOD, Nepal

Dr. Nidhi Singh (Fellow), through a rigorous selection process, was chosen for 10 days professional training course on "Multiscale Integrated River Basin Management (IRBM) in Hindu Kush Himalaya" organized by (ICIMOD), Kathmandu, Nepal.

September, 2023
ICIMOD, Nepal
Dr. Vishal Singh (Executive Director, CEDAR) shared insights with participants from different HKH countries on a consultation workshop on “Foresight and scenarios for anticipatory adaptation in the Hindu Kush Himalaya”.

October, 2023
Adaptation Futures, Canada
Dr. Singh also attended the session of Adaptation Futures on “Financing adaptation and building resilience: Developing a gender lens climate investment framework” at Montreal, Canada. As a panelist he discussed about the role of Gender Inclusion and Strategic engagement in Climate Investment Framework.

March, 2024
Dadheldhura, Nepal
Dr. Suyal participated in a simulation event for flood early warning communication systems organized by Oxfam partners in Parashuram Dham, Nepal. The objective was to introduce technological innovations to support local communities.

Publications

Scientific Publication

Research paper

- Singh, S. P. & **Thadani, R.** (2023). A Leaf Based Classification for Himalayan Forests. International Journal of Ecology and Environmental Sciences, 50(1), 11- 31. DOI: 10.55863/ijees.2024.3250
- **Thadani, R.** (2023). Snow damage in a Himalayan forest maintains the dominance of evergreen oaks. Biotropica, 55(4), 737-741. https://doi.org/10.1111/btp.13236
- **Thadani, R.** (2023). What's in a name? The curious case of Banj oak (Quercus leucotrichophora). Tropical Ecology, 65(1), 11-15. DOI: 10.1007/s42965-023-00305-w
- Sugat B Bajracharya, Amina Maharajan, **Nidhi Singh**, Nandini Sanyal, **Vishal Singh** and Sheikh Tawhidul Islam (2024). Do perception factors affect adaptation behaviours against air pollution among vulnerable occupation groups? evidence from Chittagong and Dehradun. Environmental Research Communication. DOI 10.1088/2515-7620/ad287
- Fraser, A. M., Allington, G. R., Luthra, A., Virkar, P., Rana, S., **Suyal, R.**, **Rawat, A., Ratna**, A., Cunningham, K., **Raikwal, N.**, **Pandey, A., Singh, V.** (2024). Pollination deficit in apples increases with elevation. Agriculture, Ecosystems & Environment, 371, 109068. https://doi.org/10.1016/j.agee.2024.109068

Popular Article

Photo Story

- What's polluting the hill town of Dehradun? These photos hold the answer By **Nidhi Singh**. Citizen Matters. https://citizenmatters.in/dehradun-air-pollution- causes-effect-photos/

Knowledge Products

Policy Brief

- An assessment of 4 cities of Uttarakhand (Promoting RWH)

Technical

- Website (www.nainitalwater.com)

Booklet

- Bird Diversity in Naini Lake Catchment by **Nidhi Singh** & Manya Singh

Cartography

- Landuse and drainage map of Nainital

Infographics

- Facts & Truth About Naini Lake

Dissertation

Name of the Student: Sammarth Khanna
Title: Biodiversity and Forest Carbon of Aravalli forest patch
Institution: TERI, School of Advanced Studies, New Delhi

Memorandum Of Understanding (MOU)

Gurugram Metropolitan Development Authority, (GMDA)
University of Petroleum and Energy Studies (UPES), Dehradun

Donors & Partners

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: 17 Annual General Meeting held on 22 September 2023
Time: 11:30 AM
Venue: 814, Indira Nagar, 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.
703, Surya Kiran building, 19, Kasturba Gandhi Marg,
New Delhi - 110001

Our Bankers

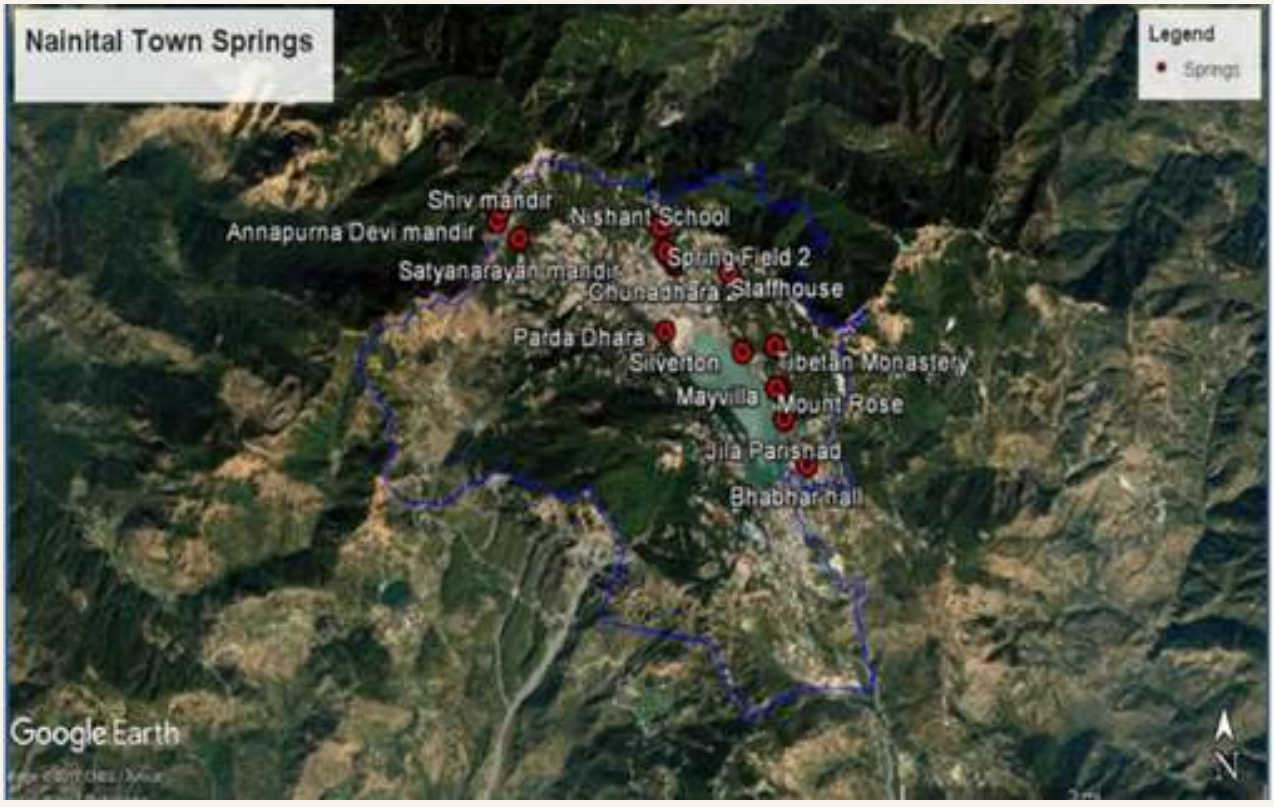
Industrial Credit and Investment Corporation of India (ICICI) Bank,
New Delhi State Bank of India (SBI), Delhi
Indian Overseas Bank (IOB), Dehradun
Axis Bank, Dehradun

Annexure-I

Water Balance of Lake Nainital computed using developed GLM lake model.

Year	Month	Volume	Change in Storage	Inflow	Outflow	Rain	Level
		(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(m)
2022	2	7.30	-0.18	0.04	0.22	0.01	25.3
2022	3	7.05	-0.28	0.00	0.29	0.00	24.8
2022	4	6.77	-0.27	0.00	0.27	0.00	24.1
2022	5	6.56	0.16	0.03	0.28	0.37	23.7
2022	6	6.79	0.08	0.15	0.27	0.21	24.2
2022	7	6.93	0.21	0.41	0.28	0.07	24.5
2022	8	7.15	0.34	0.58	0.29	0.07	25.0
2022	9	7.54	0.31	0.51	0.28	0.09	25.9
2022	10	7.96	0.25	0.76	0.47	0.10	26.8
2022	11	7.83	-0.30	0.10	0.39	0.00	26.5
2022	12	7.51	-0.34	0.05	0.39	0.00	25.8
2023	1	7.21	-0.26	0.02	0.29	0.01	25.1
2023	2	6.95	-0.25	0.01	0.26	0.00	24.6
2023	3	6.76	0.02	0.17	0.28	0.04	24.1
2023	4	6.86	-0.03	0.24	0.27	0.04	24.3
2023	5	6.83	-0.01	0.30	0.22	0.00	24.3
2023	6	6.70	-0.14	0.07	0.22	0.00	24.0
2023	7	6.88	0.32	0.55	0.23	0.01	24.4
2023	8	7.21	0.34	0.56	0.23	0.01	25.1
2023	9	7.32	0.01	0.49	0.49	0.00	25.4
2023	10	7.29	-0.06	0.17	0.23	0.00	25.3
2023	11	7.19	-0.14	0.08	0.22	0.00	25.1
2023	12	7.01	-0.20	0.03	0.23	0.00	24.7

Geo tagging of recharge zones of Naini lake catchment.

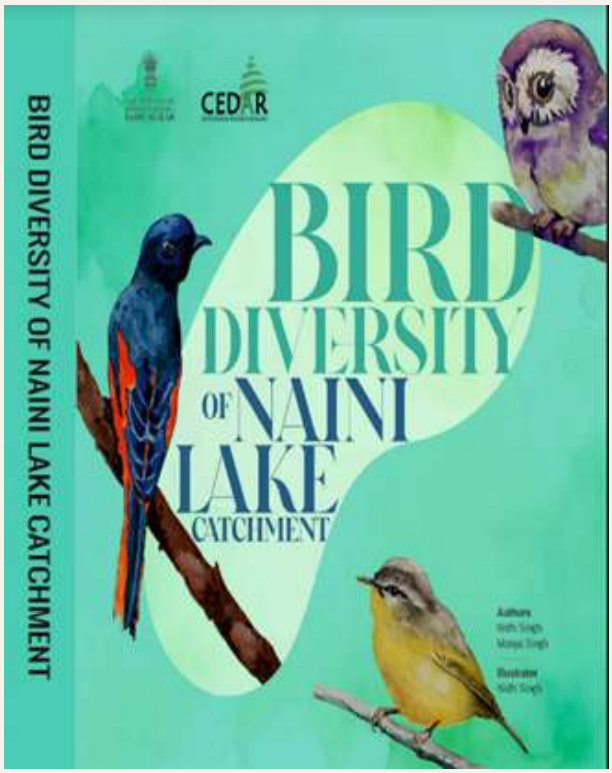


Geo tagging of springs in Nainital

Dimensions of vulnerability in various wards of Nainital

Ward name	Exposure	Sensitivity	Adaptive capacity	Vulnerability	Rank
Sree Krishnapur	0.014	0.359	0.234	0.257	11
Harinagar	0.015	0.473	0.388	0.298	14
Tallital Bazar	0.011	0.424	0.414	0.225	7
Rajbhawan	0.009	0.316	0.340	0.153	1
Sher ka Danda	0.006	0.400	0.367	0.221	6
Narayan Nagar	0.008	0.314	0.209	0.215	5
Uppar Mall Road	0.008	0.378	0.406	0.182	3
Shukhatal	0.009	0.345	0.302	0.204	4
Nainital Club	0.011	0.421	0.312	0.275	13
Snow View	0.007	0.415	0.356	0.246	9
Sainik School	0.010	0.352	0.251	0.237	8
Mallital Bazar	0.014	0.444	0.418	0.249	10
Awagarh	0.014	0.461	0.404	0.273	12
Ayarpata	0.008	0.350	0.399	0.160	2
Staff House	0.009	0.483	0.352	0.316	15

An Attempt to Community involvement in data collection



AWS, installed in District Sports Academy building, Nainital.

Annexure- II

Format of report shared by farmers

Farm A: Govind Singh Bisht

Purpose of the project: To document the different types of bee and bee-like pollinators that are visiting your and other farms. This report summarizes what we have learned so far.

Number of participating farms: 15

Number of samples per farm analyzed in this report: 4
The first sample in each farm was collected by the research team in early February and the other three samples were collected by you and the other farmers in mid-February, early March and mid-March

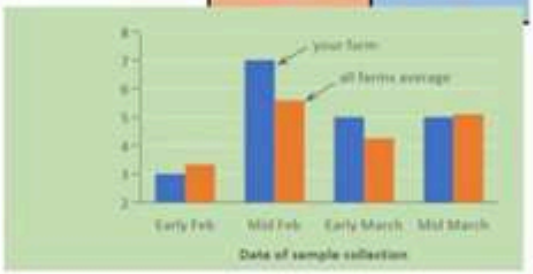
What does the table on the right show?
How many individuals of each type (# and %) that were collected on all farms combined and on your farm.

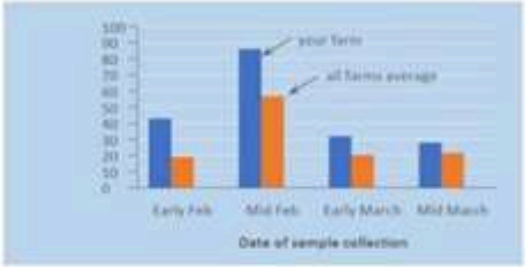
- On all farms: 1327 individuals representing 14 types
- On your farm: 175 individuals representing 9 types (Below is a picture of bees collected from your farm)

	All farms	Your farm
asioglossum	521 (39%)	73 (42%)
Halictus	341 (26%)	28 (16%)
Andrena	320 (24%)	58 (33%)
Ceratina	47 (4%)	7 (4%)
Syrphid fly	28 (2%)	2 (1%)
Apis	18 (1%)	0 (0%)
Nomada	16 (1%)	1 (1%)
Sphecodes	10 (1%)	1 (1%)
Osmia	9 (1%)	0 (0%)
Bombus	8 (1%)	1 (1%)
Braunsapis	4 (<1%)	4 (2%)
Hylaeus	3 (<1%)	0 (0%)
Colletes	1 (<1%)	0 (0%)
Psythirus	1 (<1%)	0 (0%)
Total	**1327**	**175**

What do the two graphs on the right show?
How the number of pollinator types (top graph) and individual pollinator insects (bottom graph) changed over time (sampling date) on your farm and on all 15 farms combined.

Collections from your farm are shown as ■ blue bars; averages from all farms combined are shown as ■ orange bars.





What does all this mean?
Your farm had more different types of pollinators than the average for all farms during most sampling dates, and a higher number of individuals than average during all sampling date. This is good news and suggests that your farm may be providing important resources for pollinators, and that you may be using less pesticides than some other farms, especially during the mid-February to early March period.

What should you expect next?
Once we have collected and analyzed the last two insect samples from farms, we will provide a more thorough report on how well pollinators are doing on your farm. Results from the apple blossom experiment we conducted on all farms will also help us know whether pollinators are limiting apple production, and the steps you can take to make your farm more pollinator-friendly.

Audited Financial Statement

CENTRE FOR ECOLOGY, DEVELOPMENT AND RESEARCH

BALANCE SHEET
As at March 31, 2024

PARTICULARS	CURRENT YEAR Rs.	PREVIOUS YEAR Rs.
LIABILITIES		
Corpus Fund	2,00,000	2,00,000
Reserve Fund		
As per last Balance Sheet	24,62,162	27,99,497
Add: Transferred from Income and Expenditure Account	(26,49,252)	(3,37,335)
	(1,87,090)	24,62,162
Current Liabilities		
Projects in Progress (Schedule - 1)	18,20,715	10,00,020
	18,33,625	**36,62,182**
ASSETS		
Fixed Assets (Schedule - 2)		
Gross Block	9,83,670	7,96,061
Less: Depreciation	1,91,944	1,72,696
Net Block	7,91,726	6,23,365
Current Assets, Loans and Advances		
Current Assets		
Bank Balances		
With Scheduled bank - In saving accounts	5,88,030	26,93,356
Tax Deducted at source	4,15,869	3,10,461
Advance to Others		-
Security Deposit	38,000	35,000
	18,33,625	**36,62,182**

Significant Accounting Policies and Notes - Schedule 4

In terms of our report of even date annexed.

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

Chairman

Vice Chairman

Executive Director

Puneet Jain
Partner
Membership No. 520928
Place: New Delhi
Date:

CENTRE FOR ECOLOGY, DEVELOPMENT AND RESEARCH		
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED MARCH 31, 2024		
PARTICULARS	CURRENT YEAR Rs.	PREVIOUS YEAR Rs.
INCOME		
Project Funding		
Receipts during the year		
Local Grants		
NHMS :- (National Mission on Himalayan Studies): Creating Climate-resilient Communities in Mid-Hills of Uttarakhand: Interventions Towards Forest & Water	-	15,18,658
MOWR :- Hydro-Geological assessment and socio economic implications of depleting water resources in Tourist Towns of	53,85,491	15,00,000
GIZ :- Integrated Management Planning of Pong Ramsar Site Himachal Pradesh Supported by GIZ, India.	-	8,11,318
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	21,00,100	2,00,000
Iamgurgaon :- Baseline Forest Monitoring of the Ghata Bandh in Gurgaon	-	60,000
WWF :- Assessing Carbon Stocks in High-altitudinal Wetlands of Uttarakhand	12,68,755	1,40,973
Abhipsa Foundation :- Community-based eco restoration project Damdama Biodiversity Park & Lake	8,50,000	-
Living Water Museum (LWM) :-The mussoorie chapter, Living Water Museum	1,00,000	-
Cookstove Distribution :-Executing alternate energy source (Improve cook stove) for climate credits and co-benefits in uttarakhand	10,20,408	-
Foreign Contribution		
SUAS :- Impacts of the COVID-19 Pandemic on Forest Resource use by Rural Communities in India	-	5,92,622
SUAS :- Creating evidence for forest based resilience during Covid-19	-	20,48,729
ICIMOD :- Atmosphere, Study on exposure and impact of air pollution in the growing cities in the HKH region.	-	2,63,872
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	8,53,724	9,95,097
	1,15,78,478	**98,80,499**
Projects in progress brought forward (brought forward from unutilised funds of last year)	10,00,020	42,70,252
Other Receipts (Schedule 3)		
Donation	3,50,000	6,38,685
Administrative Cost Realised	4,37,722	13,07,556
Interest Income	62,300	1,34,129
Interest on income tax refund	-	9,688
FD Interest Received	-	-
	8,50,022	**20,90,058**
TOTAL INCOME	**1,34,28,520**	**1,62,40,809**

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
MOWR :- Hydro-geologocal assessment and socio economic implications of depleting water resources in Tourist Towns of Uttarakhand	51,00,809	16,80,464
GIZ :- Integrated Management Planning of Pong Ramsar Site Himachal Pradesh Supported by GIZ, India.	-	12,99,318
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	16,20,149	1,98,489
Iamgurgaon :- Baseline Forest Monitoring of the Ghata Bandh in Gurgaon	18,000	42,000
WWF :- Assessing Carbon Stocks in High-altitudinal Wetlands of Uttarakhand	14,52,712	-
Abhipsa Foundation :- Community-based eco restoration project Damdama Biodiversity Park & Lake	7,09,593	-
Living Water Museum (LWM) :-The mussoorie chapter, Living Water Museum	20,936	-
Cookstove Distribution :-Executing alternate energy source (Improve cook stove) for climate credits and co-benefits in uttarakhand	1,59,956	-
Foreign Contribution		
PEER :- Planning plantations: past learning, toward triple wins in carbon, biodiversity and livelihoods	-	9,39,227
CAF :- Gurgaon Sensors Project	-	13,82,866
SUAS :- Impacts of the COVID-19 Pandemic on Forest Resource use by Rural Communities in India	-	12,00,983
SUAS :- Creating evidence for forest based resilience during Covid-19	-	23,83,478
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	3,75,920	5,40,000
Pollination Work :- Pollination Limitation in apples in the Uttarakhand Himalayas	10,38,258	7,90,811
	1,04,96,333	**1,29,88,974**

OTHER EXPENSES		
Communication Expenses	29,439	16,381
Consultancy and Honorarium	3,51,000	2,44,696
Balance Write Off (Schedule - 2)	-	31,448
Depreciation (Schedule - 2)	1,91,944	1,72,696
Employee Costs	20,63,500	12,47,950
Office Expenses	3,64,612	1,40,222
Insurance	27,210	21,676
Audit Fees	41,300	39,766
Printing and Stationery	5,560	2,715
Rent	4,64,700	4,76,500
Travel and Conveyance	92,246	1,30,817
Other Expenses	1,29,213	64,283
	37,60,724	**25,89,150**
TOTAL EXPENSE	**1,42,57,057**	**1,55,78,124**
Balance	**(8,28,537)**	**6,62,685**
Less: Transferred to Project in Progress (As per Schedule - 1)	18,20,715	10,00,020
Surplus transferred to Reserve Fund	**(26,49,252)**	**(3,37,335)**

Significant Accounting Policies and Notes - Schedule 4

In terms of our report of even date annexed.

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

Chairman

Vice Chairman

Puneet Jain
Partner
Membership No. 520928
Place: New Delhi
Date

Executive Director

Acknowledgement

The Governing Board and the entire team at CEDAR extend their deepest gratitude to the esteemed donor organizations that have generously supported our mission throughout the years. Your unwavering support has been instrumental in driving our work forward. We would like to express our heartfelt thanks to the Ministry of Jal Shakti, Government of India; World Wide Fund for Nature-India (WWF); The George Washington University (GW), USA; International Union for Conservation of Nature (IUCN), India; Capgemini Technology Services India, Ltd.; and the Wipro Foundation. Your contributions have been vital to our efforts in promoting sustainable practices and conservation.

We are also profoundly grateful to our partners, whose collaboration has been crucial in our endeavors. Our sincere thanks go to the Forest Research Institute (FRI), Dehradun; Indian Institute of Technology (IIT), Roorkee; Center for Business and Entrepreneurial Development (CBED), Dehradun; and People's Science Institute (PSI), Dehradun. Your expertise, commitment, and shared vision have enriched our work and expanded our impact.

Furthermore, this acknowledgment would be incomplete without recognizing the invaluable support of numerous well-wishers who have stood by CEDAR over the years. To each and every individual who has believed in our cause and contributed in various ways, we offer our sincere thanks.

Lastly, and most importantly, we are deeply indebted to the communities who have placed their trust in CEDAR and actively participated in our initiatives. Your faith and collaboration have been the cornerstone of our work in fostering Sustainable Mountain Ecosystems. We are honored to walk this path with you and remain committed to continuing our shared journey toward a more sustainable future.

Address: 814, Indira Nagar
Dehradun 248006,
Uttarakhand, India
Contact Number: 01352 763403
Email: info@cedarhimalaya.org
Website: www.cedarhimalaya.org