



NAULA[®]
Himalayan Wetlands & Spring Biodiversity
N E T W O R K



VIGYAN PRASAR
Department of Science & Technology
Govt. of India

Empowered by:



National Mission for Clean Ganga
Ministry of Jal Shakti
Department of Water Resources,
River Development and
Ganga Rejuvenation, Govt. of India



Proceeding
of
Stakeholders Webinar
on Pahad-Paani-Parampra
आत्मनिर्भर हिमालय

10 -11-12 June 2021



Topic: Atmnirbhar Himalaya (Himalayan Sustainability)

Day I
10th June 2021

Media Webinar Platform: Vigyan Prasas Moderator: Dr. Reema Pant, Founder Director, Techno Hub, Dehradun

Coordinator: Mr. Mahender Baneshi, Social Reformer, Naula Foundation Naula Foundation

Chief Guest: Padmashri Prof. (Dr.) Yashodhar Mathpal,
Renowned Archaeologist, Painter & Naula Heritage expert, Chief Patron, Naula Foundation

Special Guest: Mr. D. P. Mathuria, Executive Director, (Technical) National Mission for Clean Ganga, Ministry of Jal Shakti, Govt. of India

Special Guest: Dr. Nakul Parashar, Director, Vigyan Prasas, Govt. of India

Special Guest: Padmashri Kalyan Singh Rawat, Maiti Movement, Dehradun

Keynote Speaker: Dr. Durgesh Pant, Professor, Uttarakhand Open University, Haldwani, Nainital

Keynote Speaker: Dr. Naveen Chandra Joshi, Wildlife Ecologist, Naula Foundation

Keynote Speaker: Dr. Suresh Mathpal, Forest Scientist, Naula Foundation

Keynote Speaker: Shri Shivendra Pratap Singh, Geologist, Coordinator, Kosi Punarjeevan Abhiyan, Almora

Keynote Speaker: Dr. Gajendra Pathak, Experts on wild fire, ANR Specialist, Naula Foundation

Keynote Speaker: Swami Veet Tamso, Environmentalist, Naula Foundation

Keynote Speaker: Dr. Vivekanand Pathak, Geo Hydrologist, Naula Foundation

Keynote Speaker: Mr. Manohar Singh Manral, Environmentalist, Naula Foundation

Keynote Speaker: Mr. Kesar Singh Riverkeeper, India Water Portal, Dehradun

Keynote Speaker: Mrs. Pragati Jain, Social Reformer, Naula Foundation

Keynote Speaker: Ms. Ruchi Godiyal, GIS Hydrologist, Naula Foundation

Keynote Speaker: Mr. Narayan Singh Rawat, Social Reformer, Naula Foundation



Topic: Water is Calling (Pani ki awaj suno)

Day II
11th June 2021

Media Webinar Platform: Vigyan Prasar Moderator: Dr. Reema Pant, Founder Director, Techno Hub, Dehradun

Coordinator: Mr. Mahender Baneshi, Social Reformer, Naula Foundation Naula Foundation

Jal Vandana by Ms. Mamta Baranwal, Social Reformer, Naula Foundation

Chief Guest: Padmashri Prof. (Dr.) Yashodhar Mathpal,

Renowned Archaeologist, Painter & Naula Heritage expert, Chief Patron, Naula Foundation

Special Guest: : Mr. G Ashok Kumar IAS,

Additional Secretary & Director, National Water Mission, Ministry of Jal Shakti, Govt. of India

Special Guest: Prof. (Dr.) Tanu Jindal, Professor & Pro Vice Chancellor, Amity University, Noida

Special Guest: Brigadier Dhires Kumar Joshi, Social Reformer, Naula Foundation

Special Guest: Mr. D. P. Mathuria, Executive Director (Technical), National Mission for Clean Ganga, Ministry of Jal Shakti, Govt. of India

Keynote Speaker: Dr. A. S. Maurya, Professor, IIT Roorkee

Keynote Speaker: Dr. Varun Joshi, Professor, GGS Indraprastha University

Keynote Speaker: Dr. Vaibhav Gosavi, Scientist, GB Pant Himalayan Institute, Kosi Katarmal, Almora

Keynote Speaker: Dr. Soban Singh Rawat, Hydrologist, National Institute of Hydrology, Roorkee

Keynote Speaker: Dr. Parmanand Kumar, Scientist, FRI, Dehradun

Keynote Speaker: Dr. Arvind C Ranade, Sr. Scientist, Vigyan Prasar

Keynote Speaker: Mr. Mahatim Yadav IFS, DFO, Almora

Keynote Speaker: Ms. Priyanka Bhatt, Naula Foundation



Topic: Aao Laut Chalen (Our Tradition in a modern concept)

Day III

12th June 2021

Media Webinar Platform: Vigyan Prasar

Moderator: Dr. Mukesh Bora, Naula Communication Consultant

Coordinator: Mr. Mahender Baneshi, Social Reformer, Naula Foundation Naula Foundation

Chief Guest: Padmashri Prof. (Dr.) Yashodhar Mathpal,

Renowned Archaeologist, Painter & Naula Heritage expert, Chief Patron, Naula Foundation

Special Guest: Mr. Brijesh Sikka, Sr. Consultant, National Mission for Clean Ganga, Govt. of India

Special Guest: Mr. Onkar Singh Janoti, Sr. Environmental Journalist, DW, Germany

Special Guest: Dr. Mohan Chandra Tiwari, Vaidik Jal Vigyan Expert, Naula Foundation

Keynote Speaker: Mr. Dinkar Tewari, DFO Soil Conservation, Nainital

Keynote Speaker: Ms. Nanda Sati, Theme based Traditional Singer, Chamoli

Keynote Speaker: Mr. Sandip Manral, Social Reformer, Naula Foundation

Keynote Speaker: Mr. Praksh Upreti, Delhi University

Keynote Speaker: Mr. Prem Singh Baneshi, Social Reformer, Naula Foundation

Keynote Speaker: Mr. Bhaskar Joshi, Educator, Dhaulchhina, Almora

Keynote Speaker: Mr. Girdhar Bisht, Gram Pradhan, Community Engagement Representative, Ramganga Valley, Chaukhutia

Keynote Speaker: Mr. Jyotsana Pradhan Khatri, Spring Ecology Visheshgya, Dehradun

Keynote Speaker: Mr. Chatar Singh, Eco Tourism Expert, Community Engagement Representative, Tons Valley, Uttarkashi

Keynote Speaker: Arch. Mrs. Pragati Jain, Social Reformer, Bhimtal, Nainital

Keynote Speaker: Ms. Suman Kumari, Gram Pradhan, Community Engagement Representative, Gagas Valley, Dwarahat

Keynote Speaker: Mr. Amar Nath, Social Reformer, Naula Foundation

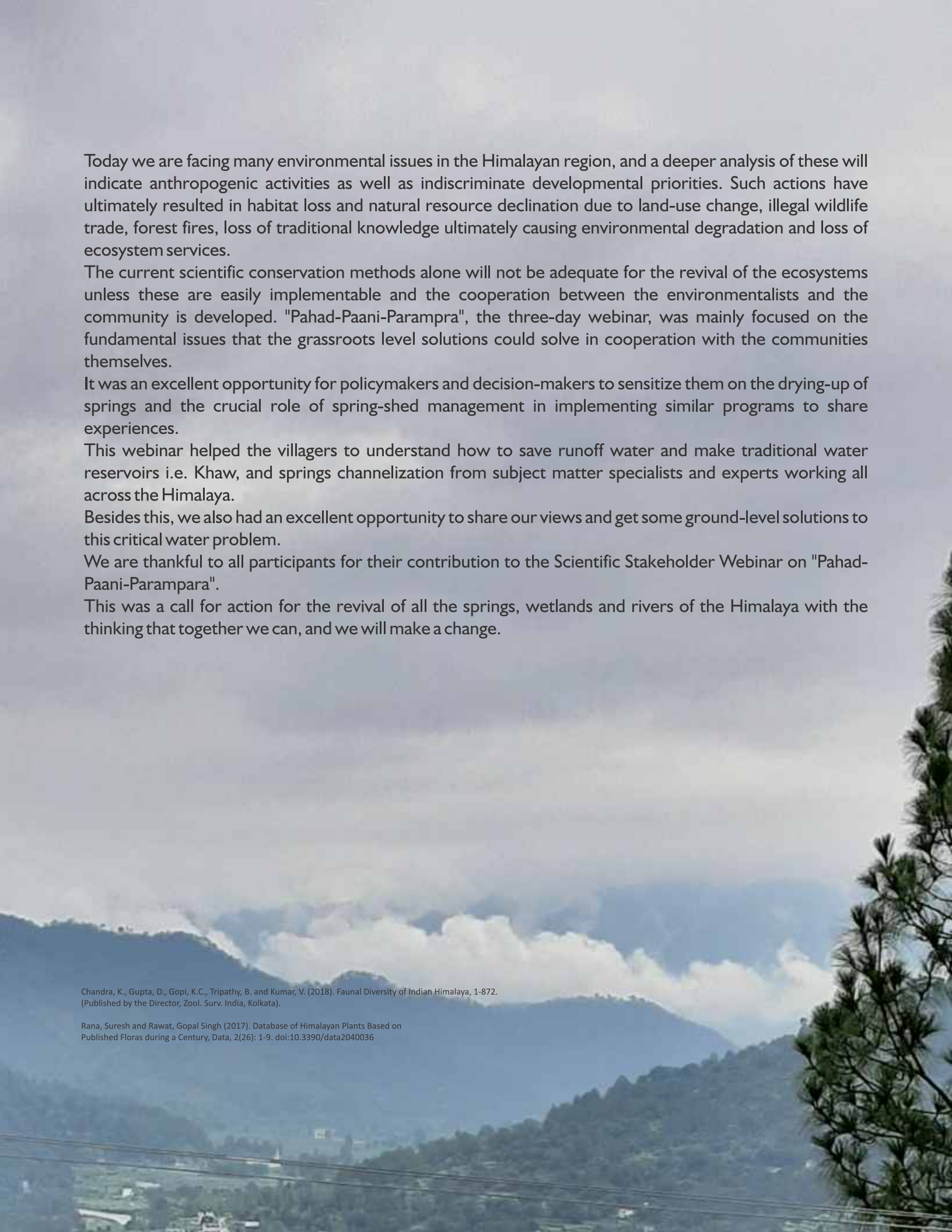


A b s t r a c t

Himalaya is among the youngest mountains of the earth and constitutes about 12% of the country's landmass. It is also home to rich biodiversity many types of flora and fauna as it supports about 30.16% of the nations fauna and is home to about 10,500 species of flora. The great diversity in the Himalaya is due to the vast gene pool it exhibits due to the variability in the climate, rainfall, and altitude and soils type. This genetic variation is also seen in the traditional landraces of agricultural crops, vegetables, cereals etc., which are slowly losing out to the more commercial cropping pattern and monoculture practice. Similarly, the traditional indigenous practices are also getting lost, some of which was very critical to the survival of early Himalayan society.

The hydrological system of the Indian Himalayan Region (IHR), upon which some 1.5 billion people depend, is under enormous stress as about one-third of the springs of Himalaya are drying up. Complex and diverse climatic, geographical, cultural, and socio-economic factors influence water security. The projected changes in the Himalayan climate will threaten the availability of natural resources, including water, NTFPs and food. Water stress will affect many other sectors in the region, among which agricultural systems are the most important, which is the primary livelihood source in the region. The water stress will further increase the conflict in the region with the growing demand for water due to the increasing population and rapidly growing urbanization. Developmental processes such as the construction of hydropower dams are further going to amplify water stress.

Good water governance is the need of the hour. Ensuring local and regional water security requires proactive IHR-wide teamwork, unambiguously in open data sharing among governments and scientists; conflict management via regional platforms; and investment of public- and private-sector funds for generating and exchanging knowledge stimulating action, and enhancing public awareness. Trade-offs between upstream and downstream water use, between urban and rural areas, and among industrial, energy, irrigation, and other sectors must be carefully managed to enhance water security. Participatory and cooperative decision making, transparent programme implementation, evidence-based policies, transboundary and regional cooperation, and accountability at all levels are essential to ensuring water security in the region.



Today we are facing many environmental issues in the Himalayan region, and a deeper analysis of these will indicate anthropogenic activities as well as indiscriminate developmental priorities. Such actions have ultimately resulted in habitat loss and natural resource declination due to land-use change, illegal wildlife trade, forest fires, loss of traditional knowledge ultimately causing environmental degradation and loss of ecosystem services.

The current scientific conservation methods alone will not be adequate for the revival of the ecosystems unless these are easily implementable and the cooperation between the environmentalists and the community is developed. "Pahad-Paani-Parampra", the three-day webinar, was mainly focused on the fundamental issues that the grassroots level solutions could solve in cooperation with the communities themselves.

It was an excellent opportunity for policymakers and decision-makers to sensitize them on the drying-up of springs and the crucial role of spring-shed management in implementing similar programs to share experiences.

This webinar helped the villagers to understand how to save runoff water and make traditional water reservoirs i.e. Khaw, and springs channelization from subject matter specialists and experts working all across the Himalaya.

Besides this, we also had an excellent opportunity to share our views and get some ground-level solutions to this critical water problem.

We are thankful to all participants for their contribution to the Scientific Stakeholder Webinar on "Pahad-Paani-Parampara".

This was a call for action for the revival of all the springs, wetlands and rivers of the Himalaya with the thinking that together we can, and we will make a change.

Chandra, K., Gupta, D., Gopi, K.C., Tripathy, B. and Kumar, V. (2018). Faunal Diversity of Indian Himalaya, 1-872. (Published by the Director, Zool. Surv. India, Kolkata).

Rana, Suresh and Rawat, Gopal Singh (2017). Database of Himalayan Plants Based on Published Floras during a Century, Data, 2(26): 1-9. doi:10.3390/data2040036

Topic: Atmnirbhar Himalaya (Himalayan Sustainability)

Day I
10th June 2021



All the delegates were welcomed on behalf of Naula Foundation, National Mission for Clean Ganga, Ministry of Jal Shakti, Govt. of India and Vigyan Prasar, Govt. of India, to the three days Scientific Stakeholder Webinar titled "Pahad-Paani-Parampara" by **Padmashri Dr. Yashodhar Mathpal**, *Uttarakhand's internationally renowned archaeologist and expert of Naula Architecture*, he said: "Pahad-Paani-Parampara" is an initiative of Naula Himalayan Wetlands and Springs Biodiversity Conservation Network aimed with the community participatory efforts to restore the Himalayan ecosystems and their traditional sources of water, to ensure water security in the Himalayan Region. Residents of the Uttarakhand community have traditionally relied on springs and small mountain streams as Naula's, Kul, Gul, Gadhere etc. for their water needs as the big rivers, which flow way deep down the slopes, are not of much use to the people living on mountains as springs have been providing water to the hill communities for time immortal and are still the major source of water in most of the remote villages of Uttarakhand. But unfortunately, these springs are now drying and facing a threat due to several reasons such as variation in climatic conditions, anthropogenic pressure, lack of policy and conservation measures. Sadly, these traditional Naulas are falling by the wayside as people increasingly turn towards the convenience of piped water supply. With its concentrated construction and transient populations, urbanization has a role in the loss of the Naula, as has post-colonial alienation from natural resources.

Naula is designed to collect water from subterranean springs. The flow of these springs is very sensitive and can be disturbed by seismic activity and human disturbance. Many parts of Uttarakhand Naulas or Dhara have dried up owing to the tremors of an earthquake. For the craft of the Naula building to be continued, the awareness among people and communities must be increased, and their active involvement in the conservation process has to be ensured.

Today the common man is less responsible for water scarcity, but rather big hotels and factory businessmen are exploiting it indiscriminately. The common people still pray for water as Lord Vishnu. He said that the problem of the water crisis could be further aggravated by industrialists and foreign tourists coming here, due to which a considerable amount of groundwater get exploited. Due to the level of the declining groundwater, the water sources in hills are drying up. He also reiterated to media channels that the present groundwater crisis has arisen due to commercialization.

Chief Guest, **Mr. D.P.Mathuria**, *Executive Director (Technical), National Mission for Clean Ganga steering implementation of Namami Gange program of Government of India towards pollution abatement in the industrial and municipal sector in Ganga basin, implementation of e-flow regime, sand mining and R & D schemes*, added: for the water management in the Himalaya, the first and foremost action is to place appropriate mechanism for coordinated actions needed by intensive capacity building and awareness program to lower most level of management, i.e. local community, Water User Associations, etc. All sections of society, mainly youths, are actively involved in the process. Apart from research activities related to the implementation of the development program, particularly about water conservation through storages—either surface or underground (which need to be continued on long-term basis), specific action is planned to be completed.

The studies in respect of the impact of climate on water resources indicate that various components of the hydrological cycle would be affected, resulting in further intensification of temporal and spatial variations of the water availability. This situation calls for urgent steps for the conservation of the available water resources. It is also necessary to take immediate steps for the augmentation of the utilizable water resources. The objective of water conservation can be achieved through storage over the surface as well as under the ground through the very active participation of all stakeholders. The objective of augmentation of water resources can be achieved by transferring the surplus flood water into utilizable water. Mass awareness and capacity building are key strategies.

In the present situation, appropriate measures for mitigation of the impact of climate change on water resources and the adaptive measures, are required to be undertaken by respective ministries and the State Governments. However, for identification of the most appropriate measures from the national perspectives and for ensuring effective implementation of the identified activities, it is necessary to have proper coordination among all the stakeholders on the one hand and the various implementing agencies like Naula Foundation on the other hand.

Dr. Nakul Parashar, *Director, Vigyan Prasar*, said Vigyan Prasar is focused on enabling access to appropriate information promptly aligned with India's developmental imperatives so that her citizens will be able to acquire the necessary scientific insights to improve their core strengths in all sectors of learning with implications for sustainable development. Therefore, the logical framework of science communication, emphasizes enriched learning and enhanced abilities for well-informed action. Therefore, information on aspects of science relevant to various thrust areas and tools/techniques for communication is presented. He further invited all the fellow citizens to derive the best out of the information and enrich our collective learning through valuable inputs and feedback.

Padamshree Kalyan Singh Rawat informed all the delegates about the various movements of Uttarakhand related to water conservation and biodiversity conservation. He said that the *Maiti movement* started by him in 1995 is based on emotional attachment to nature and trees and emphasizes planting trees and their conservation. This movement started by him has taken its roots in many countries globally, including 18 states of India today. He continues: Traditional springs, called naulas, are the primary source of drinking water in Uttarakhand from the ancient ages. Scarcity of water takes a heavy toll on women's lives in the hills because they spend hours walking up and down hillsides to fetch water from far-flung areas. Fights break out when the water source cannot meet the demand. The depletion of groundwater is an inevitable and natural consequence of withdrawing water from an aquifer. The unsustainable utilization of water by humans subsequently reduces groundwater and depletion of natural resources. Hence active plans are needed, which should simultaneously go with traditional knowledge and application of modern techniques.

Dr. Durgesh Pant associated with Uttarakhand Open University as a Professor & Director of the School of Computer Science and IT, Vocational Education and ONLINE education, stated that After the 2017 monsoon is about to over, it became obvious that the country had received a below-normal monsoon that year. The monsoon season had ended with about a 5.2% deficit. About 50% of the districts received normal rains, while more than a third, i.e., about 215 districts, had deficient rainfall. The issue of immediate concern is that because we get rain, snow, etc., for a very short duration, it is just not possible to utilize the water entirely. The only solution is to make arrangements for collection and storage of the water so received so that we could be comfortable for the rest of the year till the next monsoon. We need to reverse the age-old proverb: "Saving for the rainy days". In this case, we need to save for the dry days. But the tragedy is that we have been neglecting that aspect miserably. Most of the water received from the sky is not stored, and it is lost to the seas and oceans. In the process, the water also creates various problems like soil erosion, land degradation and floods. Hence, we must try all possible means to conserve available water and also economize on water consumption. Avoiding wastage can help in a big way in meeting the goal.

Dr. Naveen Chandra Joshi, subject matter specialist and Scientist, Wildlife Institute of India, Dehradun, explained that springs to overall water budgets within the region are poorly understood. The groundwater from the springs in the mid-hills of the Indian Himalayan Region (IHR), is a significant contributor to river base flow. Better scientific knowledge of groundwater in the IHR is urgently needed, primarily because millions of mountain people rely directly on springs. Today, the Himalaya is threatened by recurrent natural disasters and is at risk of catastrophic loss of life. Due to the impacts of climate change on precipitation patterns such as a rise in rainfall intensity, reduction in its temporal spread, and a marked decline in the winter rain, coupled with other anthropogenic causes, the problem of drying springs is increasingly felt across the Indian Himalayan Region. Due to man-induced climate change impact in the state, the process of transformation of non-glacial fed rivers into seasonal rivers has also been started in Kumaun as the mighty Kosi, and Gagas rivers which are lifelines of the Almora and Ranikhet towns, have been converted into seasonal rivers first time in their life history in the year 2003 and 2005, respectively. If no river regenerative measures are taken immediately, all the non-glacial fed rivers of the Uttarakhand State might be converted into seasonal rivers within the next two/three decades; and the summer discharges of all the non-glacial fed rivers may dwindle alarmingly. The Naula and Dhara are two important traditional water spring sources throughout the Himalaya. The channelization of the water of these springs up to the rivers can help in reviving the drying rivers in the region, including the holy Ganges. With this background concept, the Naula-Ganga Channelization programme is being initiated by Naula Foundation with the aim to revive the springs in the region and proper channelization of spring water to rivers so that both the springs and the rivers are revived, and water security is ensured in the Himalayan region. This is a call for action for the revival of all the springs, wetlands and rivers of Himalaya. We strongly believe, together we can, and we will make a change. The hydrological system of the Indian Himalayan Region (IHR), upon which some 1.5 billion people depend, is under enormous stress as about one-third of the springs of Himalaya are drying up. Complex and diverse climatic, geographical, cultural, and socio-economic factors influence water security. The projected changes in the Himalayan climate are going to threaten the availability of natural resources, including water, NTFPs and food. Water stress is going to affect many other sectors in the region among which agricultural systems are the most important, which is the primary livelihood source in the region. The water stress will further increase the conflict in the region with the growing demand for water due to increasing population and rapidly growing urbanization. Developmental processes such as the construction of hydropower dams are further going to amplify the problem of water stress.

Dr. Suresh Mathpal, *Forest Scientist, Naula Foundation* says: Women's participation in local institutions for governing natural resources is critical for sustainable land, forest and water management, as well as for building resilience and planning for climate change and adaptation strategies. Significant evidence now shows that climate change impacts women more than men, primarily because of the social roles they inhabit. That is why I want Naula Foundation to help women take a lead in sustainable development in the region. Their partnership is focusing on making a difference in women's lives under the eco-village development programme, a volunteer based initiative.

"Unlike other rivers, Kosi is a non-glacial river; therefore, its life depends on the water recharged in its huge catchment area. Unfortunately, that is happening less," said **Shivendra Pratap Singh**, *Coordinator Kosi Punarjeewan Abhiyan, Almora*; that gives expertise on revival of the Kosi. Many rivulets feeding the river will be preserved.

"About 350 villages fall in the catchment area; hence participation of local people is necessary to save the river (Kosi) from dying." Groundwork has been done to identify problem areas, and data is being collected. The project has made multiple positive impacts in many sectors — social, environmental and economic. With large plantation, there is an increased flow of water and there is an improvement in overall water retaining capacity of the catchment. Associated fauna is also getting protected. Communities are participating with great zeal and enthusiasm; as a result, it has become a new socio-environmental movement of Uttarakhand.

Explaining the Aatm Nirbhar Himalaya, **Swami Veettamso**, said that, today, the Himalaya is threatened by recurrent natural disasters and is at risk of catastrophic loss of life. Due to the impacts of climate change on precipitation patterns such as rise in rainfall intensity, reduction in its temporal spread, and a marked decline in the winter rain, coupled with other anthropogenic causes, the problem of dying springs is increasingly felt across the Indian Himalayan Region. Due to man-induced climate change impact in the State, the process of transformation of non-glacial fed rivers into seasonal rivers has also been started in Kumaun as the mighty Kosi and Gagas rivers which are lifelines of the Almora and Ranikhet towns have been converted into seasonal rivers first time in their life history in the year 2003 and 2005, respectively. If no river regenerative measures are taken immediately, all the non-glacial fed rivers of the Uttarakhand State might be converted into seasonal rivers within the next two/three decades; and the summer discharges of all the non-glacial fed rivers may dwindle alarmingly.

Planning and implementation of development works in accordance with the complex geology and sensitive ecology and environment of the Himalayan region is very important. We believe that the Himalayan region plays an important role in the regulation, control and operation of the country's climate. Any movement or disturbance occurring here has an effect on the local land and residents as well as the remote plains. Due to this, geographical, social, economic and environmental crises are continuously increasing. Therefore, making a comprehensive assessment of the major resources like land, water and forest here, their database should be prepared. And proper protection, promotion and use of these basic resources should be made the main basis in the development process.

In this context, in view of climate change, rising temperature, etc., the establishment of a high-level Himalayan Ecological Development Commission is very necessary for the social, economic development and ecological balance of the Himalayan region. It should be headed by the Prime Minister or the Deputy Chairman of NITI Aayog. In this commission, besides the ministers of finance, environment, agriculture, energy, transport, the chief ministers of the Himalayan states and the members in charge of the mountainous region of NITI Aayog should be there. The commission became the supreme regulatory body with respect to the Himalayas and submit a report at least once a year on the condition of the Himalayas before the NITI Aayog.

There is a need for adopting community-centric adaptation strategies. Success stories of how conservation and sustainability can be adopted to save Himalaya through a collaborative effort between the government, Self Help Groups, and communities need to be replicated in other vulnerable areas. It is important that traditional methods are involved in the formulation of the adaptation plans for Aatm-Nirbhar Himalaya. It is time to stop looking at the our traditional community as "beneficiaries"; instead, they need to be involved as promoters of government plans.

Dr. Gajendra Pathak, A.N.R. {Assisted Natural Regenesi}s Specialist; elaborated various reasons behind depletion of traditional water resources and recommended to the policy makers and stakeholders the following points:

a) Government should provide alternatives energy and livelihood options to the villagers like L.P.G. and modern agricultural equipments so that their dependency on forests may be reduced and remaining forests may be conserved.

b) Forests fire is a big threat not only to water resources but also to the biodiversity and local ecosystems. Hence steps should be taken to prevent forest fire.

In order to develop new forests, we should adopt A.N.R. {Assisted Natural Regenesi}s method in place of plantation method. A.N.R. is a better method acknowledged by many developing countries.

Mr. Manohar Singh Manral renowned environmentalist, Capacity Building trainer, President of Eco development Committee, stated that: We have no choice but to pay more attention to how we are using water, and how we may be wasting it. We must bridge the gap between our understanding of how important water is to our survival and what we can do to ensure that we have an adequate supply of clean water for years to come.

It is time to active participation of local users at all stages is vital to the success of local water governance and management, irrespective of the type of management, community, private, or government. It is important to ensure that governmental interventions do not interfere with the already existing our traditional mechanisms that are a part of the traditional institutional arrangements. Local non-governmental organizations can play a valuable role in forming and activating community organizations to ensure representation of social structures, and empowerment of women and disadvantaged groups. Local government institutions, such as village councils and village assemblies, play an important role in resolving disputes related to water use rights. There are many traditional water use rights, and local government may have a role to play in settling water use disputes, channelizing funds or, managing local water storage facilities thus highlighting the need for capacity building of local government institutions. Proper watershed management and consideration of upstream-downstream linkages are very important for the success of local water storage initiatives. Watershed management committees, government agencies, or non-governmental organizations can play an important role in helping community organizations use scientific information in their water management decisions.

Mr. Mahatim Yadav, IFS, DFO Almora, have a strong interest in understanding how communities form and change over time. In fact, they have spent a lot of time observing how complex communities, like forests, arise from empty land or bare rock. He study, for example, sites where volcanic eruptions, glacier retreats, or wildfires have taken place, clearing land or exposing rock. In studying these sites over time, Forest department have seen gradual processes of change in ecological communities. In many cases, a community arising in a disturbed area goes through a series of shifts in composition, often over the course of many years. This series of changes is called ecological succession. He also explained the benefits of Pine for mixed forest as they are generally tough plants that tolerate sun, drought, cold and a wide range of soil conditions. Also they are suitable for erosion control, with the roots holding soil in place and layers of pine needles helping to soften the impact of falling rain. The dense foliage and branching habits of pine trees provide cover for birds and other small wildlife.

Increasing public awareness, in the area of water hydrology have made the use of advanced technologies indispensable. *Naula Foundation Geographic Information Systems (GIS) Expert, Ms. Ruchi Godiyal*, stated the benefits of GIS as an effective tool for storing, managing, and displaying spatial data often encountered in springs hydrology. The application of GIS in springs mapping is constantly on the rise. Identification and management of recharge zones through field-based hydrogeology and community knowledge, mapping and modeling of spring catchment discharge, and smart construction can help revive the dying springs in IHR. Any depletion in spring flow or spring discharge will surely impact the flow of rivers. Springs are also the primary source of water for the rural households in the hilly region. But surprisingly springs have not received their due attention and are facing the threat of drying up. Many springs are reported to be declining due to the increased water demand that is due to increasing civilization, changing lifestyle, rapid urban expansion and growing commercial consumption, deforestation that leads to ecological degradation, changing land-use patterns, and erratic trends in precipitation etc. Nowadays in the Himalayan region many villages, hamlets and settlements are facing a water crisis. Therefore decreasing spring discharge has become a matter of concern throughout the Himalayan region. Springs are the point of natural groundwater discharge and decreasing spring discharge is an indication of reducing recharge to the mountain aquifer system that feeds the spring. An aquifer is a body of porous rock or sediments that hold groundwater. Groundwater is the term used to describe precipitation that has infiltrated the soil beyond the surface and collected in empty space underground. The channelization of the water of these springs up to the rivers can help in reviving the drying rivers in the region, including the holy Ganges.

The discussion ended with a thanks Note given by **Narayan Singh Ravat** stated that Atam Nirbhar Himalaya, is an important and urgent area of research and hence, requires the involvement of various expertise to understand the mechanism, particularly geotechnical researchers. It would be interesting to trace the source of the spring water (that emerges naturally in the foothills of the mountain) and the capacity of the mountains to store the water. Local Community will also trained for regularly measuring water discharge and testing water quality. They will also encouraged to protect their natural resources and culture. In Uttarakhand, especially in the hilly districts, the sources of drinking water are in the form of Naulas, Dhars (waterfalls) and Gadhars, etc. In most places, exploitation of groundwater is not possible due to geographical conditions. The discharge of natural drinking water sources is continuously decreasing in the state. Due to the drying up of many sources due to damage, the water crisis is getting worse. Therefore, it is absolutely necessary that they be saved and treated scientifically, and revived. There is a need to make a commitment to save the Naula, Dhara, Chal, Khaw traditional sustainable water sources from becoming dormant after their proper care, conservation, management after revival. Due to the non-storage and harvesting of rainwater, the system of recharge of local water sources has come to an end. There is excessive use of cement, concrete, etc. in roads and buildings, due to which the availability of raw land (which can absorb rainwater and recharge the sources) is continuously decreasing. Therefore, rainwater harvesting and storage are necessary. The plantation is necessary to maintain continuity in the discharge of water sources and to prevent erosion and erosion of land.



Topic: Water is Calling
(Pani ki awaj suno)

Day II
11th June 2021



The second day Started by "Jal Vandana" sung by **Mamta Baranwal**, Naula Foundation.

Session started by Moderator **Dr. Reema Pant**, says: It's my great pleasure to welcome you all to the Pahar-Pani-Parampara Webinar. I should like to extend my heartiest welcome to our Chief Guest Mr. G. Asok Kumar Additional Secretary & Mission Director at National Water Mission, MoWR, RD & GR. At the same time, I should also like to express my deep gratitude to VIGYAN PRASAR for hosting the webinar with the Naula Foundation to prepare for this Webinar.

Shri G Ashok Kumar IAS, *Additional Secretary & Mission Director, National Water Mission* stated that: Water is a universal phenomenon. Water is considered Divine by the Vedas. Clearly, ancient Indians were aware of the importance of rain and other hydrologic variables for society. The water veins beneath the earth are like veins in the human body, some higher and some lower. The water falling from the sky assumes various colours and tastes from differences in the nature of the earth. It scientifically explains in our Vedas about evaporation, condensation, rainfall with suitable examples and says that the water cannot be destroyed; only its state is changed; only its state is changed in various phases of the hydrologic cycle. Evaporation, condensation, cloud formation, precipitation, and its measurement were well understood in India in Vedic times. Having a varied terrain in India poses a challenging prospect when it comes to water conservation and water usage. One particular solution is thus not applicable to different areas of the country. In addition, while the use of technology and advancement of science can provide ready solutions, sometimes, traditional time-tested ways can help fulfil the requirements of people in a much more effective way. Traditional heritage medieval period water harvesting structures Baolis, also known as baoris or vavs, are man-made step-wells that were constructed to serve as underground water resources. These structures have always been popular in India, primarily in the arid areas, and played a significant role in water conservation. More commonly seen in the western parts of India, the baolis provided villages with water for drinking, washing, bathing, and also for irrigation, especially during periods of water shortages in seasonal fluctuations. The early step-wells in India were more of the functional types; hence basic in architecture. They were built as a necessity to store monsoon rain waters that would provide a year-round supply of water, especially during the dry months. Over the centuries the basic functional baolis gave way to complex and heavily ornamented architectural structures, especially in Rajasthan & Gujarat; with various designs and styles being opted, from being an L-shaped structure to a rectangular one, or sometimes even circular in form.

Good water governance is the need of the hour. Water is the primary life-giving resource. Its availability is an essential component in socio-economic development and poverty reduction. Water stress is going to affect many other sectors in the region among which agricultural systems are the most important, which is the primary livelihood source in the region.

The water stress will further increase the conflict in the region with the growing demand for water due to increasing population and rapidly growing urbanization. Developmental processes such as the construction of hydropower dams are further going to amplify the problem of water stress.

In India, 85-89% of water usage is for agricultural purposes and about 5% usage is for drinking and domestic purposes. Hence, even a small percentage saving of water in agricultural usage will have a significant impact in water availability for drinking and domestic purposes. According to the current scenario, we cannot stop the growth of intensive farming. It is a need for time to come up with more awareness among people to reduce groundwater exploitation.

For the additional water to fulfil the demand of the agricultural sector, rainwater harvesting is the only sustainable solution. Keeping the future scenario in mind, all state governments should come up with policies to encourage rainwater harvesting based on a scientific assessment of irrigation demand. It is possible to cope at least 70% of demand should be met from rainwater harvesting. National Water Mission started various measures to increasing water use efficiency in Agricultural as well as Industries. National Water Mission's (NWM) campaign "Catch the Rain" with the tagline "Catch the rain, where it falls, when it falls" is to nudge the states and stakeholders to create appropriate Rain Water Harvesting Structures (RWHS) suitable to the climatic conditions and sub-soil strata before monsoon. Under this campaign, drives to make check dams, water harvesting pits, rooftop RWHS etc; removal of encroachments and de-silting of tanks to increase their storage capacity; removal of obstructions in the channels which bring water to them from the catchment areas etc; repairs to step-wells and using defunct bore-wells and unused wells to put water back to aquifers etc are to be taken up with the active participation of people. To facilitate these activities, states have been requested to open "Rain Centers" in each district-- in Collectorates/ Municipalities or GP offices. During this period, these Rain Centres will have a dedicated mobile phone number and will be manned by an engineer or a person well trained in RWHS. This centre act as a technical guidance centre to all in the district as to how to catch the rain, as it falls, where it falls. Efforts should be made so that all buildings in the district should have rooftop RWHS and that maximum quantity of rain water falling in any compound should be impounded within the compound itself. The basic aim should be that No or only limited will water to flow out of the compound. This will help in improving soil moisture and raising ground water table. In urban areas it will reduce water gushing onto roads, damaging them and will prevent urban flooding.

Chief Guest, **Mr. D.P.Mathuria**, *Executive Director (Technical)*, *National Mission for Clean Ganga* added: This year's World Environment Day theme was Ecosystem Restoration. The National Mission for Clean Ganga's ultimate objectives is the same with restored ecosystem & physiologically, biologically & chemically free continuous overall flow of Ganga (Nirmal Aviral Ganga). The meaning of Ganges is not only one river, but it is symbolizes water of all the rivers of India is included. The river Ganga, along with her many tributaries, has been the source of physical and spiritual sustenance of Indian civilization for millennia. And all through the ages, Indians held the munificent River Ganga as a Divine Body and the flow of River Ganga as the flow of Divinity. To the Indian mind, River Ganga is not only the holiest of rivers and purifier of mortal beings, but also a living Goddess—" Mother Ganga". It is time to seriously consider the existence of rivers as separate living entities, not only the medium of overexploitation of the river ecosystem. Our government, even the judiciary is worried about the current deteriorating condition of more than 300 rivers. With huge pressure on the population, & sewage system, there is a dire need for proper sewage management. Thus the newly created structure attempts to bring all stakeholders on one platform to take a holistic approach towards the task of Ganga cleaning and rejuvenation.

The Ganga action plan was, started in 1986 with the main objective of pollution abatement, to improve the water quality by Interception, Diversion and treatment of domestic sewage and present toxic and industrial chemical wastes from identified grossly polluting units entering in to the river. The ultimate objective of the GAP is to have an approach of integrated river basin management considering the various dynamic interactions between abiotic and biotic ecosystem. Notwithstanding some delay in the completion of the first phase of GAP it has generated considerable interest and set the scene for evolving a national approach towards replicating this program for the other polluted rivers of the country. The Government of India proposed to extend this model with suitable modifications to the national level through a National River Action Plan (NRAP).

After the commencement of NMCG, is to accomplish the mandate of National Ganga River Basin Authority (NGRBA); To ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management and to maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

Initiatives of Namami Gange for Spring rejuvenation:

NMCG has approved the following two projects for spring rejuvenations:

Pilot Project on Spring Rejuvenation in Tehri Garhwal District of Uttarakhand

The project has been approved by Executive Committee and will be implemented by CGWB in partnership with Survey of India, for a period of one year. The activities proposed under the project are as follows: -

- Systemic mapping of Tehri Garhwal district for inventory of springs, ground truthing & delineation of their spring sheds using drone based LiDAR (shall be carried out by Survey of India).
- Hydro-geomorphical & linement studies for identification of different type of springs & their recharge zones as well as selection of feasible sites for rainwater harvesting and recharge structures (shall be carried out by CGWB).
- Implementation of spring rejuvenation by constructing rainwater harvesting and artificial structures for spring rejuvenation (shall be carried out by CGWB along with State Nodal Agencies, Uttarakhand). Rejuvenation of dying springs in Tokoli Gad Catchment of Tehri Garhwal District using Geo-chemical & Geo-physical techniques' by IIT Roorkee.
- The project has been sanctioned to IIT Roorkee in December 2019, for a detailed study of Tokoli Gad Catchment in Tehri Garhwal district at an estimated cost of Rs 1.35 Cr. The project duration is 3 years and the project shall be carried out by IIT Roorkee with partner institutes viz HNB Garhwal University, National Institute of Hydrology, Roorkee and NISER, Bhuwadeshwar. An implementable action plan shall be provided by IIT Roorkee after 1st year of investigations and study and the results so obtained shall be assimilated for investigations and studies in subsequent years.

The objectives of the project are:

- To assess the impact of land use land cover change or impact of natural or anthropogenic precipitation variability in order to find out the causes of spring discharge depletion.
- Identifying the frequency of inherent and superimposed structural attributes to enhance porosity and permeability along the stream path for localizing the recharge zones.
- To identify the recharge zone and flow path of drying/dried up springs using stable and unstable (3H) isotopes, hydro geochemical, geological and ERT technics.
- To develop a cost effective standard operative procedure (SOP) to implement in other Himalayan area. To strengthen local water governance and participatory spring shed management approach.
- To prepare Water budget of the water shed villages for prediction of sustainability of village water resources.

The two projects sanctioned by NMCG are of high significance and may help in increasing the flow in river Ganga & its tributaries. The projects are also in line with the recommendations of the Working Group on "Inventory and Revival of Springs of Himalaya for Water Security" constituted by NITI Aayog.

Traditional knowledge can make a significant contribution to sustainable development for water conservation efforts. The sustainability of our indigenous knowledge practices has been proven to enhance and promote biodiversity & a healthy river ecosystem. National Mission for Clean Ganga focuses on It is necessary to involve local communities in water management programs; the role of the community in the management of water bodies is very important. When water is life, everyone has a responsibility to conserve it. Conservation is all about responsibility for oneself and others in all that we do.

Mountain springs are the primary source of water for rural households in the Himalayan region. As per a rough estimate, there are nearly 3 million springs in the Indian Himalayan Region (IHR) which has a population of around 50 million. Spring recharge is reported to be declining due to increased water demand, land use change and ecological degradation.

For the Water Management in Himalaya the first and foremost action is to put in place appropriate mechanism for coordinated actions needed by intensive capacity building and awareness program up to lower most level of management i.e. local community, Water User Associations etc. All sections of the society, particularly youths are actively involve in the process. Apart from research activities related to implementation of development program, particularly about conservation of water through storages –either surface or underground (which need to be continued on long-term basis), specific action which are planned to be completed.

The studies in respect of impact of climate on water resources indicate that various components of the hydrological cycle would be affected resulting in further intensification of temporal and spatial variations of the water availability. This situation calls for urgent steps for conservation of the available water resources. It is also necessary to take immediate steps for augmentation of the utilizable water resources. The objective of water conservation can be achieved through storages over the surface as well as under the ground through very active participation of all stakeholders. The objective of augmentation of water resources can be achieved by transferring the surplus flood water into utilizable water. Mass awareness and capacity building are key strategies.

In the present situation, appropriate measures for mitigation of the impact of climate change on water resources, as also the adaptive measures are required to be undertaken by respective ministries and the State Governments. However, for identification of the most appropriate measures from the national perspectives and for ensuring effective implementation of the identified activities, it is necessary to have proper co-ordination among all the stakeholders on one hand and the various implementing agencies like Naula Foundation on the other hand.

Prof. (Dr.) Tanu Jindal, *Professor in Department of Environment & Pro Vice Chancellor (R&D), Amity University, Noida* elaborated discharge of toxic elements from industries and landfills and diffused sources of pollution like fertilizers and pesticides over the years has resulted in high levels of contamination of groundwater with the level of nitrates exceeding permissible limits in more than 50% districts of India. Water quality in Delhi is on alarming situation, east and northeast districts of Delhi are undergoing arsenic contamination of groundwater, and furthermore, they have recorded nitrate and fluoride pollution. These three pollutants have major health impacts. While arsenic is carcinogenic, high nitrate levels are known to cause methemoglobinemia, or like disease.

The impact indicates how much the city is overdrawing its groundwater. She added: Water both in terms of quality and quantity has become a serious concern. The poor quality of water is especially taking a toll on our health and lowering the immunity levels which is affecting our day to day living. An extreme caution is to be taken with water you consume as it may be contaminated. Along with purifying the water, one also needs to understand the importance of saving water too. Water shortage can lead to serious repercussions! Remember every drop counts. Many studies comprise to result that the pesticides pollution potential near Yamuna and Hindon river basin region, in Delhi national capital region. to find accuracy qualitative and quantitative estimation of pesticides was done using gas chromatography. Among various organic, inorganic, and biological water pollutants, pesticides are very dangerous and harmful because of their carcinogenic properties. It's not just the Hindon River which is highly polluted but also the groundwater in its basin which is consumed by thousands, as a report has found the presence of metals, high salinity, and even the coliforms in water samples from these areas resulted in the high amount of calcium, iron, manganese, and nitrates, as well as fecal coliform, which is basically human or animal waste. The presence of pesticides in river sediment shows reducing the self-purification capacity of the river adsorption process. Yamuna tributaries and effluent drains are also polluting the Yamuna watershed. Most of the samples were collected from hand pumps and bore wells in the villages, clearly indicate maximum use of pesticides in agriculture. It is clear that the farmers here and elsewhere in the country need urgent awareness, knowledge, and skills to safely use pesticides.

Visionary environmentalist **Brig. Dheeresh Joshi** said that, The total Naula construction was in the shape of a temple and a statue of water god "Varun" or "Lord Vishnu" is placed on the wall of the Naula to give the sanctity of a temple. The consumption was strictly regulated by the social norms. The Dhare and Naule have given a special architect, they are made in a shape of temple a roof, walls and well built-up courtyard and chambers for the use of water. In fact the location of rural settlement was largely determined by the location of these springs. The number of naulas in a village depends upon the size and social structure of the village. The water seepage channels are checked or diverted due to unplanned construction and this causes drying of springs. As the advancement of technology and human migration for various reasons, the traditional methods of practice are being ignored. This leads to the lack of maintenance of water bodies due to siltation and finally extinction. The data of Kumaon hill, the study area shows that for 46% of the villages, the main source of water are the conventional sources (Naule and Dhare). There should be practices to be followed based on geological and geomorphology experts to overcome this problem. Till about five-six decades ago, Naula was the only source of pure drinking water in the mountainous rural areas. The care and maintenance of the Naulas were done all together. Early in the morning, before sunrise, the girls of the houses would retire from their daily chores, carrying a copper cup of water, would go along on the cistern to take water, talk, humming, putting water on their heads, and coming back home in a queue, getting busy in their work. From time to time, other members of the family also used to bring water from Naula to meet their daily needs. Water was brought from the Naula to drink for the cattle living in the house and to irrigate small beds. Goodwill was strengthened by mutual interaction.

Later on, through government schemes, by exploiting the underground water, by obstructing water sources, or by stopping the flow of rivers with dams, the work of collecting them in big tanks started reaching door to door. When water was available at home as per the need, the rivers were neglected and the heritage of our forefathers eroded and reached the verge of extinction. * Naula * No, the culture that nurtures our values of life will end, if we do not wake up on time.

Groundwater is continuously depleting. Where there were ponds, ponds, simars, gajars, concrete atlasses stood up. Cement and asphalt roads were built. The forests were destroyed. The land that takes rainwater into the earth's womb is decreasing day by day. The per capita consumption of water is increasing with the passage of time. Excessive exploitation of groundwater also has an adverse effect on agriculture. Today the need is to revive the endangered traditional water sources and develop the technology which our ancestors adopted centuries ago to nurture nature and culture.

Dr. A. S. Maurya, *Professor, IIT Roorkee, Uttarakhand*, said that in the Himalayan mountains, the great variation in the geology plays an important role to control the spring outflow. Springs occur with faults, fractures, joints, shear zone, alluvial and colluvial deposits. Today people collect water when there is demand, whereas springs overflow the rest of the time. Pooling may be socially difficult, because springs in specific villages are restricted to the village community; villagers resort to them in times of dry weather or when government drinking water schemes fail. Solutions must thus be site-specific and consider such diverse features as rainfall, recharge zone characteristics, water-use patterns, and local traditions. Increased water availability during the dry season (April–June) would be a great help to many mountain communities. Spring sanctuary development could help achieve this aim. But investigations must be conducted for a longer term before conclusive results are possible. Moreover, the state government should enable inhabitants to assume greater responsibility for local water management, because this can curb mismanagement and waste. Hence, water management and spring recharge require multi dimensional approaches, including engineering and biological as well as social and managerial measures. The Ganga River water at Rishikesh shows significant temporal variations in composition of water isotopes and ionic concentrations, as reflected in EC and temperature. The ^{18}O and EC values of the river water have been used to estimate temporally varying relative fractions of (i) surface runoff (monsoon rainfall runoff C post-monsoon interflow C winter snow-melt); (ii) groundwater discharge and (iii) glacial ice-melt to the total river discharge. A three-component mixing model with fixed end-member values has been used to estimate relative fractions of each of the three components. The relative contribution of the surface runoff peaks (70–90%) during winter, due to the near-zero contribution of glacial ice-melt, essentially represents melting of surface snow from the catchment. On the basis of excess of the river water during post-monsoon, winter and spring seasons, it is suggested that the snow- and ice-melt water has a significant component precipitated during winter from westerlies.

Nowadays in the Himalayan region many villages, hamlets and settlements are facing a water crisis. Therefore decreasing spring discharge has become a matter of concern throughout the Himalayan region. Springs are the point of natural groundwater discharge and decreasing spring discharge is an indication of reducing recharge to the mountain aquifer system that feeds the spring. An aquifer is a body of porous rock or sediments that hold groundwater. Groundwater is the term used to describe precipitation that has infiltrated the soil beyond the surface and collected in empty space underground. Groundwater enters an aquifer as precipitated water seeps through the soil. It can move through the aquifer and resurface through springs and well. Locally these springs are called Naula (aquifer) and Dhara (spring). The profound dependence of hill communities on springs their conservation, rejuvenation, sustainable spring shed management and recharge is required special attention immediately. If no river or spring regenerative measures are taken immediately, all the non-glacial fed rivers of the Uttarakhand state might be converted into seasonal rivers within the next decades. Therefore, an attempt has been made towards the conservation, rejuvenation; sustainable spring shed management and recharge of the springs that are the lifeline of the hilly region of State Uttarakhand.

Mountain natural springs are the main freshwater sources that serve nearly 40 million people across the Himalayas. The water problems of hill towns like Shimla are a direct result of the drying of springs. According to one estimate, almost all 58,000 inhabited villages in IHR are dependent on the natural water springs or small streams originated from springs, of which at least half of the springs are drying up or have witnessed a decline in water discharge resulting in acute water shortages across thousands of Himalayan villages and hill towns.

My suggestions are:

- 1.) Customary practice can make us disciplined water users but it is not a cure to damage already occurred to water sources.
- 2.) Only application of science and technology are going help us to restore our water sources.

Dr. Vaibhav Gosavi, Scientist at Centre for Land and Water Resources Management, G. B. Pant National Institute of Himalayan Environment, Kosi- Katarmal, Almora, Uttarakhand highlighted the actions taken by GBPNHE in recent past. He said an initiative called as "Jal Abhayaranya" was introduced and discussed which means development of water sanctuary or protected area for springs and any other water resources present in a particular area.

Jal Abhayaranya includes structural engineering measures (bio-engineering measures for rejuvenation activities), social engineering measures (which is basically creating more awareness and belongingness of water sources) along with administrative engineering (i.e. coherence with different line departments and/or schemes) in order to maintain or sustain a water source in long run.

Activities that are underway: Spring inventory and discharge monitoring, rejuvenation activities, social awareness, building mobile based application for data collection and storage, creating cadre of Para-hydrologists for local assistant, village water security plan development etc.

It's an effort to maintain equilibrium between Jal, Jungle, Jamin, Janvar and Jan.

Dr. Parmanand Kumar, Scientist, Ecology, Climate Change, and Forest Influence Division, FRI, Dehradun discussed that three-fourth of the earth's surface. 2.7% of the globally available water is fresh water and 1% surface water; 20% groundwater 79% glaciers and ice caps out of this 1% easily available surface water, 52% is available in lakes; 38% is available as soil moisture. Water Quality Monitoring: the collection of the relevant information on water quality, Water Quality Assessment: The evaluation of the physical, chemical and biological nature of water in relation to the natural quality, human effects and intended uses." Major sources of water pollution Urban and domestic waste Industrial waste Agricultural sources mining wastes Induced contaminated sources radioactive substances etc. Wash off from landfill sites. He also discusses some case studies to monitor water quality parameters at different sites comparing suitability for human consumption At Haridwar, he found that pH value throughout the investigation was within the permissible limit at all the Ghats. For EC, all the samples were within the permissible limit. DO value was least because of the increased population load of the devotees. Ganga water was found to be unsafe for drinking purposes due to the presence of fecal coliforms. Disposal of untreated domestic and sewerage effluents in the river directly through so many drains from the city area.

Dr. Soban Singh Rawat, *Subject matter specialist and Hydrologist from NIH, Roorkee* appreciated the theme i.e. Pahar-Pani-Prampra of the webinar jointly organized by Naula foundation, Vigyan Prasar and Namami Gange. Dr Rawat apprised that all the villages/hamlets of entire Himalayan area are located in proximity of natural water springs as water from rivers and glaciers are not easily and economically accessible. Therefore, there have been developed a noble spring civilization in entire stretch of the Himalaya. But due to unprecedented urbanization in the region particularly in last five decades, there are heavy pressure on these springs along with their recharge areas have been disturbed significantly. In addition to this climate change exacerbated the rate of drying of these springs. Therefore, there is urgent need to revive and restore of these critical water resources. NITI Aayog has already given stress on inventorization and revival of Himalayan springs in its working group report released in 2018. Dr Rawat advocated that it's a high time to take initiative by the local NGOs, civil society and local administration to identify the vulnerable springs and then efforts should be done to revive them by the help of scientific inputs form various research institutes and universities.

There is urgent need to sensitize local people and agencies and link various government and CSR schemes to mobilize the manpower, funds and resources for revival of drying springs in the entire stretch of the Himalayas. Explained "Inventory and Revival of Springs of Himalaya for Water Security", which was formed last year to take stock of the magnitude of drying of mountain springs across the Himalayas, the quality of water from springs, review related policies across the IHR to ascertain its adequacy and gaps, review existing initiatives, spring revival and suggest short-, medium- and long-term actions to tackle the depletion. Role of springs are crucial for our major rivers too. It is certified that 49% of water share in River Ganges in Devprayag is glacial water, rest is spring water.

He also emphasized on conservation and protection of the traditional Naula-Dhara culture of hills and recommended to declare every Naula and Dhara as a water cultural Heritage sites on the tourist map of Uttarakhand. Proper Spring Data management is need of time, and it is impossible without proper involvement of Civil Society & communities, for systematic mapping of springs across the IHR States under one single spring data management policy. Awareness and education of communities regarding spring water management under a changing climate can play a crucial role in springshed management. In my opinion Govt should involve local people in water conservation activities.

It's worth notable that all measures used for conservation of water are equally applicable for checking soil erosion. Every village must be self sustainable in terms of water requirements, should not encourage water lifting schemes. Local available spring should be preserved, protected and develop for mitigation of future water demand. It is lesson from this pandemic that every smallest demographic unit i.e. village must be self sustainable so that it can be isolated any time to fight against any pandemic.

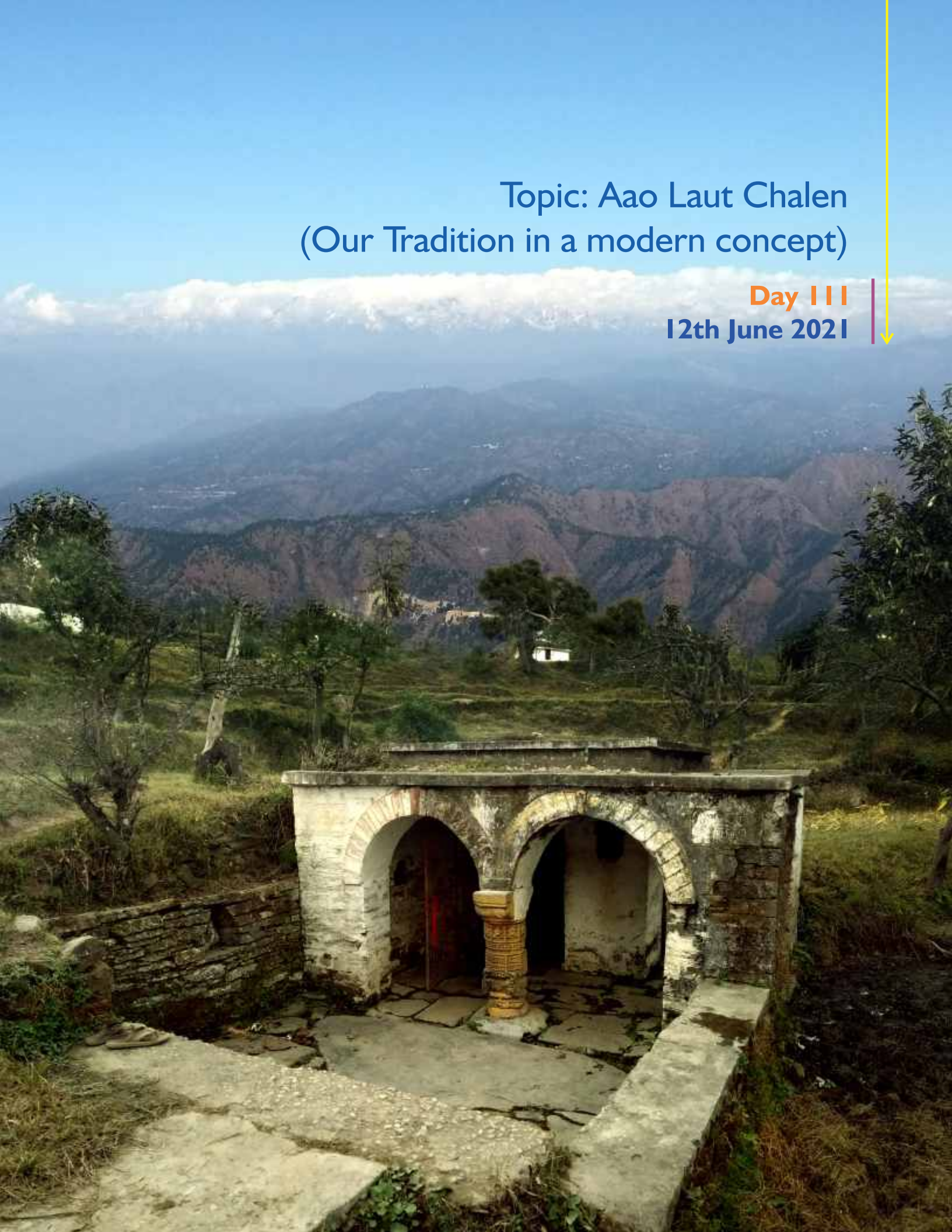
According to **Dr. Varun Joshi**, *Professor, GGS Indraprastha University, Delhi*; relationship between rainfall and spring discharge study is important to understand hydrological behaviour of springs and water resources management. In the Himalayan mountains springs are the freshwater sources for household consumption. He said they studied six springs of different recharge area characteristics in two micro-watersheds in western Himalayan mountains in India.

Based on the recharge area geology these springs were divided into fracture/joint (FR/JT) and fracture/joint/colluvium (FR/JT/COLL) and found a strong positive relationship between rainfall and spring discharge. Peak spring discharge coincided with peak rainfall in two FR/JT/COLL springs, which was delayed by about one month in FR/JT springs. Mean annual discharge was about two times greater for FR/JT/COLL springs than the FR/JT springs (6.47 vs. 3.94 liter per minute). But spring discharge per 1000 L of rainfall in spring recharge area for FR/JT springs was about 2.3 times greater than the FR/JT/COLL springs (49 vs. 21 liter per minute). In the FR/JT springs, rainfall in spring recharge area and spring discharge were weakly related ($r=0.174$), while they were strongly related in FR/JT/COLL springs ($r=0.595$). In the former category of springs decline in discharge was gradual, while it was rapid in the latter category of springs. Therefore, with regard to sustained supply of water for household consumption FR/JT springs can be considered more suitable. Land use and land cover such as moderately grazed pasture, abandoned agricultural terraces and few trees but dense growth of bushes and oak forest in the spring recharge area were found conducive for spring discharge and may be promoted for long-term water resource conservation in this region.

Ms. Priyanka Bhatt, *Naula Foundation* said: springs biodiversity restoration via adopting traditional methodology to ensure water security in Himalayan region. Access to clean drinking water for all is one of the crucial goals of global sustainable goals. Providing water to the burgeoning population in the Himalayan region has become a challenge. Traditional adaptations and coping strategies need to be revived. As multiple factors affect water availability in a region, including spring biodiversity, maintenance of recharge zones, awareness, and local climatic conditions, all need to be monitored regularly. To counter the arduous and immediate threats to human drivers' water security and climate change, productive, equitable, and sustainable water use should be encouraged through regionalized decision making, improved infrastructure planning, effective management of urban pollution, and enhanced regional cooperation. With this background concept, the Naula-Ganga Channelization programme is being initiated by Naula Foundation with the aim to revive the springs in the region and proper channelization of spring water to rivers so that both the springs and the rivers are revived, and water security is ensured in the Himalayan region. This is a call for action for the revival of all the springs, wetlands and rivers of Himalaya. We strongly believe, together we can, and we will make a change.

Topic: Aao Laut Chalen (Our Tradition in a modern concept)

Day III
12th June 2021



Mr. Brijesh Sikka, Sr. Consultant, NMCG said; Wetlands are fragile ecosystems and are susceptible to changes even with little change in its composition of biotic and abiotic factors. In recent years, there has been increasing concern over the continuing degradation of wetlands and in particular, rivers and lakes. Wetland sustains all life and performs some useful functions in the maintenance of overall balance of nature. Wetlands are most productive and biologically rich ecosystems on earth and are also among the most endangered. They interface between land and water systems. "Wetlands" is the collective term for marshes, swamps, bogs, and similar areas. They filter sediments and nutrients from surface water and support all life forms through extensive food webs and biodiversity.

Wetland systems directly or indirectly support millions of people and provide goods and services to them. They have important processes, which include the movement of water through the wetland into streams or the ocean; decay of organic matter; release of nitrogen, sulphur, and carbon into the atmosphere; removal of nutrients, sediment and organic matter from water moving into the wetland; and the growth and development of all the organisms that require wetlands for life. Wetlands may benefit directly as components/products such as fish, timber, recreation and water supply or indirect benefits which arise from the functions occurring within the ecosystem such as flood control, ground water recharge and storm protection. The mere existence of wetlands may hold great significance to some people as a part of their cultural heritage.

Wetlands have capacity to retain excess floodwater during heavy rainfall that would otherwise pay a share to flooding. By retaining flood flows, they maintain a constant flow regime downstream, preserve the water quality there and increase biological productivity for both the aquatic life of the wetland and for the human communities of the region. Periodically inundated wetlands are very effective in storing rainwater, which are having preponderate in recharging ground water supplies. The extent of ground water recharge by a wetland depends upon soil and its permeability, vegetation, sediment accumulation in the lakebed, surface area to volume ratio and water table gradient.

Wetland vegetation plays a major role in erosion control, which in turn contributes to shoreline stabilization and storm protection. Coastal wetlands, in particular mangrove forests, pay a share to shoreline stabilization and storm protection, by helping dissipate the force and protect the coast by reducing the damage of wind and wave action. Thus wetland plays an important role in management of natural hazards at much lower cost, reducing current velocity through friction and improves water quality.

Wetlands retain nutrients by storing eutrophication parameters like nitrogen and phosphorus flooding waters in vegetation or accumulating them in the sub-soil, decreasing the potential for eutrophication and excess plant growth in receiving waters. They also help in absorbing sewage and in purifying water supplies. Apart from these, the socio-economic values through water supply, fisheries, fuel wood, medicinal plants, livestock grazing, agriculture, energy resource, wildlife resource, transport, recreation and tourism etc., is significant. The functional properties of wetland ecosystem demonstrate clearly its role in maintaining the ecological balance.

Namami Gange aims for this and the Ganga rejuvenation project includes tributaries, small rivers, wetlands, floodplains, etc. Rivers that have been instrumental in the development of civilizations were exploited badly for too long, but in recent times, governments, environmentalists, self-help groups, and individuals are coming together to rejuvenate rivers. An understanding of the river and its entire ecosystem is needed.

One significant component of river rejuvenation is the conservation of wetlands. Wetlands are distinct ecosystems that are flooded with water either permanently or seasonally. Wetlands are neither completely land-based habitats nor completely aquatic habitats. They are somewhere in-between. For a long time, the perception of wetlands like marshes, swamps, and river meadows, etc was of negative habitats (research attributes these issues to the demonization of wetlands in children's literature). This led to wetlands being ignored or encroached and finally being endangered.

The vision of 'Ganga Rejuvenation' is in terms of ensuring aviral and 'nirmal' Ganga and also protecting its ecological and geological entity. The healthy wetland can play a major role in this and the basin is dotted with a large number of wetlands of varied nature and sizes. Wetlands are globally important carbon sinks and are important in buffering the impacts of climate change. 'Namami Gange' mission has been working with several partners such as WWF, WII, state wetland authorities for developing a good inventory, ground verification, integrated management plans (IMP) and their implementation for conservation and protection.

Mr. Onkar Singh Janoti, *Environmental Journalist in DW, Germany* recalls flash back to his root in Uttarakhand ; The Himalayan region, spread over 16.3 percent of the total geographical area of India, is considered a rich water tank. Dense forests cover 45.2 percent of the Himalayan range. People who have lived in the middle of rivers, mountains for centuries also have folk science to keep the Himalayan culture and civilization intact. Natural resources are slipping from the hands of the people. Therefore both youth and water are fleeing from the mountain. That is, the planners will make a good plan for the conservation of glaciers, mountains, rivers, and biodiversity, but these plans have not yet taken the ground form. The Himalayan region was expanded into different states, but the standards of development are still plains. are the same. As a result, the exploitation of the Himalayas has increased. The cycle of disasters has intensified. The plan to develop tree farming, fruit farming, small hydropower in the form of industries has remained only a matter of rhetoric of the leaders. The impetus that should have been given to the methods of local water conservation. But in its place, cemented water structures are being built, due to which the water sources are drying up. Uttarakhand state is rich in water but proper water management is not being done. Everything from mountain farming to irrigation systems to drinking water is dependent on the spring water source. The Ganges basin, which originates from Uttarakhand, is the largest river system in India, draining almost a quarter of the country. 52% of the water in such Ganga basin is non-glacial rivers based on mixed rain forests. The rivers of water in Uttarakhand are mainly fed by rainfall. During the summer, their flow becomes very low, and some of the tributaries i.e. the Gadhera dry up, only to be revived in the monsoons. Due to the normal monsoon in Uttarakhand, it is very important to collect, store and use rainwater for various purposes throughout the year. In ancient times, a unique water harvesting civilization took shape for rainwater harvesting in this region. In pre-colonial times however the state was not responsible for providing water to its citizens; There was no interference in the various uses of water by its people, yet there was community management of water for irrigation and drinking as per the needs of the people. From this, the traditional water management system was born. Local communities had ownership rights over the use of local natural resources and the state-recognized this right. Water sources were always considered sacred sites. Since the water bodies were considered sacred, they were well maintained. Traditionally in Uttarakhand, the main systems of water harvesting are Naula, Dhara, Gul, Khal, Simar, Jheel, Kund, or Gajar and Gharat (water mills). After independence, due to administrative neglect, the traditional water harvesting method and irrigation system collapsed and there was a rapid migration from the mountain, 70% of the water of the rivers in India is spring-fed i.e. traditional natural water source, which is lack of forest cover, irregular distribution of rainfall. And due to the uncontrolled development process, the real stakeholder on the conservation, promotion of springshed (recharge area of the stream) in this Himalayan state has to be ensured by the participation of the local people.

Dr. Mukesh Bora, *Naula Communication Consultant*, said; The Himalayan region has been the source of water, mountains, rivers, climate, biodiversity, and vast cultural diversity for centuries. But Uttarakhand, the origin of the Ganga-Yamuna rivers, which irrigates the whole of North India, is itself thirsty today.

The main source of water here is the traditional and sustainable natural water source. Which are drying up due to lack of forest cover, erratic distribution of rainfall, and uncontrolled development process. In such a situation, when the water supply from water pipelines, hand pumps installed by Swajal stops, then people's attention turns towards traditional natural sources. who is in a state of death today?

Access to clean drinking water for all is one of the crucial goals of global sustainable goals. Providing water to the burgeoning population in the Himalayan region has become a challenge. Traditional adaptations and coping strategies need to be revived.

As multiple factors affect water availability in a region, including spring biodiversity, maintenance of recharge zones, awareness, and local climatic conditions, all need to be monitored regularly. To counter the arduous and immediate threats to human drivers' water security and climate change, productive, equitable, and sustainable water use should be encouraged through regionalized decision making, improved infrastructure planning, effective management of urban pollution, and enhanced regional cooperation.

In the districts of Nainital, Almora, Bageshwar of Kumaon division of Uttarakhand, work is being done to revive traditional natural water sources with community participation. Women-led water committees have been formed with increasing the participation of local people in this work. Through which the work of natural springs channelization, check dam, contour trench, and plantation is being done in the catchment area of Naula. Along with this, work is being done to check water quality and groundwater management and to increase awareness related to sources. In the last few years, more than 90 water sources have been worked by the organization through about 53 water committees. In which efforts are being made to establish water dialogue in villages on Naulas, Paners, and Dhara through public cooperation and public participation. The works of tree plantation, forest fire, environmental protection, etc., in the forests are being done through the committee.

Prof. Mohan Chand Tiwari, *Naula Foundation*, started the conversation and stated that Indian ancient scripts and Vedas are rich in water science. He began by quoting from Atharva Veda, Kanda 19 "May the water that flows down from the snow-clad mountains bring you happiness. May the water that flows in the rivers bring you happiness. May the swift-flowing streams bring you happiness. May the water of the monsoon bring you happiness. He said that there were people who were aware of how to use water in the treatment of ailments. Such people were learned, and to them, water was a source of power. He also said that there is a chapter in the Brihatsamhita of the well-known astrologer Varahamihira called Udkaragal (obstruction of water). This chapter of 125 verses summarises the various conditions and their knowledge of groundwater. He further said that hydrologic knowledge in India has a historical footprint extending over several millenniums through the Harappan Civilisation (~ 3000 BC – 1500 BC) and the Vedic period (~ 1500-500 BC). As in other ancient civilizations worldwide, the need to manage water propelled the growth of hydrologic science in ancient India. However, most of the ancient hydrologic knowledge has remained hidden and unexplored to the world at large till recent times.

Mr. Prakash Upreti, *Assistant Professor in Delhi University*, says: We hope that soon with the efforts of the Naula Foundation, some of the natural water sources and aquifers (Naula) will be revived throughout the year so that this initiative can be promoted across Uttarakhand. Positive activities that provide a better environment for our local community need to be encouraged.

There is a need to protect the broadleaf species of trees, shrubs, vines, biodiversity present in all the forest areas of the area and forest fire so that the vegetative cover is maintained, for the forest workers working in this forest area and the villagers living around this area, especially to maintain constant communication with women for their active participation.

Discussions should be held with the women self-help groups of all the villages adjoining the forest areas about the importance of forests to keep the continuous flow of spring fed rivers safe and to increase it.

Formation of Village SHGs (Self Help Groups) of Women & Children in each village.

ANR method should be used for the protection and promotion of mixed forests; selective plantation should be done only when required. In order to strengthen drinking & agricultural use water sources of the Gram Panchayat and all the water bodies springs in the Van Panchayat, restore the water reservoir will be constructed for the collection of rainwater in the direction above the water source.

For rainwater conservation/harvesting works, emphasis should be given to quality rather than a number. Continuous dialogue should be established with the villagers especially women, meetings should be held at least 4 times a year.

Alternative agricultural equipment to the needy farmers of all the villages falling under the watershed area Alternative method should be adopted so that the oak trees which are being cut for the manufacture of agricultural implements are protected.

For Active public participation, more awareness program seminars, capacity building training, debates, and speech competitions should be organized on behalf of the Naula Foundation in all the government-private schools and colleges.

Before the fire season, people from the reserved forest area should be given letters of help in extinguishing the fire to the Mahila Mangal Dal Van Panchayats in all the villages.

Instead of extinguishing the fire, it should be emphasized that there is no labor in the forest, and safe disposal should be added at the time of the hood.

Sandip Manral, *Naula Foundation* said ; Community Based Non profit Naula Foundation in Uttarakhand has been working closely with the stakeholders, along with scientists from various National and International Institutes. Till date, the foundation has been focussing mainly in Uttarakhand. As a result of constant efforts, many spring sheds and Naula-Dhara systems have been rejuvenated and restored in Kumaon region of Uttarakhand. Naula Foundation takes various measures to bring about real water savings, including recharging and revival of groundwater level or rehabilitation of the main old water tributaries that delivering water to Main River, land levelling, canal lining, improved drainage, tree plantation, biodiversity conservation, as well as livelihood sustainability of local villagers, capacity building skill training programs, along with the education among the citizens through workshops, capacity building program, stakeholders seminars, skill development program, webinars, and mass awareness programmes. In order to revive the age-old civilization of sustainable use and management of water resources, the Naula foundation has developed a Himalayan Declaration of Springshed Rejuvenation (HDSR 2030) as per the context of UNSDGs.

As springs have been providing water to the hill communities for time immortal and are still the major source of water in most of the remote villages of Uttarakhand. But unfortunately, these springs are now drying and facing threat due to several reasons such as variation in climatic conditions, anthropogenic pressure, lack of policy and conservation measures. We plan to revive and manage the springs and tributaries of major rivers in the Kumaon region of Uttarakhand so that the major rivers do not become seasonal and they remain perineal.

The project will implement strategic actions identified in the Kheer Ganga Springshed Rejuvenation Pilot project river basin control land degradation, wetland habitat loss, and contamination of waters by sediments, nutrients, heavy metals and persistent organic pollutants. With this background concept, the Naula-Ganga Channelization programme is being initiated by Naula Foundation with the aim to revive the springs in the region and proper channelization of spring water to rivers so that both the springs and the rivers are revived, and water security is ensured in the Himalayan region. This is a call for action for the revival of all the springs, wetlands and rivers of Himalaya. We strongly believe, together we can, and we will make a change.

Ms. Suman Kumari Gram Pradhan, Gram Panchayat Surna, Gagas Valley, Dwarahat Block, & **Mr. Girdhar Bisht** Gram Pradhan, Gram Panchayat Kanoni, Masi, Ramganga Valley, Block Chaukhtia in District Almora, Uttarakhand. Both are young and energetic to work for springs biodiversity for their region with the association of Naula Foundation. Their suggestion are tree plantation and afforestation will help in meeting the requirement of fodder, wood, the fuel of the local people as well as prevent soil erosion and retain the moisture of the land, which will reduce the dependence on rainfall of an irrigated land. Efforts are being made to get the foundation arranged for the planting of trees of suitable species for the area by getting the soil tested. In order to revive the natural water sources, the foundation will do intensive plantation in the catchment area of river and rivulets & village micro wetlands surroundings by traditional method. It will definitely take a couple of years to revive that water source but it will be long term. Such activity helps to restore the ecological biodiversity and solve the water scarcity of area. Traditionally spring water is considered clean and pure due to the natural filtering that occurs during infiltration and its movements through shallow and deep acquirers as the case may be. Naula Dhara culture plays an important for social significance. Just about five-six decades ago, Naula was the only source of pure drinking water in the mountainous rural areas. The care and maintenance of the Naulas were done altogether. Early in the morning, before sunrise, the girls of the houses would retire from their daily chores, carrying a copper cup of water, would go along on the cistern to take water, talk, humming, putting water on their heads, and coming back home in a queue, getting busy in their work. From time to time, other members of the family also used to bring water from Naula to meet their daily needs. Water was brought from the Naula to drink for the cattle living in the house and to irrigate small beds. Goodwill was strengthened by mutual interaction. It is a bitter truth but reality that at present, by exploiting the underground water through government schemes, by obstructing water sources, or by stopping the flow of rivers with dams, the work of collecting them in big tanks and reaching them door to door. When water was available at home as per the need, the rivers were neglected and the heritage of our forefathers eroded and reached the verge of extinction. Depletion of Naula culture, the culture that nurtures our values of life will end, if we do not wake up on time.

The Webinar was also addresses by **Chatar Singh, Architect Pragati Jain** and many more delegate in constructive discussion about the rejuvenation of the drying springs especially Naulas in IHR. Several issues including the unavailability of fuelwood and energy needs as well as problems being faced by local people were also discussed by delegates in this Webniar.

The discussion ended with a thanks Note given by **Mr. Amar Nath**, *Naula Foundation* stated that The Science of the Naula, is an important and urgent area of research and hence, requires the involvement of various expertise to understand the mechanism, particularly geotechnical researchers. It would be interesting to trace the source of the spring water (that emerges naturally in the foothills of the mountain) and the capacity of the mountains to store the water. Local Community was also trained for regularly measuring water discharge and testing water quality. They were also encouraged to protect their natural resources and culture. Now it is necessary to make "watershed atlas" of Uttarakhand from which we can get a lot of information. People nothing is possible except participation, public participation has been considered as an integral part of the watershed development program. Due to which more attention will be given by the rural society to natural resources like soil and water and catchment water.

By increasing the interest of the rural society in the development program, the following objectives can be accomplished:-

1. To make economic development of the rural community of the village which directly and indirectly depends on the catchment development.

(a) To make full use of the natural resources found in the catchment area such as land, water, vegetation etc., This will reduce the adverse effect of drought and prevent degradation of progress, the income and savings of the villagers will be boosted.

2. To promote maintaining ecological/environmental balance in the village

(a) Continuous efforts by the rural community for the operation, maintenance, and further development of the assets created in the catchment area.

(b) To develop simple, easy, and affordable techniques by harnessing local knowledge and existing resources to solve the problems of the catchment area.

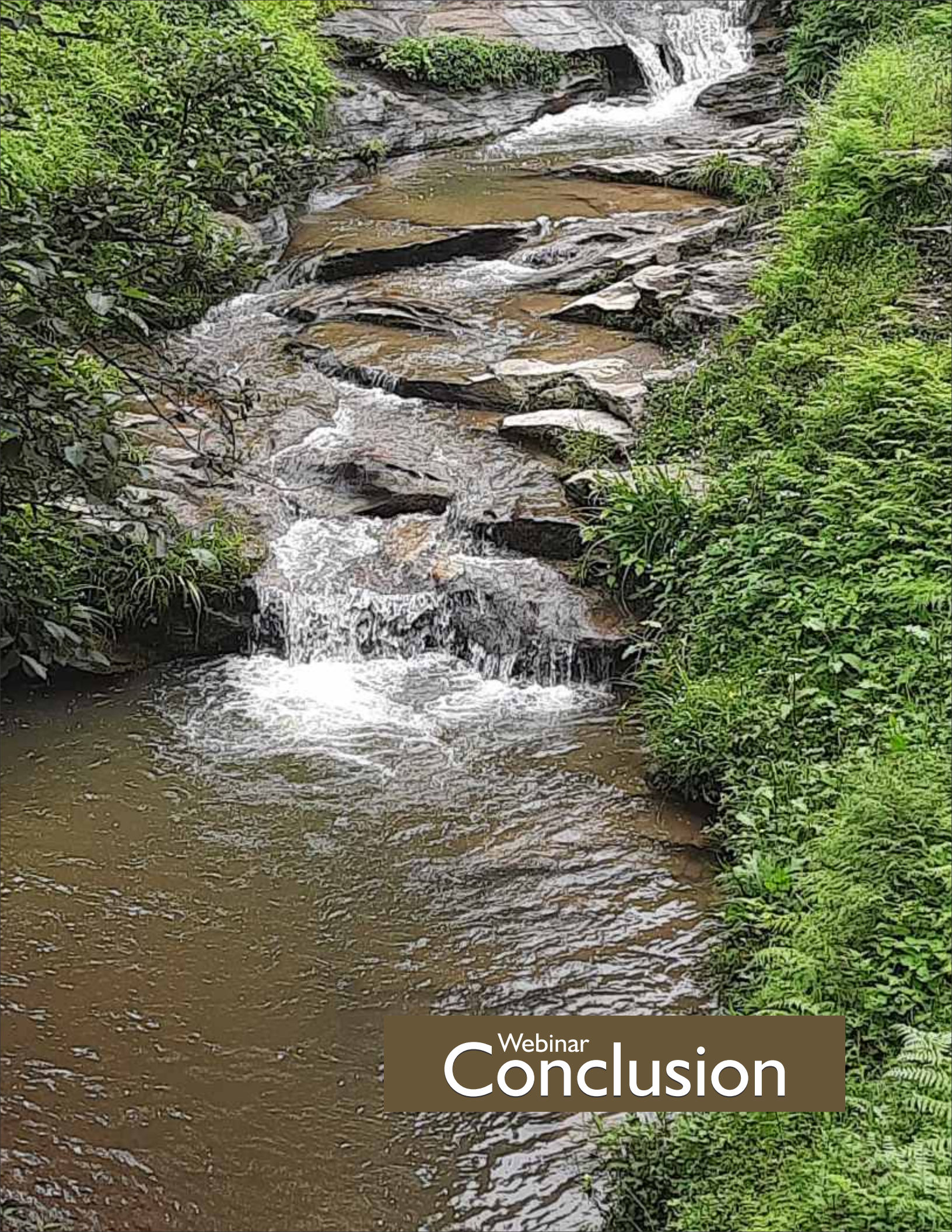
3. To pay special attention to the social and economic progress of the poor, backward, and resource less persons of the catchment area.

(a) To distribute the benefits and financial resources received from the development of land and water resources equally among the villagers of the area.

(b) To encourage maximum development of income-generating sources and development of human resources.

It is necessary to keep the above policy flexible so that problems can be overcome by incorporating traditional knowledge and skills of rural society. *modus operandi* Under the methodology, the scheme will emerge from the smallest unit of development, that is, the village. There may be variations in the planning components and treatment methods of the program due to local problems and variations in circumstances. For the successful implementation of the program, it is necessary that the people for whom this program is being run should take full interest in the program and understand the program. The best way is that the villagers themselves should make plans for the development of their village, like what crop to take on the field, make a dam somewhere? According to this scheme, the villagers themselves will get the work done and after completion of the works, they will also maintain and operate them. Employment will be created for the villagers and along with social and economic.





Webinar
Conclusion

Conservation Strategy

We firmly believe that unless and until we revive the small streams and tributaries of bigger rivers of Uttarakhand it is impossible to achieve big missions like Clean Ganga and Clean Yamuna. For the implementation of Gagas River rejuvenation treatment measures, a massive awareness programme has to be started by coordinating government departments, NGOs, Research and Development Institutions, Education Centres, Army, NSS, NCC, Block Panchyat, Gram Panchayats, Mahila Mangal Dals, Nehru Yuwa Kendra, students, teachers and local inhabitants. Micro-Planning for the rejuvenation has to be prepared at the village level. The project activities are designed to implement the global sustainable goals and are concentrated in six principal components as set forth below.

Component I: Water Quality and Environment Protection

Component II: Conservation of the Gagas River Basin

Component III: Land Degradation

Component IV: Stakeholder Involvement and Sustainable Development

Component V: Organizational Structure Development

Component VI: Integrated Watershed Management Program Implementation

Active recommendation for springshed rejuvenation

- Naula the natural source of water, must be protected by designing a special protective water policy for entire Indian Himalayan Region to resolve the local issues related to water governance. This resolution needs to be from the demographical, political, economic, financial, traditional, social and cultural aspects. Unfortunately, these springs didn't get their due attention which has deteriorated its condition over a period of time resulting in drying of these springs. The drying up of Naula, directly affects the flow of India's perennial major rivers such as the Ganga, Yamuna. Almost approx. 3.65 million in the Indian Himalayan Region and over 50 percent of them are drying up. Ground-level data and input from local and individuals must be included for designing protective water policy to improve the health of the watershed.
- The systematic mapping of dried springs and the running springs across the IHR is required, the creation of a web-enabled database, capacity-building activities are also recommended. To restore all springs it was highly recommended to identify the true recharge zones using hydro geological techniques and implementing recharge measures in those zones.
- Operation and maintenance activities of remaining traditional naule-dhare are best organized through a restoring and rejuvenation Naula Model.
- *The remit of a community caretaker involves the:*
Inspection, cleaning and repair of natural source of each springs, monitoring activities in the surrounding area, up keeping the protection zone/ repair of the surrounding, checking for appropriate operation by users and providing health education to the local.
- An integrated approach is needed to revive the whole landscape by taking up the revival of Check Dams, critical streams, and springs and developing their catchment using rainwater harvesting watershed and springshed approaches. Enhance the public participation and women empowerment. This would also include the compilation and dissemination of a program of public environmental information designed to address current and potential future socio-environmental problems arising from tourism, agriculture, and urban development (through educational programming) in critical environmental habitat areas.

- Site specific biological treatment measures for groundwater augmentation including plantation drives with special emphasis on the plantation of the herbal plants in the rejuvenated zones to provide alternate livelihood options to the villagers by promotion of ecotourism, supporting not only a sustainable tourist industry but also a program of transmittal of environmental information to patrons;
- Artificial rainwater harvesting measures such as the digging of trenches, pits, check-dams, and plantation of native tree species in the spring recharge area is recommended. The planted trees need protection from cattle which have to be done by barbed wire fencing which would help in minimizing grazing and cutting of fuel wood and grasses. Social mobilization is required to create the effect and stabilization of the spring heritage sites.
- Incentivizing rainwater harvesting in farmers' fields and grasslands.
- In order to develop new forests A.N.R. {Assisted Natural Regenesis} method in place of plantation method is recommended.
- Outreach program are required for developing local capacity and institutional mechanisms for springshed management through awareness and education of communities on importance of Naula spring water management must be ensured.
- The springshed development approach further refines the spring heritage site approach in using the underlying geology to identify the recharge area (known as the springshed), which often does not follow catchment or administrative boundaries. It involves mapping of the hydro geological layout of the spring along with the conceptual model of the spring recharge area and aquifer.
- This springshed is then developed by artificial rainwater harvesting works to reduce the surface runoff and increase infiltration, thereby resulting in improved recharging of the spring aquifer. It is expected that the results of this action research will help to improve the designing of mountain springs revival.
- The human made interventions in the name of development are having even greater impact on the springs that also needs to be assessed, avoided, mitigated and reversed where possible. All the collective efforts, along with attempts for revival will definitely bring a change in the region. Together we can and we will make a difference.
- Capacity building trainings including training hands on bio-diversity conservation and livelihood sustainability for community and in-line agencies.
- Enhancement of Women Empowerment through awareness and promoting their participation in management practices and decision-making process.
- A review existing environmental and water resources legislation within the basin and proposal of specific legislative actions required to harmonize and improve legal instruments for environmental and water resources protection.
- Grassland management and developing new small grasslands on the hill tops to reduce the runoff water.



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