

and migration of NSCs. Thus NSCs derived from induced pluripotent stem cells serve as a model to study neurological diseases.

Surfactant-like peptide (SLP) nanotubes can be considered as a class of biocompatible and biodegradable materials used for biomedical applications. Debashree Chakraborty (NIT, Suratkal) discussed the structural and dynamical properties of water near SLP nanotubes. She discussed the outcomes of an atomistic molecular dynamics simulations study of water molecules near nanotube-like structures, where glycine and lysine were taken as the constituents for the composition of SLPs.

DNA metabolic processes such as transcription, repression, replication and DNA damage repair elicit movement of proteins from one subnuclear location to another. Arnab Bhattacharjee (JNU) discussed the molecular features of proteins

and nucleic acids that allow fast dynamics and high-affinity binding on both single- and double-stranded DNA.

The last day of the annual meeting came to a close with a special lecture by C. Jagadish (Australian National University) on the topic of semiconductor nanowires for optoelectronics, energy and neuroscience applications. Jagadish began his talk highlighting that we are now in the fourth industrial revolution that merges the digital and biological worlds using light to sense and interface humans and machines. With the World Economic Forum identifying holographic displays, wearable optical sensors, light navigation and communication, 3D vision and gesture recognition, enhanced machine vision and augmented reality as technologies of the future, such aspirational technologies require fundamentally new approaches for smart and miniaturized optical systems. Nanowires are

considered as building blocks for the next-generation electronics and optoelectronics. Jagadish discussed how nanowires are synthesized and how the shape, size and composition of the nanowires influence their structural and optical properties. He also discussed how nanowires open up opportunities for manipulation of light-matter interaction at the nanoscale and help in developing a new class of lasers, THz detectors and modulators, solar cells and photoelectrochemical water-splitting, integrating optoelectronic devices on various platforms and engineering the growth of neuronal networks.

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**Pratik Pawar\*** and **S. Priya\***, Current Science Association, Bengaluru 560 080, India.

\*e-mail: pratik@ias.ac.in; priya@ias.ac.in

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## MEETING REPORT

### The Upper Indus Basin Network\*

The Upper Indus Basin (UIB) stretches across the regions of Pakistan, India, China and Afghanistan. The Upper Indus Basin Network-India Chapter (UIBN-IC) coordinates the research with six thematic working groups (TWGs). It acts as a platform to share research outcomes, discuss the progress and the challenges of the TWGs. This collaborative platform co-organized by the International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal, and Jawaharlal Nehru University (JNU), New Delhi, India provides cross-cutting understanding on the areas of climate, cryosphere, water, hazards, and vulnerability, etc. within these TWGs.

The first workshop of UIBN-IC on 'Bridging and strengthening science-socio-economic understanding' was held on 19 April 2019 in New Delhi. The event was attended by representatives from the Government and research organizations in a day-long discussion. It focused on largely identifying key re-

search areas such as modelling of climate extremes, glacier monitoring and pollution stress faced by water bodies for each of the six TWGs in the first half of the discussion. During the second half, the deliberation was on future structure plans to integrate research activities among the TWGs.

To assess the progress made while taking these discussions forward, a second workshop on 'Bridging and strengthening science-socio-economic understanding' was organized on 13 December 2019 at JNU. Again, this was attended by various stakeholders from academia, institutions and the Government.

The third workshop on 'Understanding key drivers of change for science-socio-economic understanding' was held through the Web platform on 21 June 2020 during the COVID-19 pandemic, with the objective to assess and analyse discourses surfaced during the course and discuss the recent researches proposed within the TWGs. It emphasized the need to link all these TWGs to interdisciplinary dimensions further for progress. It discussed flagship studies by various researchers, and the need to ad-

dress and bridge the data gaps that currently exist in research in the UIB.

A. P. Dimri (JNU) mentioned the objectives of the workshop focusing on integration and perspectives followed by an overview on UIBN by A. Shrestha (ICIMOD). Anil Kulkarni (IISc, Bengaluru) in his keynote address on 'Advanced Land Observing Satellite 2 with Phased Array Type L-band Synthetic Radar (PALSAR-2)' discussed about monitoring the glaciers using differential interferometric pair. He presented the formation of ponds on the glacier surface, debris cover, bottom topography, glacier lake near the terminus, and melt water from tributary glaciers to be possible causes for mass wastage of glaciers. He concluded by stating that the communities near the mountains are vulnerable.

TWG1 deals with the 'Framework of data collection, quality, and standardization'. G. Jeelani (University of Kashmir, Srinagar) deliberated upon 'Evaluating the groundwater resources of Upper Indus Basin (UIB), Ladakh'. Water stress and availability remain an issue in the UIB.

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\*A report on Upper Indus Basin Network-Indian Chapter was held on 19 April 2019 in New Delhi.

TWG2 deals with 'Climate change, air pollution variability, and black carbon'. The aim is to study extreme climate profiles using multi-model ensembles, assessments of teleconnections between western disturbances and monsoon, LULC changes, sensitivity in future warming scenarios, impact of air pollution and climate change on biodiversity, agriculture and human health. Air quality for PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>4</sub>, PM<sub>10</sub>, CO<sub>2</sub> and gaseous emissions at various sites of Srinagar city was analysed. According to Ashwini Kulkarni (IITM, Pune) average rainfall is more in the upper basin than the lower basin, and the southern part of the basin receives less rainfall than the northern parts. After analysing the trends in winter and summer using RCP4.5 and RCP8.5, it was concluded that the winters are getting warmer.

TWG3 focuses on 'Cryosphere monitoring and modelling'. R. Thayyen (NIH, Roorkee) presented the current status of cryosphere research and its future outlook in the UIB. Maximum and minimum temperature patterns led to the unanticipated conclusion that in six regions of mountain ranges in Ladakh very high lapse rate in the range of 13°–14°C was observed. A. L. Ramanathan (JNU) discussed about mass balance observation, reconstruction, and sensitivity of Stok glacier, Ladakh between 1978 and 2019. The team of researchers had also unearthed challenges in estimating runoff from the UIB. Glaciers had balanced conditions during 1978–1989, followed by a severe (1989–2009) and moderate loss (2011–2019). High interannual variation in winter mass balance could be a major reason for mass loss and a ~27% increase in precipitation is required to compensate for mass loss due to a 1°C rise in temperature. Due to fewer gauging stations on the Indian side, these researchers faced few challenges which can be overcome by international collaborations. They are now planning to expand the estimation to a larger region.

TWG4 deals with 'Surface and groundwater hydrology, water availability and demand'. Water availability assessment and extreme rainfall analysis in the UIB under climate change scenario are critical. D. S. Arya (IIT, Roorkee) mentioned that the total rainfall varies

from ~1400 mm at stations in the southern slopes of the Himalaya to <200 mm at valley floor stations in the Karakoram. He compared variation in projected water yield using RCP4.5 and RCP8.5 during the mid-century and far-century, which led to contrasting results. The selection of the most suitable hydrological model due to different glacier components is a pre-requisite requirement. A. K. Pandey (NGRI, Hyderabad) discussed on slope–river interactions of Sutlej valley region linked to river incision and landslide episodes.

TWG5 focuses on 'Understanding and managing Hazards and Risks'. S. Mal, Delhi University along with his team characterized the glacial lakes based on their evolution, trans-boundary Glacier Lake Outburst Flood (GLOF) issues and estimated the volume of lakes using various models. Out of 2320 glacial lakes studied in Jammu and Kashmir (J&K) 572 moraine dammed, 104 ice-dammed, 1452 bedrock dammed and 192 other lakes were classified. GLOF dangers to croplands, roads, population and hydroelectric power projects were analysed. A graph showing volume of all the lakes in J&K and Himachal Pradesh was presented using the relationship between area and depth, but the fieldwork remains pending. D. Shukla (IIT Mandi) introduced his work on landslide susceptibility zonation. Using landslide inventory maps, the location of a landslide, its dimensions, and geographical extent can be analysed. Input parameters are given to a model through various weights calculation and interpolating methods. Geomorphology, geology, lineaments, thrust, and fault of the Beas basin were studied and mapped using various models. It was concluded that 'On discrete imbalanced dataset, LR and FDA give good results for LSI threshold of 0.55'.

TWG6 deals with 'Managing gendered socio-economic impacts through adaptation measures'. Quantitative assessment on the impact of climate change on household social and aggregate consumption in Ladakh was carried out by M. K. Mehra (JNU). He mentioned that climate variables such as water source, altitude, slope and aspect, solar radiation, soil content and proximity to snowline influence local farming, with a large

dependency of food and livelihood systems being affected. For the study, household-level economic data for Leh and Kargil districts were obtained from the National Sample Survey Organization's 68th round of Consumer Expenditure Survey; data on health and education expenditure were obtained from the 71st round of Social Consumption Survey and climate data were drawn from India Meteorological Department's data supply portal. Data were estimated using three models and later analysed.

During the closing session C. Huggel (University of Zurich) spoke about integrated basin-scale water resource management through modelling concepts. He compared the trends of our dependence on mountain water resources from 1961 to 2050. C. G. Goodrich (ICIMOD) focused on the need of gender and social inclusion in UIBN-IC. He mentioned that the research should be gender-sensitive, inclusive, pro-poor and socially accepted to the communities.

In his concluding remarks Dimri emphasized on looking to provide solutions for critical issues and problems related to the UIB and society. He mentioned the need for a comprehensive compendium over the UIB, publishing research under different TWGs relevant for a future perspective. The UIBN-IC is an effort to bring timely and coordinated solutions to those who are most vulnerable to climate change. Sharing knowledge from researches can help us understand and combat climate change more effectively. The effort, although local, has a trans-boundary scope and also has the potential to improve the lives of the 215 million people who are dependent on the ecosystem services of UIB, contributing to building a resilient Hindu Kush-Himalayan region.

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**A. P. Dimri\*** and **M. Anand**, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067, India; **A. Shrestha**, International Centre for Integrated Mountain Development, Kathmandu, Nepal; **A. Kulkarni**, Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru 560 012, India.

\*e-mail: apdimri@hotmail.com