

Report

LANDUSE–LANDCOVER MAPPING AND MODELLING IN DIFFERENT ECOLOGICAL REGIONS OF THE MONSOON INTERNATIONAL SCHOOL AND SYMPOSIUM – 2023

March 13–26, 2023

THE Landuse-Landcover Mapping (LEM) project, as approved under the Humans and Biosphere Commission (HABCOM) of the International Union for Quaternary Research (INQUA), is hosted at the Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow. This project, awarded to Drs. Trina Bose, Anjali Trivedi, BSIP and Navya Reghu, Manipal Academy of Higher Education (MAHE), is the first of its size and kind approved from the subcontinent by INQUA. LEM held its first International School and Symposium (LEM-ISS) from 13th to 26th March 2023 in the tropical dry deciduous forests of western Vidarbha, Maharashtra, India.

The LEM project aims to map and model land use and land cover indicators in different ecological regions of the monsoon to quantify modern analogues of the climate variations to address knowledge gaps in these regions during the late Quaternary Period. One of the main aspects of the project is to introduce the methods of Landcover-Landuse

mapping and modelling and their inherent concepts to students of related fields of sciences. A further primary aim is to conduct outreach interactions to introduce the concepts of biodiversity, conservation and sustainable development to the general populace, especially young students of these ecologically significant regions.

In addition to INQUA and BSIP, LEM-ISS-2023 was also supported by the Department of Forests, Government of Maharashtra; the Science and Engineering Research Board (SERB), Government of India; Ministry of Earth Sciences (MoES), Government of India; and the Association of Quaternary Researchers (AOQR). Local support was provided by the Dr. Punjabrao Deshmukh Administrative Prabodhini, Amravati, and the Vigyan Bharati Vidarbha Pradesh Mandal.

A total of 23 trainee participants from India, Nepal and Sri Lanka attended this school. They interacted with ECRs and invited experts from India, Sri Lanka, France, Austria, the United Kingdom, and the United States of America. The trainees were drawn from various educational backgrounds, including postgraduate students in Archaeology, Geography, Geology, Botany and Remote sensing.

The event opened with a welcome from Dr. Vandana Prasad, Director, BSIP, followed by a lamp lighting ceremony and address by the Chief Guest Prof. Jaykiran Anandrao



Tidke, former Vice-Chancellor Sant Gadge Baba Amravati University. Other honoured guests were Prof. Manisha Jape, Government College of Engineering, Amravati and Naresh Chafekar, Secretary Vigyan Bharati Vidarbha region. This was followed by in-person and online lectures, introducing various themes and concepts and field methods in palynology, dendrochronology, archaeology, ecology and other palaeosciences. The first speaker introducing Palynology was Dr. Anjum Farooqui, BSIP spoke about how the study of pollen grains can help us understand our past. This was followed by Dr. Jane Bunting, University of Hull, UK, who explained Relative pollen productivities (RPPs) and their applications for the quantitative reconstruction of the vegetation of the past by the REVEALS model. Prof. M.M. Sardesai, Savitribai Phule Pune University (SPPU) introduced the flora of Vidarbha. Arti Garg, Botanical Survey of India, expounded on spatial distribution data collection of the present vegetation and pollen assemblages. Prof. D.P. Tiwari, former V.C. University of Arrah discussed methods and techniques in Archaeological Excavations. Dr. Amalava Bhattacharya, BSIP introduced Tree ring sample collection, Dendro-processing, and measurement.

Following the opening statement, five days of intense fieldwork began with immersive field training on collecting surface samples for pollen analysis, mapping, and quantification of the vegetation on the surface sample using the REVEALS Method demonstrated by Drs. Anjali Trivedi and Navya Raghu. Drs. P.S. Ranhotra, Trina Bose, Mayank

Shekhar and Akhilesh Kumar Yadav demonstrated the training of sample collecting for dendrochronology and other proxies for generating contemporary analogues for palaeoenvironmental reconstruction.

On the sixth day, the school visited the Lonar Meteor Crater, an impact of an extra-terrestrial body that dates to at least around 50,000 years ago. This impact crater on Deccan basalts was targeted to study the differences in biome due to the alkaline water of the lake. This site is covered by temples of different ages showing the continued human awe of this structure.

The whole fieldwork was primarily aimed at comparison of sites reclaimed decades ago and those reclaimed recently with pristine ones. Sites explored also had associated potential human habitational history so discussions were focused on how Archaeology and various Earth Sciences are often not separable in the field. On the following day, there was a visit to the UNESCO World Heritage site of the Ellora Caves, an archaeological cave-site complex with rock-cut caves belonging to Buddhist, Brahmanical and Jain philosophies, dating to approximately between the sixth and tenth centuries CE. This archaeological site demonstrates how local environmental contexts were moulded by human action into cultural environments and how in these cultural landscapes, both human and natural forces continued to act and react, shaping the monument as we see it today.

The next five days consisted of nine academic sessions, with 32 invited lectures, and 17 keynote lectures, which



ended in a group discussion of eminent experts. The first day was devoted to Landuse studies with a keynote by Dr. Shanti Pappu, Sharma Centre for Heritage Education (SCHE) speaking on issues in Prehistory and Paleoenvironmental studies. The first session was on Landscapes, Lithics, and Lives: Perspectives from Prehistory chaired by Dr. Akhilesh Kumar, SCHE with associates Drs. Shanti Pappu, Prachi Joshi, SCHE; Anupama K, French Institute of Pondicherry (FIP), TR. Premathilake, University of Kelaniya, Sri Lanka (UKSL). The afternoon session titled: Integrating archaeological evidence in Quaternary environmental studies was chaired by Dr. Anil K. Pokharia, BSIP and co-chaired by Dr. Parth Chauhan, IISER-Mohali associated with Drs. Akash Srinivas, Ashoka University; Shashi Bhushan Mehra, IISER-Mohali and Swati Tripathi, BSIP.

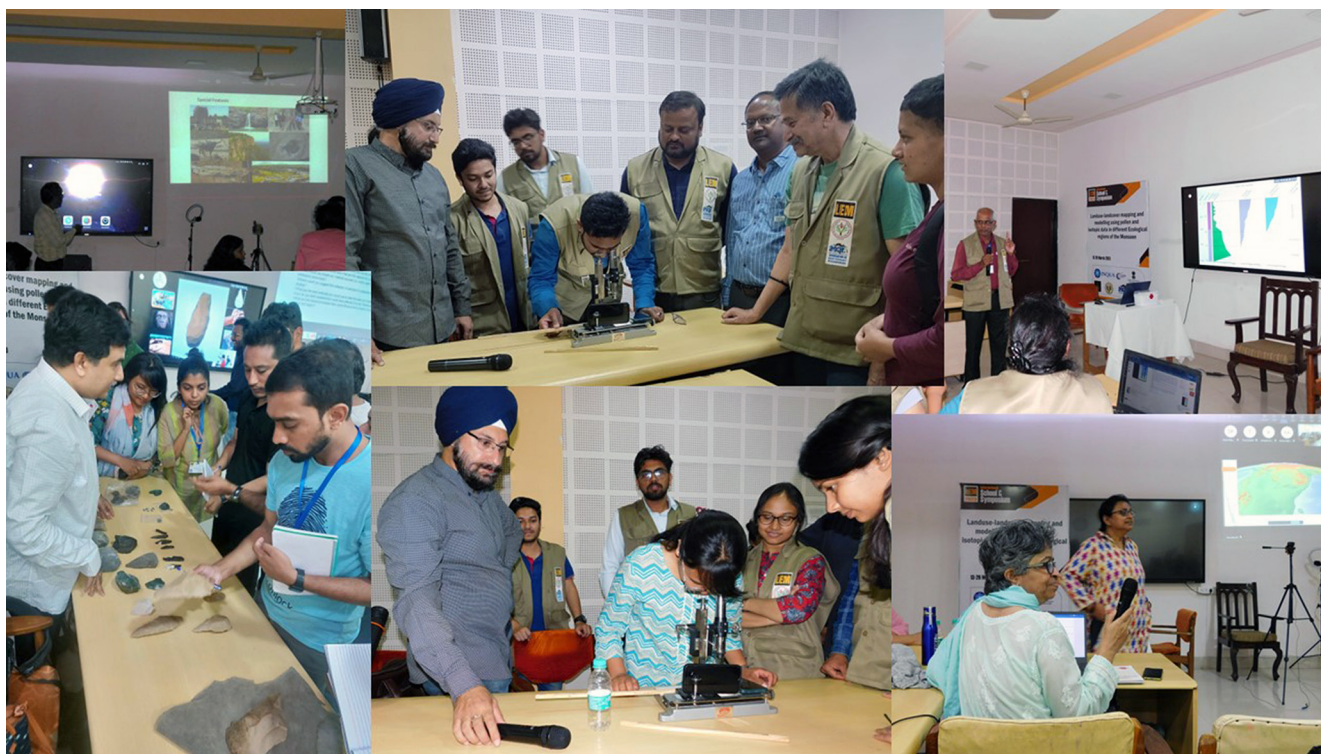
The second day started with a keynote from Dr. Prasad Srinivasan, FIP, on Journeying Back in Time with Palynology: Tracing Vegetation and Climates of the Past. This was followed by the decoding paleoclimate, human and animal interactions: environmental and magnetic proxies session chaired by Dr. Binita Phartiyal, BSIP with associates Drs. Md. Arif, BSIP and Prabhin Sukumaran, CHARUSAT. Keynote by Prof. Prasanta Sanyal, IISER-Kolkata discusses organic geochemistry as a proxy to understand the environment. The next session on methods of Organic geochemistry was chaired by Dr. Anupam Sharma, BSIP with associates Drs. Trina Bose, and Anurag Kumar, BSIP.

On the third day, Prof. Viswas S. Kale, SPPU deliberated on Holocene Paleoclimate and Fluvial Response: The Indian

Peninsula followed by the session on basics of Quaternary Palynology: pollen, non-pollen palynomorphs (NPP) and their implication in vegetation reconstruction chaired by Dr. Ratan Kar, BSIP in association with Drs. TR. Premathilake, UKSL, Sadhan Basumatary, and Sandhya Misra, BSIP. The afternoon session was on Remote sensing, GIS, and Species Distribution Modelling (SDM) chaired by Dr. Morthekai P., BSIP with lectures by Drs. Sudhakar Shukla, UPRSAC, Biswajeet Thakur, BSIP, Aravind Ananthram, ATREE, Pujarini Samal and Jyoti Srivastava, BSIP.

The fourth day started with a keynote on Understanding Past Climate from Tree-Ring: An Indian Perspective by Dr. Hemant Borgaonkar, Indian Institute of Tropical Meteorology (IITM). Next was a special lecture on Instructions for field studies and documentation of plant diversity by the celebrated taxonomist Prof. S. R. Yadava, Shivaji University, Kolhapur. This was followed by the session Tales from Trees: Dendrochronological Methods and data processing, chaired by Dr. Parminder Singh Ranhotra, BSIP with Drs. Mayank Shekhar and Akhilesh Kumar Yadava from the same institute. The whole afternoon was devoted to the Landuse-Landcover mapping and modelling session chaired by Dr. Anupama K, FIP with Florence Mazier, Université Jean-Jaurès, France; Laurent Marquer, University of Innsbruck, Austria; Navya Reghu, MAHE.

On the fifth day the morning session was devoted to the introduction of the NEOTOMA Palaeoecology Database and its Software Environment by Dr. Simon Goring, University of Wisconsin – Madison, USA. After lunch, Dr. Prabhakar



Rajagopal, Strand Life Sciences Pvt. Ltd. delivered a keynote on Building open databases for Biodiversity. Dr. Trina Bose presented an introduction to Ideas of Data Integration and modelling afterwards. The day ended with discussions regarding Biodiversity Data integration and interpretation with Anupama K, Prabhakar Rajagopal, TR. Premathilake, Shanti Pappu, Anjali Trivedi, Trina Bose, and Navya Reghu as participants. Prof. Jack Williams, University of Wisconsin – Madison, USA and Executive Director – NEOTOMA database joined after his talk titled The Neotoma Paleoecology Database: Building community-curated data resources to support global change research.

An outreach activity was conducted, where invited scientists engaged with local school students to help popularise science education and research at grassroots levels, hopefully inspiring the next generation of Quaternary researchers in South Asia. Moreover, practical demonstrations of stone tool knapping and hands-on training related to the use of various software packages and modelling programs were carried out.

The event concluded with a symposium where the trainee participants and invited ECRs presented their ongoing research work, possible future avenues for research undertakings and various observations noted during the field sessions. The wide-ranging discussions with the experts in the audience helped bridge the gap between emerging and established researchers and provided valuable advice and mentorship to the trainees.

This international school is just the start of a long-ranging project with annual field schools for research students and ECRs in various biomes of the monsoon all over South Asia. In addition to these field workshops, a meeting of experts during the flowering seasons in these different ecologies is planned. Further, samples collected during these field workshops will be processed and analysed for patterns of spatial distribution and isotopic characterisation of pollen, leaf, tree rings, phytoliths and sediment extracts. Another parallel component under the purview of the project is the designing, creation, curation and implementation of a South Asian Biodiversity Portal, which will integrate the available and generated datasets of information from archaeological, palaeoenvironmental and ecological sources, resulting in an open-access database that can help provide a sound foundation for actively contributing towards future research avenues in archaeological and quaternary studies for South Asia, in particular, and readily integrate them with more global datasets to address ongoing discourses in global quaternary studies.

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