In this issue

Urban Critical Zone
Ecosystem services

There is a natural critical zone, from the base of groundwater aquifers to the tops of tree canopies, where the interaction between the atmosphere, lithosphere, hydrosphere and biosphere confines the thin layer of living earth. Life forms on the earth interact within this critical zone to receive and provide ecosystem services. But recent technological advances and rapid urbanisation are placing road blocks in the network of the interactions, points out a General Article on **page 824** in this issue.

As a case study, the authors showcase Delhi. The multi-storey buildings that tower over tree tops; the roads, pavements and built structures that block the meagre rainfall from percolating to groundwater aquifers; the vehicles, industries and power plants that spew pollutants adding to the woes of smoke from stubble burning in nearby states and the sand from the deserts during sand storms; the atmosphere thick with particles trapped in the urban jungle making breathing difficult. All these make the city unsustainable. The ecosystem services are borrowed presently from the surrounding regions, which are also being urbanised.

There is, therefore, a need to redefine the critical zone to include the cityscape, argue the authors. Perhaps, to define the urban critical zone, there is a need to extend the upper limit to the inversion layer and to include even deeper aquifers as the lower limit.

The article exhorts experts in the geosciences, the physical sciences, the life sciences, the atmospheric sciences, the ecological sciences and the medical sciences to come together to understand the urban critical zone and to find methods to balance the natural critical zones to ensure sustainable urban development.

Crop Yield Variability
Socio-economic dynamics

From depending only on timely rains and the quality of the soils, farmers today have learned to increase crop yield by using irrigation, better quality seeds and fertiliser inputs. This helped India improve agricultural production to a remarkable level. Yet, there is a huge variability in crop yield that cannot be explained by these factors alone.

A Review Article in this issue examines the social, economic, political and cultural factors that can help us understand crop yield variability, especially in the context of the low wheat yield in Punjab and Haryana. The size of land owned or under tenancy, capital for seeds, fertilisers, farm mechanisation, and the availability of skilled manpower are important factors that determine the yield. Farmer knowledge and access to information about scientific farm management practices also influence the yield.

Infrastructure and facilities for processing, storing and transporting farm produce to the market, fluctuations in market price, etc. are broader issues that impact the capital required for the next round of cultivation and, therefore, the yield. The government can step in with policies and subsidies to save farmers from the debt trap. But, often, these steps lead to unsustainable outcomes. Therefore, to improve crop yield, we need to understand the interrelationships between these factors. And that is why you should turn to **page 846**.

Floods and Landslides
Impact on soil microbes

In 2018, the high ranges of Attapadi and Nelliyampathy in Palakkad district, Kerala experienced floods and landslides. In 2020, researchers from the Kerala Agricultural University and the Kerala Forest Research Institute collected samples of soils disturbed by landslides, soils soaked by flooding and undisturbed soils from both locations. They isolated and identified the bacterial and fungal species in the soil samples to understand the impact of floods and landslides on microflora. They report the results in a Research Article on **page 878**. The bacterial and fungal species identified may have a role in rejuvenating soil fertility after such natural disasters, they say.

Tempera Murals in Temples
Pigments from the past

The Vishnu temple at Malayadipatti in Tiruchirappalli district and the Chenraya Perumal Temple at Adhiyamankottai, Dharmapuri district are adorned with numerous sculptures and colourful murals on walls and ceiling. The temples are about 220 kilometres from each other – a five-hour drive by car now-a-days.

But when the temples were built, sometime in the 16th to the 17th century, there were no cars. The temples were built by different rulers. The Malayadipatti Vishnu temple was built by a Tamil king and the Chenraya Perumal Temple by the Vijayanagara empire. Though there were no visas or passports in those days, the artists who executed the tempera murals as well as the materials and pigments used, might be different.

A Research Article in this issue examines the differences and similarities in the pigments used for painting, the material sources of the pigments, the method of preparation of the substrate on which the murals were created and the mediums used to ensure that the paint sticks to the substrate. Physicists, chemists, biologists, geologists, historians, religious scholars and artists will find the article on **page 853** interesting to read.

K. P. Madhu
Science Writing Consultant
scienceandmediaworkshops@gmail.com