

## In this issue

### Carbon negative grasslands?

*'Is the grassland green?'*

The *Imperata* grasslands – prevalent across tropical and subtropical Asia – are of immense socio-economic value to the farmer. The *Imperata* grass (named after an Italian apothecary, Ferrante Imperato), for instance, is used as thatching material for roofs, as ingredient in local delicacies, and also as medicine. Other than providing these benefits, however, *Imperata* grasslands, unbeknownst to many, could play an important role in reigning in the rate of climate change in the near future.

The world's grasslands – prairies, savannahs, pampas, etc. – have a sweet tooth for carbon. They are nature's carbon scrubbers and their appetite is extraordinary. In fact, along with forests, grasslands swallow and store a total of 70% of the world's stock of soil carbon. Surprisingly, although *Imperata* grasslands are spread across an area numbering in the tens of millions of hectares, few, if any, studies have strived to determine whether these grasslands too are vast carbon sinks. Of course, it would be germane to assume that *Imperata* grasslands, being rich in organic biomass would also, like other grasslands, be a veritable carbon sink. But a traditional land management strategy practiced by the farmers across the world – especially in the South Asian countries of India, Sri Lanka, Indonesia – undermines this assumption. These farmers, to cultivate the land, and to improve fertility set fire to the grasslands once every year. This practice releases a lot of carbon into the atmosphere, offsetting the carbon storing 'effort' of the grassland.

Considering the above, the following question, therefore, is most pertinent: Do the traditional practices, of burning the grasslands, result in the release of more CO<sub>2</sub> than that is sequestered into the soil? In other words, are the *Imperata* grasslands a carbon source, like CO<sub>2</sub> spewing factories, or a carbon sink? A Research Communication, **page 2250**, endeavours to answer this question by conducting a yearlong study in a traditionally managed *Imperata* grassland situated in the Cachar district, Barak Valley, North-East India.

In this study, researchers ascertain several soil characteristics of the grassland such as – the rate of soil organic carbon accumulation in the *Imperata* soil; the carbon input into the soil from biomass above the ground; the carbon

input into the soil from biomass below the ground; and also the amount of CO<sub>2</sub> the soil releases into the atmosphere owing to soil respiration. The results are intriguing: The *Imperata* grassland appears to be either a sink or a source, its 'mood' governed by the climate. On the one hand, during autumn and monsoon, it is a carbon sink; while on the other hand, during winter and summer, a carbon source. But the net carbon stored over twelve months – the study highlights – in the soil of the grassland is significantly greater than the net carbon released when the grassland is burned; and hence the grassland is not a carbon source, but a carbon sink. Thus, the grassland being carbon negative is most assuredly *green*.

### MASW and HERT

Multichannel analysis of surface waves (MASW) and high-resolution electrical resistivity tomography (HERT) are two commonly used geophysical techniques to 'see' the underground without needing to excavate it.

The procedure of MASW is simple. First, a sledge hammer is brought down hard upon the ground. On impact, surface waves propagate through the solid ground. The velocity of these waves is then measured by geophones nailed to the ground surface. By using this surface wave velocity data, the Young's modulus, or 'stiffness' of the underground is deduced. And this 'stiffness' is used as an identifying thumbprint for the different sub-surface features the underground comprises. The 'stiffness' signature for soft rocks, and that of harder, more competent rocks, for example, would be in stark contrast.

HERT, however, exploits the bulk property of electrical resistivity to probe into the underground. The underground has several layers of rock and soil. And each layer, owing to differences in sub-surface features, has a different, and a characteristic electrical resistivity. Thus, in HERT geologists determine the resistivity of different underground layers by transmitting an electric current of a certain frequency through the underground, and measuring the magnitude of the current as it passes through different sub-surface features.

In a Research Article, **page 2230**, scientists use both these techniques to study shallow subsurface features such as weathered zones, faults traces, cavities and palaeo-channels, in two regions situ-

ated at the Himalayan foothills. Results of such studies could be useful in guiding urbanization efforts in the region.

### Sniff. Sniff. Decoding tiger urine

'Pheromones are Earth's primordial idiom.' – Karen Jay Fowler.

Pheromones are a language. A language composed of volatile chemical molecules which, when secreted by an organism, triggers a behavioural response from other members of the same species. Ants, for example, secrete food-trail-pheromones, the scent of which serve as guiding paths to the food source. Male moths, entranced by the scent of sex pheromones secreted by females, begin courtship rituals. Plants secrete alarm pheromones in response to herbivorous activity. Bacteria secrete pheromones to promote sexual gene transfer amongst one another. Pheromones are indeed everywhere. They are a silent language that was never made for the ill equipped human nose to smell, decode and understand.

Given how nosy and curious the human scientist inherently is, it should come as no surprise that researchers have been studying pheromones for many decades now. A Research Account, **page 2178**, is another testament to scientists eavesdropping on the chemical conversations of organisms.

In this Research Account, which is in effect a review, the authors discuss several of their own research studies, spanning over 50 years, related to the tiger pheromone. First, the authors delineate the concept of 'ethology' – the transmission of message from one individual to another. Then, they discuss the concepts of tiger territory and tiger homeland. And finally, they delve deep into the tiger's pheromones – what is their putative chemical composition?; how are they secreted by the animal?; how can they, although volatile, remain viable for many days?

So, as one can observe, the review is comprehensive in its discussion of tiger pheromones. But of all the results discussed, one revelation in particular would most assuredly humour many: A pheromone, 2-acetyl-1-pyrroline, which is present in the tiger's urine, is the same one which imparts basmati rice its characteristic fragrance.

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