

## In this issue

### Agroforestry in Uttar Pradesh

Forest cover in UP is less than 6%. The target set by the National Forest Policy 1988, however, is one-third of the geographical area. The reason for the shortfall is simple. This geographical area, of about 25 million hectares, shelters some 200 million people. About 75% of the state's rural households depend on agriculture for their livelihood.

People do plant trees in agricultural bunds and commons. The popularity of poplars in Punjab has influenced UP farmers too. But even including tree cover of nearly 3% to forest cover, land area covered is still less than 9%.

In 2014, the National Agroforestry Policy nudged a sea change that swept through the state. Over 10 lakh saplings were planted in 2015 at 10 locations in the state. This was followed by the planting of 50 million trees, from 80 species in 2016.

On **page 509** in this issue, scientists at the Indian Institute of Forest Management, Bhopal, the Navsari Agricultural University, Navsari, and the Indira Gandhi National Tribal University, Amarkantak, present a review that will facilitate informed decision making for agroforestry in UP: what to plant and where in the different agroforestry zones of the state, opportunities for synergies with other economically productive activities, scientific institutions that can support the movement, suggestions for creating an enabling environment for agroforestry in the state...

A similar review for the other states may help balance economic exploitation with ecologically sustainable practices.

### Algae for Biofuel

In the last one decade, *Monoraphidium* algal species attracted the attention of scientists as a potential source of biofuel. The ability of these algae to grow with high productivity under varied conditions makes them favourite candidates for biofuel extraction.

Lipid production in *Monoraphidium* increases under stress. Artificially created changes in temperature, pH and nutrients can shift the metabolic pathway of cells from producing membrane lipids to synthesizing triacylglycerides.

In a Research Article in this issue, scientists in TERI examine the role of nitrogen, a fundamental constituent of proteins, and phosphorus, a constituent of phospholipids and nucleotides, as factors for optimizing biofuel production in these algal cells. Though both factors are necessary, beyond critical levels of phosphorus and nitrogen, the biofuel productivity seems to go down. Read on from **page 539**.

### Temple Sculptures

There is an ancient Vishnu temple, popularly known as Sri Rama Temple, in Kadavallur, Thrissur district, Kerala. There are these carved wooden figures all around its sanctum. At two levels. They tell the stories of *Kiratharjuneeyam*, a part of the Mahabharata and portray Hindu legends and mythology.

These intricately carved figures had several fissures and cracks. They required conservation and preservation. What is the best method?

Researchers from the Archaeological Survey of India took the help of a researcher from the Kerala Agricultural University.

*Artocarpus heterophyllus*. The Jackfruit tree that grows luxuriously in Kerala was the wood used for the sculptures. Indeed, before the days of cement and Plaster of Paris, the easy-to-handle grains of the tree was one of the best resources for sculptors.

Cracking the problem of the cracked wood did not take long. Neem gum holding wood powder is used to fill the cracks. Neem keeps insects away.

And a coat of the resin from cashew kernels. The same liquid that protects boats launched into seas. A time tested natural material to ward off fungi and termites.

The technique has demonstrably improved the aesthetic impact of the statues treated so far, as per the Research Communication on **page 615** in this issue. And evidently the statues in the Kadavallur temple are not the only ones waiting to be reborn.

### Mahi – the Ink from Assam

Modern ink is a complex mixture of pigments, dyes, solvents, resins, lubricants,

solubilizers, surfactants, particulate matter, fluorescents and other materials. But it has evolved over centuries.

Ancient Egyptian ink and Chinese ink were simple and carbon-based: obtained from wood tar, burnt bone, lamp shoots, pitch or charcoal, very similar to an ink called *mashi* in ancient India.

A herbal ink, called gallotannate or iron gall ink, was popular in Europe. It contained tree galls, green vitriol, gum Arabic and water. Wine, beer or vinegar and boric acid were also used.

India too had its own herbal ink formulation. This was popular in the eastern parts – especially Assam. Sancipat manuscripts – so called because they were written on folios made from the bark of the sancip tree, *Aquilaria agallocha*, have survived for centuries in the hot and humid climate of Assam. Meanwhile, the European ink degraded the paper of the manuscripts through acid hydrolysis in much shorter time.

Researchers, from the Tezpur University and the Gauhati University, reconstruct the centuries old tradition of this herbal ink made from fruits, bark and whole plant extracts of some 10 species, besides cow urine, rusted iron and fish blood. The preparation varied and used alternatives as per the availability of raw materials.

The researchers prepared the ink under the supervision of a traditional practitioner, and conducted an array of tests on the ink to understand its longevity, glaze, anti-corrosive nature and antimicrobial activity. For details turn to **page 591**.

### Coding Numbers using Syllables

Coding numbers using syllables facilitates remembering them. Thus one can formulate slokas that spell out the value of pi to many decimal places. The technique was well developed in ancient Indian mathematics. Scientists in the SASTRA University, Thanjavur and the Indian Institute of Science Education and Research, Pune, have now automated the coding and decoding of numbers using two such systems. In a Research Communication on **page 588** in this issue, they provide details.

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