

Poaching is the major threat to the avifauna of Mangalajodi wetland. Poachers are not only killing resident birds but even the migratory birds which visit the site between September and April. They sell them in the nearby markets. Collection of birds' eggs and their sale in the open market is another problem. People cut the *Phragmites* stems and use them for fencing purpose. Due to reed harvesting, the habitats of the waterbirds are diminishing day by day. With efforts from Wild Orissa, a local NGO, some poachers have associated themselves with bird-protection committees to protect birds³. Strict vigil is required to conserve the Mangalajodi waterfowl breeding habitat, by local participation in the form of patrolling, educating the masses about bird conservation and their habitat. Use of sail boats should be encouraged rather than motor boats which spill oil from engines and also disturb the environment creating noise. Special care should be taken, providing safety to nesting areas to prevent

damage of eggs by cattle and poachers. Well-planned and structured eco-tourism projects should be implemented without hampering the birds' habitat. Alternative livelihood options should be provided by the state government to the villagers, particularly the poachers-turned-conservationists for their sustenance. The Government of Orissa should set up 'participatory management' involving the local community. According to Section 36(c) of the amended Wildlife Protection Act (1972) in 2003, the state government may declare the Mangalajodi site as a Community Reserve. The Community Reserve is nothing but where people volunteer to protect flora, fauna and traditional or cultural conservation values and practices of a certain area rich in biodiversity. However, this area should not be associated with a National Park, Sanctuary or a Reserve. Declaring Mangalajodi as a Community Reserve will not only protect the birds, but also save the wetland from further degrada-

tion. If this site is declared a Community Reserve, then it will be the first in Orissa as well as eastern India.

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Rhododendrons in Meghalaya need attention

Meghalaya, the Scotland of the east, is one of the eight states of North East India. The state has 36.8% area under forest cover. It has six types of forest, viz. tropical moist deciduous forest, sal forest, sub-tropical evergreen forest, sub-tropical pine forest and tropical semi-evergreen forest¹. Rhododendrons form the dominant or associate species in sub-tropical evergreen forest and sub-tropical pine forest, which represent 16.63% of the total forest area. Champion and Seth² describe these forests as Khasi sub-tropical wet hill forest and sub-tropical Assam pine forest respectively. Rhododendrons also grow in sacred grooves in the state, which are remnants of relict virgin forests.

Meghalaya is represented by four taxa of rhododendrons, viz. *Rhododendron arboreum* ssp. *arboreum*, *R. arboreum* ssp. *delavayi*, *R. formosum* var. *formosum* and *R. formosum* var. *inaequale*. *R. arboreum* ssp. *arboreum* and ssp. *delavayi* apparently merge into one, as ssp. *Arboreum*³. *R. formosum* var. *formosum* is mentioned as endemic to Meghalaya and *R. formosum* var. *inaequale* to North East India and adjacent places^{4,5}. However, after thorough investigation by scientists at the Botanical Survey of India (BSI), Eastern Circle (EC), it was found that *R.*

formosum var. *formosum* is endemic to North East India and adjacent places, and *R. formosum* var. *inaequale* is endemic to Meghalaya.

A recent Forest Survey of India report shows increase in forest cover in Meghalaya, but it is still a controversy. With the shrinkage of green cover everywhere, rhododendrons are also facing the impact of a disturbed ecological system. Major threats to rhododendrons in Meghalaya are the expansion of agricultural activities in the forest, over-exploitation of forests for firewood, expansion of animal farming land and extensive collection of flowers. Besides these, natural calamities such as landslides and forest fires also affect the rich growth of rhododendrons.

Local people of Meghalaya have been preserving *R. arboreum* from time immemorial, through the taboos associated with it. The Khasi people believe that if these plants are uprooted from their natural habitats and grown in one's courtyard, it would certainly bring bad luck to the household. However, it is used as firewood and for making smoking pipes, and its leaves and flowers are used in the treatment of various ailments. While *R. formosum* with no taboos associated with it is extensively collected for its beautiful

flowers by the locals, it is often uprooted from its natural habitat and planted in home gardens, where 90% of the plants fail to survive. While uprooting, the root system is damaged beyond repair as well as its mycorrhizal association (like other Ericaceae, rhododendrons have mycorrhizal association). These plants need enormous supply of water at their initial stage of their growth. They also need lot of humus for their proper growth. The uprooted plants from natural habitats are often found sold at the roadsides by the Khasi folks at Rs 50–100 per plant during the flowering seasons, i.e. March and April. Though there are certain laws preventing such acts, no law is well enforced to stop this menace.



R. arboreum ssp. *arboreum*.

Ex situ conservation of these plants is going on in BSI, EC, Shillong under a DBT-funded project to conserve these species to some extent. Those associated with life sciences and its allied subjects are well aware of biodiversity and its importance, and also the need for its conservation, but many lay people are not aware of it. Therefore, the concerned authorities should take up measures such as organizing seminars and workshops. The Government of India has already introduced environmental education at the school and college level. The horticulture department should be encouraged to take up these plants for large-scale multiplication and breeding. *R. formosum*, being a shrub with magnificent flowers, can be propagated in large scale and distributed

for plantation in institutional and Government office campuses, public and private gardens, etc. Thus it can act as a good measure of *ex situ* conservation. *R. formosum* var. *inequale* being endemic and red-listed⁶, needs more attention.

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Plant tissue culture – answer to biodiversity conservation?

Plants have been an important source of medicine for thousands of years. Even today, the World Health Organization estimates that up to 80% of the people still rely mainly on traditional remedies. It is estimated that approximately one quarter of the prescribed drugs contains plant extracts. Thus, medicinal plants (MPs) are under tremendous pressure all across the globe, especially in India. More than 90% of the MPs for herbal industries in India and for export is drawn from the natural habitats¹, thus challenging their existence. Much has been written about the importance of plant tissue culture techniques in conserving rare/endangered plant species and the pioneer role the technology will play in the future in India. A large sum of money is pumped every year to replenish the lost biodiversity and large number of protocols are available at present. Unfortunately, we are not witnessing any improvement in the status of these plant species in nature² and the current IUCN Red List reveals that the number of threatened plant species is increasing gradually³. The European and most of the Asian countries are rapidly exploiting this technology at a commercial level to conserve genetic species. In India, though the protocols are being developed at a rapid pace by the Government and academic institutions, in spite of International co-operation, it has not reached the desired level of commercialization. On one hand, forests are vigorously used by the pharmaceutical

sector and on the other hand the species are not being restored rapidly, resulting in a sharp decline in the forest cover. In Indonesia, a better public-private sector partnership has resulted in the production of 5 million plants per annum. This is likely to go up to 15 million in the coming years. Business development and technology transfer, adaptation and adoption from the developed countries to Thailand were rapid and have resulted in 30 commercial plant tissue culture companies. In India, more than 50 commercial laboratories were set up between 1987 and 1995 with a total capacity of 210 million plants/annum, which has declined in the recent years⁴. If the technology has to really flourish and play an active role in the conservation of rare/endangered MPs, it has to be implemented at a commercial level. The Indian Government should take the much required initiative and setup sophisticated laboratories in every state, which are specifically meant for the purpose of propagating a large number of MPs. Such laboratories would also help in conserving endemic and endangered plants. In addition, the area of secondary metabolite production *in vitro* should be exploited so that drug plants in nature are not harmed. There are a few national laboratories in India which work in this particular area but this aspect definitely requires collaborative and serious working at the grassroot level for enhanced production of such bioactive components, to ease the path for novel and faster

drug development. Fresh strategies of afforestation management and restoration of depleting natural resources blending with modern technologies are also required. Tissue culture laboratories should be made mandatory for the pharmaceutical sector (herbal/drug companies) to reduce the pressure on natural habitats. A strong message regarding importance of biodiversity and its conservation should be spread among the youth and tribal communities, which rely heavily on genetic species through common meetings. Though tissue culture technology is potent and has opened extensive areas of research for biodiversity conservation, it surely needs to be revived and utilized in a broader spectrum rather than confined to publications.

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