

Biological invasions in the Indian context

I would like to add a few comments to Reddy's¹ article on biological invasions. There is no appreciation of the scale of the problem in the country, and no will to combat biological invasions in any form. Current legislation actually prevents the control of invasives.

Decisions on invasives are often ad hoc and emotional, and seem to be flavoured by appeals to pity from the animal rights lobby. This is best illustrated with a case study, that of chital or spotted deer (*Axis axis*), which is affecting forest regeneration in the Andamans². I was invited to attend a meeting chaired by the Chief Secretary on this issue. I reproduce comments from this meeting to illustrate the manner in which important decisions are taken at the highest level:

- ...but they are so beautiful!
- International scientists can be completely wrong.
- Maybe these scientific principles do not hold in the Andamans.
- Andamans is part of India, how can you call this an invasive?

Apart from the 'cute, cuddly, fluffy and charismatic' syndrome demonstrated here (I thank Neil Pelkey for coining this phrase), a real problem was highlighted. Invasives occur across biological boundaries, not political ones. Animals that are

native to one part of India may cause considerable damage in others. Examples are the common mynah (*Acridotheres tristis*), introduced to the Andamans, and the house crow³, numbering seven when they were brought over to the Andamans in 2002, but found in the hundreds now. An appeal to the Forest Department then to have them eradicated was ignored. North Indian carps introduced to southern rivers have led to the decimation of local species (Daniels, R. J. R., pers. commun.). The Wildlife Act, however, treats the whole country as one biological unit.

The greatest impact that invasives have on biodiversity is obviously in the protected areas that are relatively undisturbed. In the case of mammalian or avian invasives, the Wildlife Act makes their removal problematic. While Section 11 bestows great powers to the Chief Wildlife Wardens in this regard, these are seldom used. Section 12 of the same Act allows translocation, but not culling; this is problematic when very large numbers are involved. The removal of plant invasives requires a budget, which is often not there. In protected areas, the ban on 'commercial exploitation' does not allow the removal of species which could benefit local communities economically.

The use of biocontrol agents, propagated by the Government as policy, can also cause problems. For instance, *Tri-*

chogramma wasps and ladybird beetles are being used as biocontrol agents in the Andamans⁴, though they are known to be invasive elsewhere. I have been unable to find any peer-reviewed publications assessing their impact on non-target organisms.

It is clear that a National Policy on Invasive Species is required. The Policy would have to cover the regulation of introduced species, measures to prevent their spread, their control and their eradication. Without this being done on a priority basis, there is no way that India can possibly meet the Convention on Biological Diversity targets for 2010 of: 'Target 6.1. Pathways for major potential alien invasive species controlled', and 'Target 6.2. Management plans in place for major alien species that threaten ecosystems, habitats or species'.

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2. Ali, R., *Curr. Sci.*, 2004, **86**, 1103–1112.
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4. <http://agri.and.nic.in/biocontrol.htm>

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Not all green is good... Ban on consumption of alligator weed

Alternanthera philoxeroides (Mart.) Griseb., family Amaranthaceae is a weed of international significance found growing in polluted waters (Figure 1). It is popularly known as 'alligator weed' and locally known as 'seema thotakura' and 'seema ponneganti' (Telugu), collected and sold in the vegetable market. It is native to temperate regions of South America and is now found throughout the tropical and warm temperate regions of the world. It is regarded as one of the worst weeds in the world, because of its invasiveness, potential for spread, and economic, environmental and health impacts. It is an especially troublesome weed of the wetlands¹.

At present, the alligator weed is a popular leafy vegetable mainly in urban areas. It is predominantly found in urban waterways, drainages, margins of lakes and sewage sludge of rivers, particularly in areas with high anthropogenic pressure. There are no records of its cultivation as a vegetable crop. It absorbs several heavy metals like lead, mercury, cadmium, chromium and copper from water. It can cause serious health problems to people who consume it as vegetable. Because of hyperaccumulation of heavy metals, the alligator weed is considered as a potential plant for phytoremediation. These plants accumulate pollutants in their roots, stems and leaves, and leave the substratum clean.

They clean up pollutants that cannot otherwise be removed through the normal chemical processes. These plants do not



Figure 1. Alligator weed.

damage nature and are capable of removing pollutants even from sewage. It is possible to use this species to restore bio-solid and sewage sludge-contaminated sites. The study warns usage of leafy vegetables grown in polluted beds for human consumption². Since the leafy vegetables suck up pollution, people eating them may ingest the metals which can be harmful. In India, expansion of this weed in the marshy habitats of different parts, including the Andaman Islands,

poses threat to indigenous flora³. The Government should immediately ban consumption of alligator weed and plan for its control in natural, aquatic habitats.

1. Reddy, C. S., Bagyanarayana, G., Reddy, K. N. and Raju, V. S., *Invasive Alien Flora of India*, National Biological Information Infrastructure, USGS, USA, 2008; <http://www.gisnetwork.org/>

2. Prasad, M. N. V. and Freitas, H. M. O., *Electron. J. Biotechnol.*, 2003, **6**, 6–11.
3. Reddy, C. S. and Raju, V. S., *J. Bombay Nat. Hist. Soc.*, 2005, **102**, 133.

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Rich biodiversity of Northeast India needs conservation

Northeast India, a mega-biodiversity centre and a hotspot¹, comprises eight states, viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. It occupies 7.7% of India's total geographical area supporting 50% of the flora (ca. 8000 species)², of which 31.58% (ca. 2526 species) is endemic³. It is a transitional zone between the Indian, Indo-Burman–Malaysian and Indo-Chinese regions. It is also a part of the Vavilovian centre of biodiversity and origin of many important cultivated plant species and some domesticated animals⁴. The region supports a rich biodiversity spanning from tropical rainforests to alpine scrubs. Takhtajan⁵ describes the region as the 'cradle of flowering plants' because of its diversified angiosperms. This rich biodiversity has a significant role in the maintenance of the ecosystem. Besides, the biodiversity of the region is used ethnologically by locals for various socio-economic and developmental purposes. The region is rich in orchids, ferns, oaks (*Quercus* spp.), bamboos, rhododendrons (*Rhododendron* spp.), magnolias (*Magnolia* spp.), etc.

With the shrinkage of green cover everywhere, the region is also experiencing an impact on its ecological system. The major threats to the rich biodiversity of the region are expansion of agricultural activities, over-exploitation of forests for firewood, shifting cultivation, extensive timbering, grazing, urbanization, man-made forest fires, introduction of exotic

plants, ill-managed road construction, mining, etc. which lead to habitat loss and habitat fragmentation that ultimately results in biodiversity loss. Natural calamities such as landslides, floods and forest fires also result in biodiversity loss to some extent. The region is known for its age old institutional mechanisms on cultural and social values for biodiversity conservation, namely sacred groves or forests in Meghalaya, Manipur and Nagaland; sacred landscapes in Sikkim and sacred hilltops in Arunachal Pradesh. Conserved as the abode of local dieties, these ecosystems represent remnants of ancient forests. But these practices are rapidly vanishing due to modern education and conversion of religion, which have lead to the giving up of traditional and ethnic beliefs.

India has strengthened its hold on biodiversity conservation by implementing the Indian Forest Act, 1927; the Wildlife (Protection) Act, 1972; the Forest (Conservation) Act, 1980; the Environment (Protection) Act, 1986; the Biodiversity Act, 2002; the Biodiversity Rule, 2004, etc. India became a party to Convention on International Trade in Endangered Species (CITES) since 1976. India is also a signatory of the Convention on Biological Diversity (CBD) since 1992. A network of protected areas – biosphere reserves, sanctuaries, national parks, arboreta, botanical gardens, etc. have been established throughout the country, of which this region had its share. The re-

gion has four biosphere reserves, 48 sanctuaries, 14 national parks, and two world heritage sites. But lack of awareness at the grassroots level hampers the process of biodiversity conservation. Awareness programmes such as seminars and workshops should be held in schools, and colleges and even for the local folks. Public displays in the form of billboards and handing out pamphlets with about the importance of biodiversity and the need of its conservation are needed. It is time for concerned authorities to take up the necessary actions to conserve this rich biodiversity, before it is too late.

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