



SHOOTS AND LEAVES

Guests Who Never Left



Many
More

Citizen Mapping of Invasives - Hotspot by Hotspot

Ankila Hiremath, Reshnu Raj, Milind Bunyan, Shiva Subramaniam (ATREE); Anita Varghese, Shiny Rehel (Keystone Foundation); Chintan Sheth (independent researcher)



Latitude: 11.350358
Longitude: 76.811051
Elevation: 1015.21±24 m
Accuracy: 3.0 m
Time: 25-04-2022 10:10
Note: invasive keystone

Invasive alien species are increasingly of conservation concern. These constitute the subset of species introduced by people to regions beyond their natural distribution, which begins to negatively affect biological diversity, food security, or human health and well-being. A key element to being able to manage invasive species is knowing where they occur and which species and habitats to prioritise for management. Unfortunately, in India we do not yet have good information on this. Given this gap in our knowledge, and the urgency to fill it, in collaboration with Keystone Foundation we set out to create a pilot citizen science atlas of invasive species in The Nilgiris of Tamil Nadu.

The ubiquitous power of smartphones and access to the internet has made it very easy for citizen scientists to record and share observations, leading to a growing number of such researcher-citizen scientist collaborations. We have used Google's Open Data Kit and its android application, ODK Collect, to build offline forms that can be accessed on android mobile phones. Over the past year, we have conducted a series of workshops with various groups of people – college students, Forest Department staff and interested citizen groups – to spread awareness about invasive species and the importance of mapping them, and train the stakeholders to use the ODK Collect app. We have also broadcast a number of radio programmes informing people about invasive species.

To mark Earth Day, ATREE and Keystone, with Nilgiris Natural History Society and Clean Coonoor, held a two-day invasive plant mapathon in the Nilgiris. Those who attended the event participated enthusiastically, though we had fewer participants than expected. This highlights, for us, the challenges involved in making plants exciting for citizen scientists! Many more people observe birds and animals than plants. And of those who enjoy plants, not many are aware of invasive species. But given the importance of invasive plants in altering habitats, affecting ecosystem services and potentially increasing human-wildlife conflict, it only highlights the need to do more to create an awareness about them and to involve citizen scientists in the process.

We were also invited recently to participate in a workshop for the staff of the Anamalai Tiger Reserve, organized by Nature Conservation Foundation. Tamil Nadu is the first state in India to formulate a policy on invasive species management, and the Tamil Nadu Forest Department has shown great interest in mapping invasive species in protected areas. It could set an example for invasive species assessment in biodiversity-rich areas in other parts of the country. Given the vast scale of the problem, it is imperative that we all join hands – citizens, scientists, and forest managers – to create a baseline atlas of invasive species so as to determine the status of the challenge across the country.



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Ecological invasion and its impact on native wildlife communities in drylands of western India

Chentan Misher, Abi Vanak



Ecological invasion is threatening multiple ecosystems globally, affecting their functioning and biodiversity. My study focuses on the impact of two commonly found invasive plant and animal species, *Prosopis juliflora* and free-ranging dogs, on the dry landscape of western India. The rapid encroachment of *P. juliflora* across dry grasslands alters their physical structure from open grasslands to dense thorny woodlands. This landscape transformation can have a cascading impact on different wildlife communities. For example, the woodland transformation of open grasslands may reduce the suitable habitat for open habitat specialist species like desert fox, Indian fox and desert cat. These species form the largest carnivore community of this landscape. Similarly, woodland encroachment can also influence the abundance and distribution of the prey species of these carnivores, which, in this case, are different species of small mammals. Changes in the abundance and distribution of prey species can

further influence the space utilization by carnivore species.

Similarly, the prevalence of free-ranging dogs in these novel systems can affect the native carnivore community through interspecific competition and intraguild predation, thus adversely impacting native communities. Dogs occur widely and are among the large predators of these landscapes. Being facultative scavengers, dogs in large numbers also frequently interact with the obligatory scavenger vultures through interference competition. The outcome of this competition can be deleterious for the Threatened vulture species as it reduces their accessibility to carrions. My study aims to determine the scale of these impacts on the different guilds of native wildlife, including predators, prey and scavengers, in the dry landscape of western India.



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Troubled waters: Alien Plants and Water Stress in the Nilgiris

Girish Varma and Rasikapriyaa Sriramamurthy



It is well known that the Nilgiris is a hub for tourism and biodiversity, but the district's benefits also extend to water security and hydroelectricity – providing more than half of Tamil Nadu's hydropower. A key component of this is the benefits accrued from the shola grassland ecosystem that acts as a basin for water absorption, replenishing the stock of groundwater and relinquishing it slowly to adjoining streams.

This article highlights the threat posed by the introduced invasive species during the colonial management of this landscape that thrive to this day. How do they affect the endemic flora and fauna? What are the long term hydrological implications for this ever-shrinking forest-grassland ecosystem?



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Are potentially invasive species flourishing in Vembanad?

Maneeja Murali, Anu Radhakrishnan, Priyadarsanan Dharmarajan



Vembanad Kol, a Ramsar site and the largest brackish tropical wetland ecosystem in Kerala, is unique for its physiography, climate and hydrology. Unfortunately, overexploitation and physical interventions such as salinity barrier construction, reclamation, effluent discharge and pollution in the drainage basins are causing degradation. Most appalling is the disruption to its continuity with coastal waters. The adjoining Kuttanad, the rice bowl of Kerala, is the only system in India practising below sea level cultivation. But heavy use of fertilizers is causing high nutrient load and eutrophication in the wetland. The Thannermukkom barrage has restricted the saline water intrusion from the sea and the increasing eutrophication facilitates overgrowth of the invasive water hyacinth (*Eichhornia crassipes*) in the backwaters, impacting livelihoods.

Anthropogenic activities and climate change issues have adversely affected species diversity and availability. The prevention of seawater flow into the lake during summer has led to the decline or disappearance of several fish species in saline water (Jhingran, 1975). The decline has impacted employment opportunities, with people resorting to exotic fish farming. The 2018 flood resulted in aquaculture species entering the wetland. The post-flood fish count reported 106 fin-fish, ten shell-fish and one mollusc species. Of these, five were

exotics. *Piaractus brachipomus*, *Clarias garipienus*, Indian exotic carps and *Pangasius spp.* were found extensively. A March 2019 market survey reported all the exotics from the wild, especially *Pangasius spp.*, ranging between 100-250 kg per market per week. It is concerning as *Pangasius spp.* is omnivorous, and the indigenous species have to fight predation and competition to survive. Study recommendations:

1. Detailed long-term assessment and risk analysis of exotic species
2. Strengthen quarantine measures to prevent illegal entry of exotics into India
3. Awareness programmes for stakeholders to keep these species at bay
4. Facilitating farming of native species

Using genetic tools to reconstruct the invasion history of invasive mosquitofish in India

M. Nobin Raja, G. Ravikanth



Biological invasions are the second biggest threat to terrestrial, freshwater and marine ecosystems. In India, freshwater ecosystems are under severe threat due to the negative impacts of Invasive Alien Fishes (IAF). *Gambusia affinis* and *Gambusia holbrooki* (Western and Eastern Mosquitofish, respectively) were first introduced to India for the biocontrol of mosquitoes. However, experimental and field studies have shown severe impact of *Gambusia spp.* on rotifers, crustaceans, water beetles, odonates, frog tadpoles, and native and economically important fishes. Mosquitofish compete for resources, predate and display aggressive behaviour towards the native biota (Raja and Ravikanth, 2020). Genetic reconstruction of the invasion history of IAF allows us to identify their origin, understand the routes of introduction and estimate the magnitude of their introductions. For our study, we collected mosquitofish specimens from across India. We screened for mitochondrial gene variation and Single Nucleotide Polymorphism in their genome. For the first time, the study provides mitochondrial gene sequence variation of *G. holbrooki* and *G. affinis* across different populations in India. Our study also provides the first evidence of the introduction events of mosquitofish. Reconstruction of invasion history helps to understand the introduction routes as well as the hotspots of IAF and has tremendous application in developing policies towards ornamental fish trade and for evolving effective management strategies.

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African molluscs in India

Aravind Neelavara Ananthram, Biswa Bhusana Mahapatra



Invasive alien species (IAS) are one of the major threats to biodiversity, ecosystem services, human health and the economy. At ATREE, we use a species distribution-modelling (SDM) tool to identify the potential regions where IAS can invade spatially and temporarily. Two invasive molluscs in India, Giant African snail (*Lissachatina fulica*) and Purcell's hunter slug (*Laevicaulis haroldi*), are native to Africa. The former is one of the world's 100 worst invasive alien species. Known to feed on more than 500 species of native plants, it primarily impacts agricultural and horticultural crops in India. Introduced in 1847, it has rapidly spread across the country over the last century, with sightings as far as the Andaman and Nicobar Islands.

Recent literature suggests that Purcell's hunter slug was introduced in Mumbai around 2010-2012. There is not much information about the ecology of the slug, given its Endangered categorization and limited range. Our SDM results show that eastern India, Peninsular India and the Andaman and Nicobar Islands are at high risk of *Lissachatina fulica* invasion under the current climate scenario. The central Indian region is at low risk due to high temperatures and low rainfall. However, *Laevicaulis haroldi* is likely to rapidly spread over the western and south-eastern parts of the country. While climate predictions indicate no significant change in the geographical regions of *Lissachatina fulica*, there is an increase of around 13.60 per cent and 23 per cent (RCP 2.6 & 8.5) for *Laevicaulis haroldi* in the western and south-eastern ranges, respectively.

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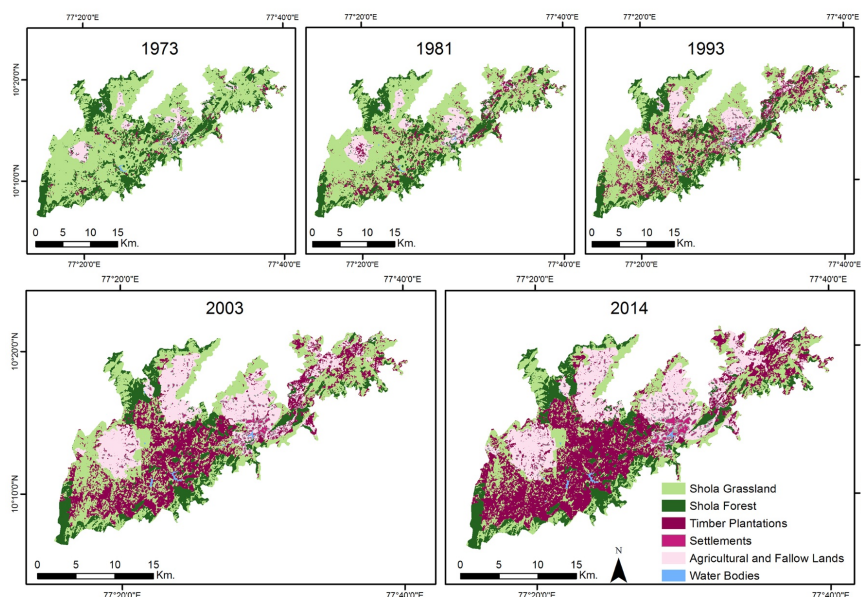
Invasive timber plantations in the Palanis - creating actionable inputs for the courts and forest departments

Milind Bunyan



About seven years ago, I was part of a ragtag group of postdocs, students, researchers and conservation practitioners staring in disbelief at an unassuming blog post comparing a satellite image of the Palanis (Anamalai) from 1973 with one from 2014. The post authored by Ian Lockwood presented an elegant visual analysis revealing a dramatic loss of tropical montane (or shola) grasslands that many residents, hikers and naturalists had known but had somehow escaped the attention of most scientists. We set out to fill that gap and answer questions regarding the pattern and process (when, what, how, why) that caused this change, supported by a small grant from INTACH. After two years, multiple field visits and funding from DMNCT, we discovered that both shola forests and shola grasslands declined in those 40 years but asymmetrically. A mix of history (India's anti-apartheid policy), judicial developments (the ban on green felling), policy (that considered grasslands as wastelands) and invasion biology had led to the loss of ~250 sq. km of grasslands.

As we widened our assessment to the Western Ghats, we realized the need to emphasize grassland loss and not forest loss, even as the Madurai bench began responding to a public interest litigation concerning the loss of native habitat. When the court ordered the restoration of 'forests' through a series of judgements in 2014 and 2015, we worked with lawyers' groups and a court-appointed expert committee to ensure grassland restoration was promoted. With support from NGS, we have since prioritized restoration sites to maximize restoration intervention impacts while minimizing unintended consequences. To prioritize these sites, we tested several high-resolution, remotely-sensed sensors and, in the process, suggested a replicable approach for resource-scarce areas that can benefit from the globally available open-access data. Most importantly, our work in mapping invasive timber plantations demonstrates the impact of creating actionable inputs for stakeholders so that our ecosystems can be restored within the ever-present constraints of logistics and funding.



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Title courtesy of Communications and Public Engagement Team of the Biodiversity Collaborative



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