



## Invasive Species- An Overview, Case Studies in Eradication and Management of Invasive Species Carried Out All Over India

(\*H. B. Roghan<sup>1</sup>, S. Vennila<sup>2</sup> and M. V. Jawahar Vishnu<sup>1</sup>)

<sup>1</sup>Forest College and Research Institute, TNAU, Mettupalayam, Tamilnadu, India

<sup>2</sup>Agricultural College and Research Institute, TNAU, Tiruvanmalai, Tamilnadu, India

\*Corresponding Author's email: [rogghanbalu@gmail.com](mailto:rogghanbalu@gmail.com)

An invasive species is a species that is not indigenous, or native, to a particular area. Invasive species can cause great economic and environmental harm to the new area.

An invasive species is a species that causes ecological or economic harm in a new environment where it is not native.

Invasive species, also called introduced species, alien species, or exotic species, any non-native species that significantly modifies or disrupts the ecosystems it colonizes.

An invasive species is one that arrives (often with human assistance) in a habitat it had not previously occupied, then establishes a population and spreads autonomously. [Conservation biology for all (2010)]

An invasive species is an organism that is not indigenous, or native, to a particular area. [National Geographic Society (2022)].

Invasive species, also called introduced species, alien species, or exotic species, any non-native species that significantly modifies or disrupts the ecosystems it colonizes. [Britannica (2023)]

Invasive species is a species that is non-native (or alien) to the ecosystem under consideration and, whose introduction causes or is likely to cause economic or environmental harm or harm to human health. [invasivespeciesinf]

An invasive species is an introduced, non-native organism (disease, parasite, plant, or animal) that begins to spread or expand its range from the site of its original introduction and that has the potential to cause harm to the environment, the economy, or to human health. [usgs]

Invasive species are animals or plants from another region of the world that don't belong in their new environment. An invasive species is an organism that causes ecological or economic harm in a new environment where it is not native. [Oceanservice]

Invasive plant species alter the native community composition, deplete species diversity, affect ecosystem process and thus cause huge economic and ecological imbalance. These plants possess a set of remarkable traits that allow them to colonize huge areas upon invasion. [International Journal of Biodiversity and Conservation (2009)]

### Invasive Species in India

S.No:	Invasive Plant Species
1.	<i>Abutilon crispum</i> (L.) Brizicky
2.	<i>Racosperma auriculiformis</i> (L) Benth.

3.	<i>Acacia dealbata</i> Link
4.	<i>Acacia mearnsii</i> De Willd.
5.	<i>Ageratina adenophora</i> (Spreng.) King & H. Rob.
6.	<i>Ageratina riparia</i> (Regel) R. M. King & H. Rob.
7.	<i>Alternanthera bettzickiana</i> (Regel) G. Nichols
8.	<i>Alternanthera brasiliana</i> (L.) Kuntze
9.	<i>Alternanthera ficoidea</i> P. Beauv.
10.	<i>Alternanthera paronychioides</i> St. Hil.
11.	<i>Alternanthera pungens</i> Kunth
12.	<i>Alternanthera tenella</i> Colla
13.	<i>Antigonon leptopus</i> Hook. & Arn.
14.	<i>Argemone mexicana</i> L.
15.	<i>Bidens pilosa</i> L.
16.	<i>Cabomba caroliniana</i> A. Gray
17.	<i>Cannabis sativa</i> L.
18.	<i>Centrosema molle</i> Benth.
19.	<i>Cestrum aurantiacum</i> Lindl.
20.	<i>Chromolaena odorata</i> (L.) King & Robin.
21.	<i>Cirsium arvense</i> (L.) Scop
22.	<i>Coronopus didymus</i> Sm.
23.	<i>Cryptostegia grandiflora</i> R. Br.
24.	<i>Cuscuta chinensis</i> Lam.
25.	<i>Cytisus scoparius</i> (L.) Link
26.	<i>Dactylandra welwitschii</i> Hook. f.
27.	<i>Dinebra retroflexa</i> (Vahl) Panz.
28.	<i>Diplachne fusca</i> (L.) P. Beauv
29.	<i>Dysphania ambrosioides</i> Mosyakin & Clemants
30.	<i>Erigeron bonariensis</i> L.,

31.	<i>Erigeron canadensis</i> L
32.	<i>Evolvulus nummularius</i> (L.) L.
33.	<i>Hyptis suaveolens</i> Poit.
34.	<i>Ipomoea eriocarpa</i> R. Br.
35.	<i>Ipomoea fistulosa</i> Mart. ex Choisy
36.	<i>Lantana camara</i> L.
37.	<i>Leucaena leucocephala</i> (Lam.) de Wit
38.	<i>Maesopsis eminii</i> Engl.
39.	<i>Mikania micrantha</i> Kunth
40.	<i>Mimosa diplotricha</i> C. Wight ex Sauvalle var.
41.	<i>Mimosa pigra</i> L.
42.	<i>Muntingia calabura</i> L.
43.	<i>Opuntia dillenii</i> Haw.
44.	<i>Opuntia elatior</i> Miller
45.	<i>Parthenium hysterophorus</i> L.
46.	<i>Pennisetum purpureum</i> Schumach.
47.	<i>Prosopis juliflora</i> (Sw.) DC.
48.	<i>Pueraria montana</i> var. <i>lobata</i> (Willd.) Sanjappa & Pradeep
49.	<i>Senna spectabilis</i> (DC.)
50.	<i>Solanum elaeagnifolium</i> Cavanilles
51.	<i>Solanum mauritianum</i> Scop.
52.	<i>Sphagneticola trilobata</i> (L.) Pruski
53.	<i>Typha angustifolia</i> L.
54.	<i>Ulex europaeus</i> L.

### Impacts of Alien Species

Invasive alien species affect all ecosystems across the globe. They occur even in Antarctica (the grass *Poa annua*). Fewer impacts in very cold, very dry or flooded habitats. No invasions are known so far in the cryosphere and deep sea. Impacts exacerbated by climate and land-use change and pollution. Over 70% of the impacts are negative which far outweigh the positive impacts; around 17 % impacts neutral. Information on impacts available for different IAS,

countries, regions and ecosystems is grossly incomplete. Large data gaps especially on the impacts of invasive microbes and fungi & invasion in marine habitats. About 10% of all alien species known are invasive. Impact information from Asia and Africa is scarce. Most impacts caused by invasive alien invertebrates and fishes. Native plant species are worst affected compared to other taxa. Most negative impacts on nature known from terrestrial habitats; invasive alien plants cause significant negative impacts in terrestrial habitats. Loss of biodiversity, population decline and local extinction of native species, affects growth, species richness, evenness, composition; threat to rare and endangered species, affects ecosystems services by nature. Economy (yield loss, infrastructure damage, disrupt navigation, management costs, non-market values etc). Human and animal health (allergy, zoonotic diseases). Good quality of life (reduction in human food supply, affects provision of materials, labour). Alters ecosystem processes. Causes physical and chemical changes of ecosystems. Hydrology, primary productivity, decomposition. Nutrient cycling, fire regimes, water availability, Soil structure and profile, erosion. Monopolizes resources for native plants. Blocks irrigation canals; prevents access to water and fodder for livestock and wild animals. Spreads human and animal diseases. Smothers native plants, causes death of vegetation. Pollution, competition, predation, hybridisation, parasitism, toxicity. Globally, both negative and positive impacts due to IAS are known more from the Asia-Pacific region. Species extinction hot spots due to IAS are also more in the region

## Cases Studies on Invasive Species Eradication

### Kerala Forest Department

Cassia (Senna) spectabilis

Lantana camera

Acacia mearnsii

## Eradiation and Management Strategies Experiments

Clearing the vegetation and planting with native species

Retain the existing seedlings and saplings and gap planting with native species

### Monitoring and Evaluation- Indicators of Success

Elimination of Acacia and Eucalyptus from the 500 Ha site

Survival rate of the trees planted

Increase in species diversity (Flora and Fauna)

Regeneration of Native Species

Biomass productivity

Increase in Ground Water Level- Measured in the open wells

Reduction in Weed Abundance

Employment opportunities and income to local communities

Availability of NTFP for the local communities

## Ecorestoration Policy 2021

**Introduction:** The Western Ghats, one of the eight ‘hottest of the hotspots’ of biodiversity in the world, has been included in UNESCO’s list of World Heritage Sites. Copious rains, abundant sunlight, high humidity and exceptional geography play a crucial role in shaping Kerala’s exceptional and rich biodiversity. In a State which is witnessing rapid developmental activities, maintaining environmental health is essential for water security, ecological stability and sustainable development.

**Approach:** The forest areas which have lost its splendour and biodiversity will be taken up for ecorestoration and the activities will be carried out through civil society. Apart from



ensuring ecological and hydrological security, this will provide employment opportunities for the local forest- dependent people.

**Methodology:** Uncontrolled forest-fire causes degradation of forests, thereby leading to loss of biodiversity, water scarcity and soil erosion. Forest fire prevention measures will be taken up through participatory forest management initiatives and by exploring the possibilities of Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

## **Asia Pacific Forest Invasive Species Network**

### **Steps of Bio-Control**

Understanding species interactions  
Overseas exploration in country of origin  
Biology/ host range studies  
Petition for agent release  
Rearing/ field release  
Establishment and impact assessment  
Redistribution and long-term assessment

### **Invasive Species Targeted**

Miconia calvescens

### **Best Quotes**

Don't touch an invasive Species; unless you have a Restoration plan  
All Invasive species naturalise; but by taking their own time

### **Forest Landscape Restoration**

Focus on landscapes  
Restore ecological functionality  
Allow for multiple benefits  
Recognize that a suite of interventions are possible  
Involve stakeholders  
Tailor to local conditions  
Manage adaptively  
Avoid conversion of natural ecosystems

### **Restoration opportunities in India**

- UN Decade on Ecosystem Restoration (2021-2030) is building a strong global movement for a sustainable future
- In India more than 40% of the country's territory, over 140 million hectares, could benefit from protecting forests and restoring farms, forests, and other landscapes
- In Madhya Pradesh, total area available for restoration: 20.40 Mha, (WRI, INDIA)
- Madhya Pradesh, Maharashtra and Chhattisgarh have the largest potential for Community Forest Resource Rights (CFR) recognition

## **CABI Strategy for Invasive Species Management**

**Integrated Landscape Management:** Integrated Landscape Management is a systems-driven approach, and brings together multiple stakeholders from multiple sectors in a long-term participatory process to consolidate the multiple – and at times competing – goals of conservation and livelihoods.

This approach considers the needs and interests of all stakeholders in a target landscape and aims to reduce trade-offs and increase synergies by defining and integrating different land use types at the landscape scale

**Tamilnadu Forest Department**  
**Sathyamangalam Tiger Reserve**

**Major Invasives**

Prosopis juliflora

Lantana camara

Senna spectabilis

**Strategies**

Mechanical removal

**Post Removal Operations**

Disposal of cut materials

Restoration of removed area

**Nature Conservation Foundation**

Maesopsis eminii (Tree)

Senna spectabilis (Tree)

Coffea canephora (Shrub)

Coffea canephora (Shrub)

Montanoa hibiscifolia (Shrub)

Sphagneticola trilobata (Herb)

**Strategies****Legal** – Preventing introduction of alien species into the country through strong quarantine laws**Policy** – Need to implement even outside forests and protected areas (involving stakeholders) to prevent species like Maesopsis eminii and Senna spectabilis**Management** – In some cases, complete removal maybe inadvisable and cause secondary invasions: requires phased approach and ecological restoration follow-up measures**Thematic Assessment of IAS and their Control Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)****Invasion by alien species – current status and trends**

Over 5000 IAS recorded across the globe (probably an underestimation due to data gaps especially from Asia and Africa)

The number of IAS has risen over years, the numbers will continue to rise significantly in the future despite concerted attempts at management

The invasions will increase significantly especially in tropical and subtropical forests – mainly due to land use changes. Apparently, these forests are also the least studied for invasion by alien species

The most widespread is invasive species are vascular plants; the number of invasive plants is also the highest compared to other invasive alien species

Majority of the IAS is recorded from terrestrial ecosystems compared to aquatic and marine systems

**The most widespread IAP's across Asia are (data from 19 countries)**

Chromolaena odorata (18)

Lantana camara (18)

Eichhornia crassipes (17)

Pistia stratiotes (17)

Mikania micrantha (16)

Parthenium hysterophorus (11)

Mimosa diplotricha (13)

Mimosa pigra (13)

Prosopis juliflora (11)

Salvinia molesta (12)

Xanthium strumarium (11)

### References

1. Agrawal, A., Chhatre, A., and Hardin, R. (2008). Changing governance of the world's forests. *Science* 320: 1460.
2. Barve, N., Kiran, M. C., Vanaraj, G., Aravind, N. A., Rao, D., Shaanker, R. U., Ganeshaiyah, K. N., and Poulsen, J. G. (2005). Measuring and mapping threats to a wildlife sanctuary in southern India. *Conservation Biology* 19: 122–130.
3. Blossey, B. (1999). Before, during and after: the need for long-term monitoring in invasive plant species management. *Biological Invasions* 1: 301–311.
4. Bogich, T. L., Liebhold, A. M., and Shea, K. (2008). To sample or eradicate? A cost minimization model for monitoring and managing an invasive species. *Journal of Applied Ecology* 45: 1134–1142.
5. Colautti, R. I., and MacIsaac, H. J. (2004). A neutral terminology to define 'invasive' species. *Diversity and Distributions* 10: 135–141.