

## **Bioinvasion and Global Environmental Governance: The Transnational Policy Network on Invasive Alien Species**

### **India's Actions on IAS**

#### **Description<sup>8</sup>**

India is located in south Asia and covers an area of 3,287,590 sq km. It is bordered from the North by Pakistan, China, Nepal, Bhutan, Burma and Bangladesh and has a total of 14,103 km of land boundaries. There are also 7,000 km of coastline, and the nation is flanked by the Arabian Sea to the west and the Bay of Bengal to the East. The climate of India ranges from tropical monsoon in the south which to a more temperate climate in the North. The terrain also varies significantly, with upland plains (the Deccan Plateau) in Southern region, flat to rolling plains along the Ganges River, deserts in the West and the Himalayan Mountains in the North. About 40% of species in Indian flora are alien, of which 25% are invasive.<sup>1</sup> The nation has a population of 1.15 billion spread over a land area of 3,287,590 sq km.

Since independence in 1947, India has been the world's largest democracy (by population) and is presently one of the world's fastest growing economies. Its free-market reforms of the early nineties have seen considerable success, fueled largely by India's information technologies sector. This growth has led to the emergence of 400 million people out of relative poverty since the reforms and a middle-class that now numbers 200 million people.<sup>12</sup> Despite these impressive gains in economic investment and output, India faces pressing problems such as significant overpopulation, environmental degradation, extensive poverty, and ethnic and religious strife. In addition, India's economy remains largely reliant on agricultural. Its major trading partners are the United States, China, and the United Arab Emirates.

#### **Overview of Biodiversity**

India is one of the 17 "megadiverse" countries and is composed of a diversity of ecological habitats like forests, grasslands, wetlands, coastal and marine ecosystems, and desert ecosystems. Almost 70% of the country has been surveyed and around 45,000 plant species (including fungi and lower plants) and 89,492 animal species have been described, including 59,353 insect species, 2,546 fish species, 240 amphibian species, 460 reptile species, 1,232 bird species and 397 mammal species.

- [CBD Country Profile](#)
- [Earth Trends Country Profile on Biodiversity and Protected Areas](#)
- [India Biodiversity Portal](#)

#### **Legislation relating to IAS**

- [The Prevention and Control of Infectious and Contagious Disease in Animals Act, 2009](#)
- [The Plant Quarantine \(Regulation of Import into India\) Order, 2003](#)
- [The Destructive Insects and Pests Act, 1914 and amendments](#)
- [The Plants, Fruits & Seeds \(Regulation of Import into India\) Order 1989](#) (PFS Order 1989)

- [Livestock Importation Act, 1898](#) and the Livestock Importation (Amendment) Ordinance, 2001
- [Environment Protection Act, 1986](#)
- [The Biological Diversity Act, 2002](#)
- [Indian Forest Act, 1927](#)
- [Wildlife \(Protection\) Act, 1972](#)
- [Forest \(Conservation\) Act, 1980](#)

### Government Agencies/Programs/Ministries dealing with IAS

- The Ministry of Agriculture
  - [The Department of Agriculture and Cooperation](#) (DAC)
  - [Department of Agricultural Research and Education](#) (DARE)
  - [Department of Animal Husbandry and Dairying](#)
  - [Indian Council of Agricultural Research](#) (ICAR)
  - [Animal Quarantine and Certification Services Stations](#)
  - [Directorate of Plant Protection Quarantine and Storage](#)
- [The National Bureau of Fish Genetic Resources](#)
- [The Ministry of Environment & Forests](#)
  - [The National Biodiversity Authority](#)
- [Plant Quarantine Organization of India](#)
- [Wildlife Institute of India](#)
- [Agricultural Marketing Information Network](#) (Ministry of Communications & Information Technology)

### Major Invasive Alien Species<sup>15</sup>

[Acacia farnesiana](#) (tree, shrub)  
[Achatina fulica](#) (mollusc)  
[Ambrosia artemisiifolia](#) (herb)  
[Aristichthys nobilis](#) (fish)  
[Bemisia tabaci](#) (insect)  
[Cabomba caroliniana](#) (aquatic plant)  
[Chromolaena odorata](#) (herb)  
[Chromolaena odorata](#) (herb)  
[Columba livia](#) (bird)  
[Cryphonectria parasitica](#) (fungus)  
[Cyprinus carpio](#) (fish)  
[Eichhornia crassipes](#) (aquatic plant)  
[Eugenia uniflora](#) (tree, shrub)  
[Gambusia affinis](#) (fish)  
[Gymnocoronis spilanthoides](#) (aquatic plant)  
[Hypophthalmichthys molitrix](#) (fish)  
[Lantana camara](#) (shrub)  
[Ludwigia peruviana](#) (aquatic plant)

[Mikania micrantha](#) (vine, climber)  
[Mimosa diplotricha](#) (vine, climber, shrub)  
[Monomorium pharaonis](#) (insect)  
[Oncorhynchus mykiss](#) (fish)  
[Oreochromis mossambicus](#) (fish)  
[Oreochromis spp.](#) (fish)  
[Phalaris arundinacea](#) (grass)  
[Parthenium hysterophorus](#) (herb)  
[Prosopis spp.](#) (tree, shrub)  
[Ricinus communis](#) (tree, shrub)  
[Salmo trutta](#) (fish)  
[Salvelinus fontinalis](#) (fish)  
[Salvinia molesta](#) (aquatic plant, herb)  
[Solenopsis geminata](#) (insect)  
[Tinca tinca](#) (fish)  
[Vibrio cholerae](#) (micro-organism)  
[Zosterops japonicus](#) (bird)

### Native Species Exported/Introduced to Non-Native Environments<sup>15</sup>

<a href="#"><i>Acridotheres fuscus</i></a> (bird)	<a href="#"><i>Hygrophila polysperma</i></a> (aquatic plant)
<a href="#"><i>Albizia julibrissin</i></a> (tree)	<a href="#"><i>Hypericum perforatum</i></a> (herb)
<a href="#"><i>Alternanthera sessilis</i></a> (herb)	<a href="#"><i>Landoltia punctata</i></a> (aquatic plant)
<a href="#"><i>Axis axis</i></a> (mammal)	<a href="#"><i>Lepidium latifolium</i></a> (herb)
<a href="#"><i>Caesalpinia decapetala</i></a> (tree, shrub)	<a href="#"><i>Lutjanus kasmira</i></a> (fish)
<a href="#"><i>Casuarina equisetifolia</i></a> (tree)	<a href="#"><i>Microstegium vimineum</i></a> (grass)
<a href="#"><i>Channa marulius</i></a> (fish)	<a href="#"><i>Paspalum scrobiculatum</i></a> (grass)
<a href="#"><i>Clarias batrachus</i></a> (fish)	<a href="#"><i>Pennisetum polystachion</i></a> (grass)
<a href="#"><i>Dalbergia sissoo</i></a> (tree)	<a href="#"><i>Rattus rattus</i></a> (mammal)
<a href="#"><i>Dioscorea bulbifera</i></a> (herb, vine, climber)	<a href="#"><i>Streptopelia decaocto</i></a> (bird)
<a href="#"><i>Dioscorea oppositifolia</i></a> (herb, vine, climber)	<a href="#"><i>Suncus murinus</i></a> (mammal)
<a href="#"><i>Hedygium flavescens</i></a> (herb)	<a href="#"><i>Syzygium cumini</i></a> (tree)
<a href="#"><i>Hiptage benghalensis</i></a> (vine, climber, shrub)	<a href="#"><i>Ziziphus mauritiana</i></a> (tree, shrub)

About 28 species native to India have been found to be invasive to other biogeographical zones.<sup>14</sup>

**Table 1 Actions to prevent, detect and manage IAS categorized into three themes: biodiversity, human health, and economic**

*Note: Actions (such as projects, publications and programs) are classified according to the most obvious theme but may also fit into the dimensions of another.*

Theme	Action
Biodiversity	<ul style="list-style-type: none"> <li>• <a href="#">National Biodiversity Action Plan</a>: Regulation of introduction of invasive alien species and their management. As presently there is no exclusive legislation or policy in India to deal with the invasive alien species, actions include:<sup>14</sup> <ul style="list-style-type: none"> <li>- Develop a unified national system for regulation of all introductions and carrying out rigorous quarantine checks.</li> <li>- Strengthen domestic quarantine measures to contain the spread of invasive species to neighbouring areas.</li> <li>- Promote intersectoral linkages to check unintended introductions and contain and manage the spread of invasive alien species.</li> <li>- Develop a national database on invasive alien species reported in India.</li> <li>- Develop appropriate early warning and awareness system in response to new sightings of invasive alien species.</li> <li>- Provide priority funding to basic research on managing invasive species.</li> <li>- Support capacity building for managing invasive alien species at different levels with priority on local area activities.</li> <li>- Promote restorative measures of degraded ecosystems using preferably locally adapted native species for this purpose.</li> <li>- Promote regional cooperation in adoption of uniform quarantine measures and containment of invasive exotics.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• At the central level, there are two relevant departments in the Ministry of Agriculture – <a href="#">the Department of Agriculture and Cooperation</a> (DAC) and <a href="#">Department of Agricultural Research and Education</a> (DARE) - which are concerned with plant protection outreach and research, respectively. Through <a href="#">Indian Council of Agricultural Research</a> (ICAR), about 90 Institutes and more than 100 universities in the country have programmes on various invasive alien species.<sup>1</sup></li> <li>• The Guidelines on Quarantine and Strategic Plan for exotic introduction was published.<sup>1</sup> (see Case study “<a href="#">The Plant Quarantine Order in India</a>”)</li> <li>• The threat of invasive pest species gaining entry into India (imported plant/planting material) is addressed under <a href="#">The Plant Quarantine (Regulation of Import into India) Order, 2003</a>, under the ICAR. However, the risk analysis for invasiveness of a plant species per se is not taken care of under this order.<sup>1</sup></li> <li>• National workshop sponsored by <a href="#">The Ministry of Environment &amp; Forests</a> and organized by the Department of Botany, Banaras Hindu University was held in August 2004 to discuss various aspects relating to invasive species and biodiversity.<sup>1</sup></li> <li>• India has assessed the risks posed to ecosystems, habitats and species by some invasives within their borders. However, most assessments were done at the local level. Some states such as West Bengal and Tamil Nadu have adopted legislative and administrative measures for eradicating and preventing further invasion of the most noxious weed species and exotic fish carnivores (such as the Big Head Carp) replacing native species.<sup>1</sup></li> <li>• In terms of the restoration of degraded forest ecosystems, priority is given to regenerating native and locally adapted species groups. Furthermore, in freshwater ecosystems are given priority for clearing the effects of invasives.<sup>1</sup></li> <li>• Active cooperation among the concerned central and state government departments like agriculture, livestock, fisheries, forests, water resources, tourism, commerce, shipping, environment and rural development while involving lead institutions and NGOs are being developed on case-to-case basis.<sup>1</sup> <a href="#">The Ministry of Environment &amp; Forests</a> supports the Ministry of Agriculture in the eradication and control of invasive species and the restoration of degraded ecosystems where the infrastructure and expertise is necessary to with deal with the issues.<sup>1</sup></li> <li>• In 2002 a major training course was held at the National Police Academy of India involving wildlife law enforcement officials from 12 countries in Asia.<sup>5</sup></li> <li>• Invasive growth of the grass <i>Paspalum distichum</i> has changed the ecological character of large areas of the Keoladeo National Park, reducing its suitability for certain waterbird species including the</li> </ul>
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	<p>Siberian Crane. In the Kanjli Wetlands the water hyacinth which was introduced is now invasive; from time to time it is removed using mechanical means.<sup>2</sup> At the Ropar wetlands invasive weeds are also a concern and management plans are under development.<sup>2</sup></p> <ul style="list-style-type: none"> <li>• The Chilika Development Authority (CDA) received the Ramsar Wetland Conservation Award in 2002 for its work in restoring the Chilika Lake Ramsar site... increased the biodiversity, but also increased fish catches and other socio-economic benefits to the local population. Chilika Lake became degraded mainly through siltation and the choking of the seawater inlet channel, this resulted in the proliferation of invasive freshwater species, a decrease in fish productivity and an overall loss in biodiversity.<sup>3</sup></li> <li>• In selected wetlands of national and international importance, changes in the ecology has been assessed and vulnerability to invasive species has been critically evaluated, leading to specific actions for mitigation of the impacts. Management Action Plans have been formulated for 30 out of 66 wetlands identified for conservation and sustainable use... these MAPs have a focus on biodiversity conservation and restoration of ecosystem processes and functions... one of the activities carried out in association with these plans is the control of alien invasive species.<sup>4</sup></li> <li>• Legislation on Environmental Impact Assessments (EIA) applicable to wetlands has been put in place. It is mandatory to carry out EIAs for developmental projects on wetlands by the proponent organizations to obtain environmental clearance (<a href="#">Environmental Impact Assessment Notification</a>).<sup>4</sup></li> <li>• Targets for control of IAS are: the water hyacinth, <i>Salvinia</i> and <i>Ipomea</i> in 19 Ramsar sites... planned activities have included the control of the water hyacinth and other alien plant species with MAPs and other measures being developed to control the proliferation of these species.<sup>4</sup></li> <li>• A Draft National Wetland Strategy has been developed with a clear focus on control of invasive species... also, several initiatives have been undertaken under the CBD to control proliferation of invasive species in wetlands and other aquatic bodies.<sup>4</sup></li> <li>• <a href="#">The Wildlife Institute of India</a> periodically organizes training on wetland related issues including specific training modules and materials being developed to impart training to wetland managers in India and some selected participants from the South Asian region... including the field of IAS.<sup>4</sup></li> </ul>
Human health	<ul style="list-style-type: none"> <li>• <a href="#">Livestock Importation Act, 1898</a> was amended by the <a href="#">Livestock Importation (Amendment) Ordinance, 2001</a>. The Act now applies to livestock and livestock products to regulate the import of such products in a manner so that they do not adversely affect human and animal health within India. The Act applies to <ul style="list-style-type: none"> <li>○ meat and meat products of all kinds</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ egg and egg powder</li> <li>○ milk and milk products</li> <li>○ bovine, ovine and caprine embryos, ova or semen</li> <li>○ pet food products of animal origin<sup>1</sup></li> <li>● Imports require a valid sanitary import permit issued by <a href="#">the Department of Animal Husbandry and Dairying</a> and are only allowed through airports and seaports which have <a href="#">Animal Quarantine and Certification Services Stations</a>.<sup>1</sup></li> </ul>
Economic	<ul style="list-style-type: none"> <li>● <a href="#">The National Bureau of Fish Genetic Resources</a> has prepared a list of exotic/alien species under aquaculture, fisheries and aquarium trade. Their impacts of these invasives have been evaluated and a strategic plan for quarantine and exotic fish introductions has been prepared and published.<sup>1</sup> (See <a href="#">book publication list</a>)</li> <li>● Bio-security and Sanitary-Phytosanitary Import Permit will be issued by the <a href="#">Directorate of Plant Protection Quarantine and Storage</a>, Department of Agriculture and Cooperation, and the Government of India.<sup>6</sup> <a href="#">National standards</a> as set by the <a href="#">Plant Quarantine Organization of India</a>, includes (standard operating procedures) <a href="#">SOP for Export Inspection &amp; Phytosanitary Certification of plants / plant products and other regulated articles</a>.</li> <li>● With regards to the prevention of introduction of invasives there are six agencies which are responsible for issuance of certificate of export/import of bioresources:<sup>1</sup> <ol style="list-style-type: none"> <li>1. Plant Quarantine Division, NBPGR issues phytosanitary certificate for export of material and permits for import of germplasm, under the Plant Quarantine Order (PQO) 2003 of the Destructive Insects and Pests Act, 1914.</li> <li>2. The Plant Protection Adviser issues permits for import of live insects and microbial cultures, plants and plant products, and phytosanitary certificates along with the organism for export under the PQO.</li> <li>3. The <a href="#">Department of Animal Husbandry and Dairying</a> deals with import of livestock issues health certificates of the livestock to be exported if required by the importing country under the Livestock Importation Act, 1898.</li> <li>4. Directorate General of Foreign Trade issues licenses before export of any living organism or their product from the country under the Foreign Trade (Development &amp; Regulation) Act, 1992.</li> <li>5. The Ministry of Environment and Forests issues approval along with quarantine certificates for the export of wild animals and articles under the Wildlife (Protection) Act 1972.</li> <li>6. <a href="#">The National Biodiversity Authority</a> of <a href="#">The Ministry of Environment &amp; Forests</a> (MoEF) is empowered to issue approval for export of biological material from the country under the Biological Diversity Act 2002.</li> </ol> </li> </ul>

	<ul style="list-style-type: none"> <li>• <a href="#">The Destructive Insects and Pests Act 1914</a> aims to prevent introductions into India, and the transport from one province to another, of any fungus or other pest which is, or may be destructive to crops.<sup>7</sup> Furthermore, <a href="#">Customs Clearance Procedure for Food Items, Livestock Products, Plant and Plant Materials</a> are in place under the Destructive Insects &amp; Pests Act, 1914 to prevent introduction of exotic pests and diseases into the country.<sup>11</sup></li> </ul>
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**Table 2 Actions on IAS in cooperation with other countries**

<b>Agreement/ Organization</b>	<b>Countries/ Member</b>	<b>Action</b>
<a href="#">Asia-Pacific Forest Invasive Species Network</a>	Australia, Bangladesh, Bhutan, Cambodia, China, Fiji, India, Indonesia, Japan, Republic of Korea, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, US, Vanuatu, Vietnam, Tuvalu, Kiribati, France, and Russia	<ul style="list-style-type: none"> <li>• The APFISN has been established as a response to the immense costs and dangers posed by invasive species to the sustainable management of forests in the Asia-Pacific region. It is a cooperative alliance of 32 member countries of the Asia-Pacific Forestry Commission (APFC). The network operates under the umbrella of APFC which is a statutory body of the Food and Agricultural Organization of the United Nations. The APFISN focuses on inter-country cooperation that helps to detect, prevent, monitor, eradicate and/or control forest invasive species in the Asia-Pacific region. <ol style="list-style-type: none"> <li>1. Raises awareness of FIS throughout the Asia-Pacific region</li> <li>2. Exchanges and shares information on FIS among member countries</li> <li>3. Facilitates access to technical expertise, research results and training and education opportunities</li> <li>4. Strengthens capacities of member countries to conduct research, manage FIS and prevent new incursions</li> <li>5. Develop strategies for regional cooperation and collaboration in combating threats posed by FIS</li> </ol> </li> <li>• <a href="#">The Ministry of Environment &amp; Forests</a> is implementing Asia-Pacific Forest Invasive Species Network Project of the FAO, and has completed a country report on IAS.<sup>1</sup></li> <li>• Country Reports: <a href="#">Status of Forest Invasive</a></li> </ul>

<p>India and USA sign joint declaration on knowledge initiative in agriculture  <a href="#">ICAR web portal</a>  <a href="#">USDA web portal</a></p>	<p><a href="#">Indian Council of Agricultural Research</a> and <a href="#">U.S. Department of Agriculture (USDA)</a></p>	<p><a href="#">Species in India</a> (see case study below)</p> <ul style="list-style-type: none"> <li>• A Joint Declaration was signed between Ministry of Agriculture of India and the United States Department of Agriculture regarding support for <a href="#">India-United States Knowledge Initiative</a> on Agricultural Education, Research, Service and Commercial Linkages at New Delhi on 12.11.2005. [The original declaration does not mention IAS or phytosanitary issues]</li> <li>• <a href="#">Fifth US-India Agricultural Knowledge Initiative Board Meeting</a> (Washington D.C. June 2007): <ul style="list-style-type: none"> <li>- In view of the emerging socio-economic volatility and global threats, biosecurity as related to agriculture becomes an important area. It is required to be addressed as a new component under already identified focus areas of emerging biotechnology. Starting from minimizing the risk of introduction of alien invasive species up to averting the release of bioagents of mass destruction, a global partnership is necessary between the like-minded nations.</li> <li>- The Board would be reconstituted upon completion of 2 years with each side deciding on the composition, which is limited to 7 members on each side.</li> </ul> </li> </ul> <p>[This section of the USDA's report on the meeting is not on their web site, nor is biosecurity discussed at the next meeting; however a board was created]</p> <ul style="list-style-type: none"> <li>• <a href="#">U.S.–India Agricultural Knowledge Initiative: Board Members</a>: Both countries created a board comprised of academia, government, and private sector representatives from the United States and India. The board agreed to a three-year work plan that supports the "Evergreen Revolution," which is based on environmentally sustainable, market-oriented agriculture. To jump start the</li> </ul>
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		Initiative, the United States secured funding of \$8 million in fiscal year 2006, with a total of \$24 million pledged through 2008.
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## Case Studies

### [The Plant Quarantine Order in India](#)<sup>13</sup>

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#### Abstract

With a view to modernize, upgrade, standardize and enhance the somewhat outdated plant quarantine system, its capacities and the related legal and administrative framework, the Government of India has recently approved the notification of a new Plant Quarantine Order for the country. This new Order is a step forward in harmonizing India's regulatory framework with the International Plant Protection Convention and internationally accepted standards and the tenets of the SPS Agreement of the World Trade Organization. Other supporting and managerial steps are also being taken to improve, to international standards, the entire gamut of the country's quarantine activity and phytosanitary border controls, including import and export inspections, on-field surveillance for pests and vectors, treatment standards and processes, and certification methodology. India is making imports of plants and plant materials subject to pest risk analysis to protect its crops from risk of introduction of alien pests. Efforts are also under way to improve the export certification process and standards to ensure that such phytosanitary certification gives an assurance of freedom from quarantine and regulated pests and vectors, including alien species for importing countries. The details and features of the legislative and executive initiatives, and the rationale and methodology adopted are outlined in this paper.

### [Status of Forest Invasive Species in India](#)<sup>10</sup>

The Directorate of Plant Protection, Quarantine & Storage, located at Faridabad, Haryana, under the Ministry of Agriculture (Department of Agriculture and Co-operation) is responsible for implementation of plant quarantine regulations in India and is headed by the Plant Protection Adviser (PPA) to the GOI. Presently, there are 25 plant quarantine stations functioning all over India. The plant quarantine stations at major/minor stations are headed by Plant Protection Officers and are assisted by Technical Officers of Grade-I, II, & III. They are responsible for issuing the Phytosanitary and quarantine certificates as per the regulations. Presently there is no fool proof system of reporting about the existence of IAS or FIS in India either to the government officials or

the general public. Only when a species becomes invasive and starts affecting socio-economically, measures are taken for its eradication and control. About 52 many of the NGOs, universities and private institutions undertake research in collaboration with the government departments and cooperate in monitoring and control of the FIS

### [Invasive Species and Poverty: Exploring the Links](#)<sup>9</sup>

In 1993, the Office of Technology Assessment of the US Congress estimated that annual losses to invasive pest species in India were approximately \$91.02 bn USD. Estimated damage caused by invasive species was equivalent to 78% of agricultural GDP... this accounts to 20% of total GDP in 1999 being directly associated with the cost of control and damages from IAS.

#### Case Study 1: Lantana camara

“Lantana camara is regarded as one of the world’s ten worst invasive alien species, but in India it is used as a hedge plant, as a source of paper pulp, fuelwood and traditional medicine, and even as a craft material for weaving baskets and making furniture.

Invasion by Lantana is known to cause significant changes in the structure and function forests by obstructing potential succession processes, interfering with fire regimes and pollination services, and displacing native flora and fauna. However, in recent years several local communities have begun using Lantana as a craft material in place of bamboo and rattans, which have dwindled due to overextraction. Encouraging people to use Lantana in this way not only reduces pressure on native resources, but also creates options for improving rural livelihoods. Large-scale harvesting may even help control the spread of the species, and allow native biodiversity to regenerate and recover”

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