

# 100 OF THE WORLD'S WORST INVASIVE ALIEN SPECIES

A SELECTION FROM THE GLOBAL  
INVASIVE SPECIES DATABASE



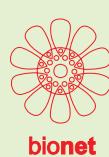
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Cover image: Brown tree snake (*Boiga irregularis*).  
Photo: Gordon Rodda

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# Biological Invasion

What happens when a species is introduced into an ecosystem where it doesn't occur naturally? Are ecosystems flexible and able to cope with change, or can a new arrival have far-reaching repercussions and do permanent damage? Will something special be lost forever? Does it matter?

In the distant past, the earth's mountains and oceans represented formidable natural barriers to all but the hardiest of species. Ecosystems evolved in relative isolation. Early human migration saw the first intentional introductions of alien species as our ancestors attempted to satisfy physical and social needs, but the magnitude and frequency of those early introductions were minor compared to those associated with today's extensive global trade and passenger movements.

History is rich with tales of the disastrous outcomes of some intentional introductions such as that of the Nile perch, which resulted in the extinction of more than 200 other fish species. We can avoid repeating such mistakes by learning from history. Yet surprisingly, potentially damaging introductions continue. The ongoing release of the mosquito fish that feature in this brochure, is a good example. Another is the questionable behaviour of some participants in the international garden seed and pet trade.

Careless behaviour leads to unintentional introductions. So-called 'accidents' now account for the majority of successful invasions.

The list of "100 of the World's Worst Invasive Alien Species" in this booklet illustrates the incredible variety of species that have the ability, not just to travel in ingenious ways, but also to establish, thrive and dominate in new places. Today, alien invasion is second only to habitat loss as a cause of species endangerment and extinction.

The genes, species and ecosystems that make up the earth's biological diversity are important because their loss and degradation diminishes nature. Species other than our own have a right to exist and to retain their place in the world. We do not know how to estimate which species are essential to ecosystem functioning, which are redundant, and which will be the next to flourish as the world changes. When we introduce a new species into an ecosystem, the full impact is often not immediately apparent. Invasion by species such as *Miconia calvescens* can change entire habitats, making them unsuitable for the original native community.

Safeguarding the earth's diversity is the best way to maintain our life support system. There is evidence to suggest that the biosphere acts as a self-regulating whole and that diverse systems may be more resilient. Island ecosystems, which have evolved in isolation often have relatively fewer plants, herbivores, carnivores and decomposers to maintain essential processes and are more vulnerable to invasion. On islands around the world species extinction is increasing at an un-

precedented rate. A number of the invasive alien species featured in this booklet are contributing to these losses.

Useful initiatives, which contribute to better management practices and a reduced incidence of biological invasion, are being taken by communities all over the world. Invasive alien species are now a major focus of international conservation concern and the subject of cooperative international efforts, such as the Global Invasive Species Programme (GISP). As awareness grows, people and their communities are able to make informed choices that will have lasting effects on their descendants.

The list of "100 of the World's Worst Invasive Alien Species" that is presented here is designed to enhance awareness of the fascinating complexity, and also the terrible consequences, of invasive alien species. Species were selected for the list according to two criteria: their serious impact on biological diversity and/or human activities, and their illustration of important issues surrounding biological invasion. To ensure the inclusion of a wide variety of examples, only one species from each genus was selected. There are many other invasive alien species, in addition to those on this list of examples. Absence from the list does not imply that a species poses a lesser threat. We hope that, by raising general awareness, the risks of further harmful invasions will be reduced in future.

## Crazy Ant (*Anoplolepis gracilipes*)



Photo: H. T. Imai and M. Kubota

Crazy ants (so called because of their frenetic movements) have invaded native ecosystems and caused environmental damage from Hawai'i to the Seychelles and Zanzibar. On Christmas Island in the Indian Ocean, they have formed multi-queen supercolonies in at least eight areas of rainforest, foraging in all habitats, including the rainforest canopy. They are also decimating the red land crab (*Gecarcoidea natalis*) populations. In 18 months the crazy ants were able to kill 3 million crabs. The land crabs play an important role in Christmas Island's forest ecosystem

helping in litter breakdown and influencing forest composition by eating leaves and seedlings of rainforest trees. Crazy ants also prey on, or interfere in, the reproduction of a variety of arthropods, reptiles, birds and mammals on the forest floor and canopy. Their ability to farm and protect sap-sucking scale insects, which damage the forest canopy on Christmas Island, is one of their more surprising attributes. Although less than 5% of the rainforest on Christmas Island has been invaded so far, scientists are concerned that endangered birds such as the Abbott's booby (*Sula abbotti*), which nests nowhere else in the world, could eventually be driven to extinction through habitat alteration and direct attack by the ants.

## Brown Tree Snake (*Boiga irregularis*)

A native of Australia, Indonesia, Papua New Guinea, and the Solomon Islands, the brown tree snake is thought to have hitchhiked to Guam on military aircraft in the late 1940s or early 1950s. The lack of natural predators and ample prey allowed the snake population to explode. By the 1970s it was found island-wide and had done

extensive economic and ecological damage. It has caused major power outages across the island and sometimes bites people, but is most infamous for its near complete extermination of Guam's native forest birds. The brown tree snake is a serious threat to the biological diversity of other tropical islands. It is able to conceal itself in cargo on boats and aircraft and even in airplane wheel-wells and has reached destinations as far afield as Micronesia, Hawai'i, mainland United States and Spain. Areas most at risk are wet tropical locations that receive large volumes of human and commercial traffic.



Photo: Gordon Rodda

## Caulerpa Seaweed (*Caulerpa taxifolia*)

Caulerpa was introduced to the Mediterranean around 1984, possibly as waste from the Monaco Aquarium. There is speculation that the species released into the Mediterranean was a hardier clone of the original tropical seaweed. It adapted well to colder waters and has spread throughout the northern Mediterranean where it is a serious threat to the native marine flora and fauna. New colonies are able to start from small segments of this plant and, being an opportunistic hitchhiker, it is a threat to the whole of the Mediterranean. Wherever it has established itself, it has smothered habitats such as the beds of native sea grass that serve as nurseries for many species. On 12th June 2000, divers in a lagoon near San Diego in the United States discovered a patch of Caulerpa measuring 20 metres by 10 metres. In this case too, it is thought that the infestation occurred after somebody emptied a fish tank into a storm-water drain. Luckily this invasion was discovered at an early stage and measures were taken to eradicate it.



Photo: Alexandre Meinesz

Caulerpa infestation

## Avian Malaria (*Plasmodium relictum*)

Avian malaria was introduced to Hawai'i in exotic birds kept by settlers, but it needed a vector to spread. This was made possible following the introduction of the southern house mosquito (*Culex quinquefasciatus*) in the water barrels of a sailing ship in 1826. Hawaii's unique native birds succumbed quickly because, unlike non-native birds, they have no resistance to avian malaria. Unique birds such as the colour-ful honeycreepers, which evolved into a diverse array of species and sub-species to fill different niches, are threatened by this disease and by habitat loss. Avian malaria, through its mosquito vector has contributed to the extinction of at least 10 native bird species in Hawai'i and threatens many more.



Photo: Jack Jeffrey Photography

Honeycreeper with malaria carrying mosquitos

# 100 OF THE WORLD'S WORST INVASIVE ALIEN SPECIES

## MICRO-ORGANISM

avian malaria  
banana bunchy top virus  
rinderpest virus

## MACRO-FUNGI

chestnut blight  
crayfish plague  
Dutch elm disease  
frog chytrid fungus  
phytophthora root rot

(*Cryphonectria parasitica*)  
(*Aphanomyces astaci*)  
(*Ophiostoma ulmi*)  
(*Batrachochytrium dendrobatidis*)  
(*Phytophthora cinnamomi*)

## AQUATIC PLANT

caulerpa seaweed  
common cord-grass  
wakame seaweed  
water hyacinth

(*Caulerpa taxifolia*)  
(*Spartina anglica*)  
(*Undaria pinnatifida*)  
(*Eichhornia crassipes*)

## LAND PLANT

African tulip tree  
black wattle  
Brazilian pepper tree  
cogon grass  
cluster pine  
erect pricklypear  
fire tree  
giant reed  
gorse  
hiptage  
Japanese knotweed  
Kahili ginger  
Koster's curse  
kudzu  
lantana  
leafy spurge  
leucaena  
melaleuca  
mesquite  
miconia  
mile-a-minute weed  
mimosa  
privet  
pumpwood  
purple loosestrife  
quinine tree  
shoebutton ardisia

(*Spathodea campanulata*)  
(*Acacia mearnsii*)  
(*Schinus terebinthifolius*)  
(*Imperata cylindrica*)  
(*Pinus pinaster*)  
(*Opuntia stricta*)  
(*Myrica faya*)  
(*Arundo donax*)  
(*Ulex europaeus*)  
(*Hiptage benghalensis*)  
(*Fallopia japonica*)  
(*Hedychium gardnerianum*)  
(*Clidemia hirta*)  
(*Pueraria montana* var. *lobata*)  
(*Lantana camara*)  
(*Euphorbia esula*)  
(*Leucaena leucocephala*)  
(*Melaleuca quinquenervia*)  
(*Prosopis glandulosa*)  
(*Miconia calvescens*)  
(*Mikania micrantha*)  
(*Mimosa pigra*)  
(*Ligustrum robustum*)  
(*Cecropia peltata*)  
(*Lythrum salicaria*)  
(*Cinchona pubescens*)  
(*Ardisia elliptica*)

## LAND PLANT (CONTINUED)

Siam weed  
strawberry guava  
tamarisk  
wedelia  
yellow Himalayan raspberry

(*Chromolaena odorata*)  
(*Psidium cattleianum*)  
(*Tamarix ramosissima*)  
(*Sphagneticola trilobata*)  
(*Rubus ellipticus*)

## AQUATIC INVERTEBRATE

Chinese mitten crab  
comb jelly  
fish hook flea  
golden apple snail  
green crab  
marine clam  
Mediterranean mussel  
Northern Pacific seastar  
zebra mussel

(*Eriocheir sinensis*)  
(*Mnemiopsis leidyi*)  
(*Cercopagis pengoi*)  
(*Pomacea canaliculata*)  
(*Carcinus maenas*)  
(*Potamocorbula amurensis*)  
(*Mytilus galloprovincialis*)  
(*Asterias amurensis*)  
(*Dreissena polymorpha*)

## LAND INVERTEBRATE

Argentine ant  
Asian longhorned beetle  
Asian tiger mosquito  
big-headed ant  
common malaria mosquito  
common wasp  
crazy ant  
cypress aphid  
flatworm  
Formosan subterranean termite  
giant African snail  
gypsy moth  
khapra beetle  
little fire ant  
red imported fire ant  
rosy wolf snail  
sweet potato whitefly

(*Linepithema humile*)  
(*Anoplophora glabripennis*)  
(*Aedes albopictus*)  
(*Pheidole megacephala*)  
(*Anopheles quadrimaculatus*)  
(*Vespa vulgaris*)  
(*Anoplolepis gracilipes*)  
(*Cinara cyprius*)  
(*Platydemus manokwari*)  
(*Coptotermes formosanus shiraki*)  
(*Achatina fulica*)  
(*Lymantria dispar*)  
(*Trogoderma granarium*)  
(*Wasmannia auropunctata*)  
(*Solenopsis invicta*)  
(*Euglandina rosea*)  
(*Bemisia tabaci*)

## AMPHIBIAN

bullfrog  
cane toad  
Caribbean tree frog

(*Rana catesbeiana*)  
(*Bufo marinus*)  
(*Eleutherodactylus coqui*)

## FISH

brown trout  
carp  
large-mouth bass

(*Salmo trutta*)  
(*Cyprinus carpio*)  
(*Micropterus salmoides*)

## FISH (CONTINUED)

Mozambique tilapia  
Nile perch  
rainbow trout  
walking catfish  
Western mosquito fish

(*Oreochromis mossambicus*)  
(*Lates niloticus*)  
(*Oncorhynchus mykiss*)  
(*Clarias batrachus*)  
(*Gambusia affinis*)

## BIRD

Indian myna bird  
red-vented bulbul  
starling

(*Acridotheres tristis*)  
(*Pycnonotus cafer*)  
(*Sturnus vulgaris*)

## REPTILE

brown tree snake  
red-eared slider

(*Boiga irregularis*)  
(*Trachemys scripta*)

## MAMMAL

brush-tail possum  
domestic cat  
goat  
grey squirrel  
macaque monkey  
mouse  
nutria  
pig  
rabbit  
red deer  
red fox  
ship rat  
small Indian mongoose  
stoat

(*Trichosurus vulpecula*)  
(*Felis catus*)  
(*Capra hircus*)  
(*Sciurus carolinensis*)  
(*Macaca fascicularis*)  
(*Mus musculus*)  
(*Myocastor coypus*)  
(*Sus scrofa*)  
(*Oryctolagus cuniculus*)  
(*Cervus elaphus*)  
(*Vulpes vulpes*)  
(*Rattus rattus*)  
(*Herpestes javanicus*)  
(*Mustela erminea*)

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For further information on these and other invasive alien species consult The Global Invasive Species Database:

[www.issg.org/database](http://www.issg.org/database)

### Feral Pig (*Sus scrofa*)



Photo: Jim Mitchell

Feral pigs are escaped or released domestic animals. Introduced to many parts of the world, they damage crops, stock and property and transmit many diseases such as Leptospirosis and foot and mouth disease. Rooting pigs dig up large areas of native vegetation and spread weeds, disrupting ecological processes such as succession and species composition. They are omnivorous and their diet can include juvenile land tortoises, sea turtles, sea birds and endemic reptiles. Management of this invasive species is complicated by the fact that complete eradication is often not acceptable to communities that value feral pigs for hunting and food.

### Strawberry Guava (*Psidium cattleianum*)



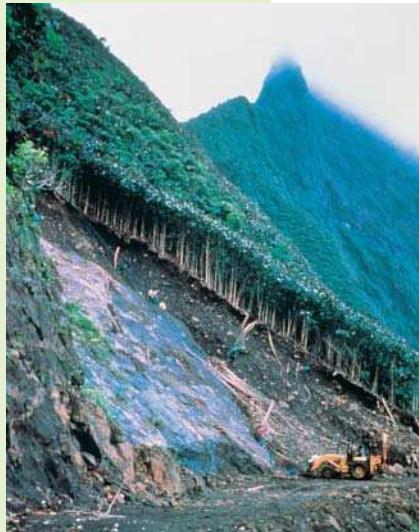
Photo: Wendy Strachan

The strawberry guava is native to Brazil, but has been naturalised in Florida, Hawai'i, tropical Polynesia, Norfolk Island and Mauritius for its edible fruit. It forms thickets and shades out native vegetation in tropical forests and woodlands. It has had a devastating effect on native habitats in Mauritius and is considered the worst plant pest in Hawai'i, where it has invaded a variety of natural

areas. It benefits from feral pigs (*Sus scrofa*) which, by feeding on its fruit, serve as a dispersal agent for its seeds. In turn, the guava provides favourable conditions for feral pigs, facilitating further habitat degradation.

## **Miconia (*Miconia calvescens*)**

A highly ornamental tree from South America, Miconia was introduced to a botanical garden on the island of Tahiti in 1937. Its huge red and purple leaves made it highly desirable for gardeners. It was spread into the wild by fruit-eating birds and today, more than half the island is heavily invaded by this plant. It has a superficial and tentacular rooting system that contributes to landslides and has become the dominant canopy tree over large areas of Tahiti, shading out the entire forest under-story. Scientists estimate that several of the island's endemic species are threatened with extinction as a result of habitat loss due to Miconia. It has been introduced to other Pacific islands, including Hawai'i where it was introduced as an ornamental in the 1960s. The plant has since been found in many locations on the Hawai'ian islands. It is still sold as an ornamental plant in the tropics.

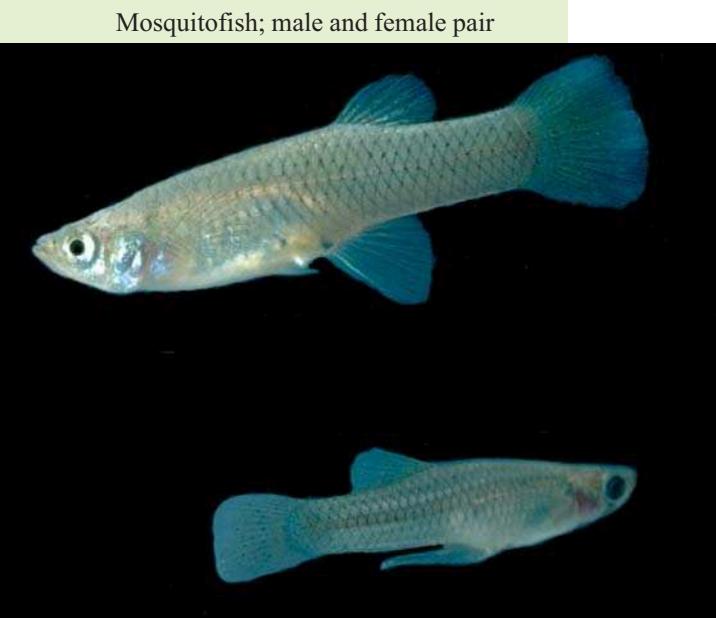


*Photo: The Nature Conservancy*

Miconia on a mountainside in Tahiti

## **Western Mosquitofish (*Gambusia affinis*)**

The mosquito fish is a small, harmless-looking fish native to the fresh waters of the eastern and southern United States. It has become a pest in many waterways around the world following initial introductions early last century as a biological control of mosquito. In general, it is considered to be no more effective than native predators of mosquitoes. The highly predatory mosquito fish eats the eggs of economically desirable fish and preys on and endangers rare indigenous fish and invertebrate species. Mosquito fish are difficult to eliminate once established, so the best way to reduce their effects is to control their further spread. One of the main avenues of spread is continued, intentional release by mosquito-control agencies.



*Photo: Bob McDowell*

## Small Indian Mongoose (*Herpestes javanicus* (*europunctatus*))

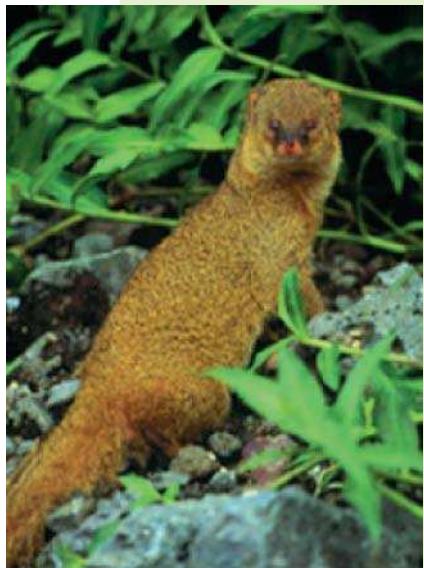


Photo: Jack Jeffrey Photography

This voracious and opportunistic predator is native to areas from Iran, through India to Myanmar and the Malay Peninsula. It was introduced to Mauritius and Fiji and to the West Indies and Hawai'i in the late 1800s to control rats. Unfortunately, this early attempt at biological control has had disastrous impacts. Island populations of native fauna, which had evolved without the threat of a fast-moving, mammalian predator, were no match for the mongoose. It has caused the local extinction of several endemic birds, reptiles and amphibians and threatens others including the rare Japanese Amami rabbit (*Pentalagus furnessi*). The small Indian mongoose is also a vector of rabies.

## Rosy wolfsnail (*Euglandina rosea*)

Native to the southeastern United States, the predatory rosy wolf snail was introduced to islands in the Pacific and Indian Oceans from the 1950s onwards as a biological control agent for another alien species, the giant African snail (*Achatina fulica*). The giant African snail was intended as a food source for humans but became an agricultural pest. In French Polynesia, the fast moving rosy wolf snail rapidly eliminated local endemic species. One group threatened by the rosy

wolf snail is the Partulid tree snails, which evolved separately from each other in isolated valleys and exhibit a variety of unique characteristics. Many Partulid tree snails have been lost already and today the survivors exist in zoos and in the world's first wildlife reserves for snails. This invasion by a biological control agent has caused a significant loss of biodiversity.



Photo: Jack Jeffrey Photography

## Water Hyacinth (*Eichhornia crassipes*)

This South American native is one of the worst aquatic weeds in the world. Its beautiful, large purple and violet flowers make it a popular ornamental plant for ponds. It is now found in more than 50 countries on five continents. Water hyacinth is a very fast growing plant, with populations known to double in as little as 12 days. Infestations of this weed block waterways, limiting boat traffic, swimming and fishing. Water hyacinth also prevents sunlight and oxygen from reaching the water column and submerged plants. Its shading and crowding of native aquatic plants dramatically reduces biological diversity in aquatic ecosystems.



Water hyacinth on Lake Victoria

Photo: Aquarius Systems, North Prairie, Wisconsin, USA

## Nile Perch (*Lates niloticus*)

The Nile perch was introduced to Lake Victoria, Africa in 1954 to counteract the drastic drop in native fish stocks caused by over-fishing. It has contributed to the extinction of more than 200 endemic fish species through predation and competition for food. The flesh of Nile perch is oilier than that of the local fish, so more trees were felled to fuel fires to dry the catch. The subsequent erosion and runoff contributed to increased nutrient levels, opening the lake up to invasions by algae and water hyacinth (*Eichhornia crassipes*). These invasions in turn led to oxygen depletion in the lake, which resulted in the death of more fish. Commercial exploitation of the Nile perch has displaced local men and women from their traditional fishing and processing work. The far-reaching impacts of this introduction have been devastating for the environment as well as for communities that depend on the lake.



Photo: Jens Bursell

**The Invasive Species Specialist Group (ISSG)** is a New Zealand-based specialist group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN). It is chaired by Dr Mick Clout (University of Auckland).

**The goals of ISSG** are to reduce threats to natural ecosystems and the native species they contain - by increasing awareness of alien invasions and of ways to prevent, control or eradicate them.

**The Global Invasive Species Database**, developed as part of GISP Phase I, managed by ISSG, is freely available online at [www.issg.org/database](http://www.issg.org/database) and mirrored at [www.invasivespecies.net/database](http://www.invasivespecies.net/database). Priorities range from a focus on some of the world's worst invasive species to a focus on areas where information and resources are comparatively scarce, including small-island developing states. The database has images and descriptions for a wide variety of invasive species. Records for these species include information on the ecology, impacts, distribution and pathways of the species, and most importantly, information on management methods as well as contact details of experts that can offer further advice. The database also provides links to numerous other sources of information.

**Aliens** is the bi-annual newsletter of the Invasive Species Specialist Group (ISSG). Its role is to put researchers, managers and/or practitioners in contact with each other and to publish information and news of alien invasive species and issues.

**Aliens-L** is a listserver dedicated to invasive species. It allows users to freely seek and share information on alien invasive species and issues, and the threats posed by them to the Earth's biodiversity. To subscribe, look for instructions on the ISSG website.

**Cooperative Initiative on Invasive Alien Species on Islands:** the aims of the Cooperative Initiative on Invasive Island Alien Species on Islands are: to enhance empowerment, capacity, cooperation and sharing of expertise in key areas of invasive alien species (IAS) management on islands; For more information, contact ISSG.

**IUCN Guidelines:** The IUCN Guidelines For The Prevention Of Biodiversity Loss Caused By Alien Invasive Species (As approved by 51<sup>st</sup> Meeting of Council, February 2000 ) can be obtained from the ISSG office, or <http://iucn.org/themes/ssc/pubs/policy/invasivesEng.htm>

**BioNET-INTERNATIONAL**, the Global Network for Taxonomy, is an initiative that promotes demand-driven capacity building in taxonomy to address sustainable development needs of developing countries. Comprised of a secretariat and nine, government-endorsed subregional LOOPs with a membership of institutions and individuals, BioNET helps coordinate and engage taxonomists, technology providers and others in the capacity building partnerships needed to address priority issues such as invasive alien species. *Why Taxonomy Matters* is a set of case studies, many of which highlight the contribution of taxonomy to IAS management (see: [www.bionet-intl.org/case\\_studies](http://www.bionet-intl.org/case_studies)).

**Websites:** Invasive Species Specialist Group: [www.issg.org](http://www.issg.org)

Global Invasive Species Database: [www.issg.org/database](http://www.issg.org/database)

IUCN-The World Conservation Union: [www.iucn.org](http://www.iucn.org)

The Global Invasive Species Programme: [www.GISP.org](http://www.GISP.org)

BioNET-INTERNATIONAL: [www.bionet-intl.org](http://www.bionet-intl.org)