Alien invasive species (AIS)

ACRONYMS AREAS COUNTRIES MARINE TERMS

DEFINITION

An alien species whose introduction and/or spread threaten biological diversity.

Convention on Biological Diversity (CBD) Secretariat 2000[1]

Note: 'Alien invasive species' is considered to be equivalent to 'invasive alien species'.

CBD Secretariat 2000[2]

NOTES ON DEFINITION

The Convention on Biological Diversity (CBD) provides definitions for both 'invasive alien species' and 'alien species'. It is worth noting that the International Union for Conservation of Nature (IUCN) definition of 'alien species' is equivalent to the CBD definition of 'invasive alien species'. The key element of both definitions is the threat that invasive alien species cause to biodiversity. The CBD definition highlights that not all 'alien species' go on to become 'invasive'.

While the CBD uses the term "alien species", some international, regional and national instruments also use the terms "exotic species", "non-indigenous species" or "non-native species" to have the same meaning [3].

FURTHER DEFINITIONS

IUCN Definition of 'alien species': An alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity.

IUCN 2000 [4]

Supporting definitions:

Alien species – A species, subspecies or lower taxon, introduced outside its natural past or present

distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce.

Convention on Biological Diversity (CBD) Guiding Principles COP 6 Decision VI/23, Annex, footnote i. to the Introduction. (2002) [1]

Native species – A species that has been observed in the form of a naturally occurring and self-sustaining population in historical times; “species” in the sense of this recommendation refers both to species and to lower taxonomic categories, subspecies, varieties, etc.

Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) Recommendation No. 57 to the 17th Meeting of the Bern Convention Steering Committee on the Introduction of Organisms belonging to Non-Native Species into the Environment (1997) [5]

Note: The Bern convention also uses the term “indigenous species” when referring to “native species”.

vector – Any living or non-living carrier that transports living organisms intentionally or unintentionally. [16]

KEY POINTS

- Invasive alien species can cause damage to the environment and potentially cause species extinction, modify ecosystem processes and act as disease vectors. The problems caused by invasive species have potentially large economic consequences.
- Not all alien species become invasive but often this results because the new environment does not contain the same ecological pressures as the original one. Thus the alien species can multiply without control.
- The introduction of invasive alien species has many different pathways including shipments of food, movements of biological materials; the pet and ornamental plant trade; and via humans movements. Ship ballast water is one of the key sources of marine invasive alien species.
- Invasive alien species prevention and management is included in the policies of multiple international conventions and agreements.

INTRODUCTION

When species are released into a novel environment they can become invasive and pose a serious problem. Invasive alien species, also known as non-native, exotic and non-indigenous [4], can cause huge damage to biodiversity and natural ecosystems.

DAMAGE CAUSED BY INVASIVE ALIEN SPECIES

Threats from invasive alien species include direct predation of native wildlife, competition for resources and ecosystem damage (e.g. through the removal of a key species such as a pollinator). Invasive species can have huge economic impact if they target commercial crop species, or indirectly influence them through effects such as soil destabilisation [6]. Invasive alien species have caused numerous extinctions, modified ecosystem processes and acted as disease vectors affecting both humans and other species [6]. The problems that invasive alien species cause have been shown to cost the global economy hundreds of billions of dollars a year [7] and the environmental harm caused is considered one of the greatest threats to the ecological well being of the planet [8].

WHY ARE SOME SPECIES INVASIVE?

Not all alien species are invasive. However, when species are taken out of their natural habitats they often lose their natural predators or control agents; this is known as “ecological release”. As a result, populations of the alien species are able to increase to levels which are potentially detrimental to the native environment [8]. While there is considerable research on the characteristics and traits which allow a species to become invasive, the reasons in individual cases may remain unclear. It has been found that the likelihood of alien species becoming invasive is increased if the species is introduced intentionally and cultivated over a long period, since it is more likely to become established and therefore invasive. In addition, if the species is a generalist, and/or is introduced into a new environment with similar climatic conditions to its origin, there is elevated risk of invasion [8]. Islands often have high levels of endemism and biodiversity not found in other parts of the world and are therefore at high risk from invasive alien species which can cause the extinction of a native species very quickly [7].

PATHS OF INVASION

Pathways, also referred to as vectors, are the means by which alien species are introduced to new environments. Depending on the ecosystem, there are likely to be a number of different pathways for the introduction of alien species. Common pathways include shipping (ballast water, boat hulls and shipping containers), the accidental or intentional introduction of species from agricultural or aquaculture activities and the escape of species introduced to a new environment. Pathways will vary between countries and will need to be identified in order to be effectively addressed [9].

Pathways are categorized as per the classification recognized by the Convention on Biological Diversity, comprising release; escape; contaminant; stowaway; corridor; unaided [17], [18].

EXAMPLES OF INVASIVE ALIEN SPECIES

Below are some of the many documented examples of invasive alien species. These species are all highlighted by IUCN’s report on 100 of the world’s worst invasive alien species [6].

Mammal: Small Indian mongoose

A classic example of a very problematic invasive alien species is the small Indian mongoose (*Herpestes javanicus (auropunctatus)*). The small Indian mongoose is native western, southern and southeastern Asia. It was introduced to control rats, a previously released invasive alien species, in areas such as Fiji, the West Indies and Hawai’i. As a direct predator, it has caused a number of extinctions of endemic birds, reptiles and amphibians. It also carries rabies [6].

Insect: Yellow crazy ant

The yellow crazy ant (*Anoplolepis gracilipes*) was introduced into Christmas Island and within 18 months had killed 3 million land crabs, despite only having invaded 5% of the forest. The crabs play a key role within the Christmas Island forest ecosystem and the ecosystem was significantly altered by the introduction of the ant [6]. The invasive alien species is poorly studied but is thought to have originated from Africa or Asia [10].

Amphibian: American Bull Frog

Another example of an invasive alien species as a predator and disease vector is the American bull frog (*Lithobates catesbeianus*) which has been imported as a food source from eastern North-America and was historically intentionally released as a bio-control agent. It is known to have been introduced in over

40 countries in the last century including Mexico, Hawaii, Japan, Italy and Canada [10]. This species is now a major economic and environmental pest causing the decline in populations of endangered amphibians and other fauna and also facilitating the spread of a fungus which is lethal to many amphibians (*Chytridiomycosis*) [11].

Plant: Water hyacinth

Plants also act as invasive alien species and the water hyacinth (*Eichhornia crassipes*) is now found in more than 50 countries in freshwater systems. The plant is thought to have originated in western Brazil. It blocks waterways, obstructing boats, fishing and swimming. It also changes ecosystems by preventing sunlight and oxygen from reaching submerged native plants and dramatically altering biodiversity [6].

Marine species: Comb jellyfish and Zebra mussel

In the marine environment, invasive alien species thought to have been introduced through ballast water, include the introduction of a comb jellyfish (*Mnemiopsis leidyi*) into the Black Sea, from eastern America, which contributed to fisheries collapse. Its native range was restricted to the temperate to subtropical estuaries along the Atlantic coast of north and south America. Another example was the Zebra mussel (*Dreissena polymorpha*), native to the Black Sea, which now causes huge economic damage in America through fowling of vessels and infrastructure and displacement of native species [12].

MULTILATERAL ENVIRONMENTAL AGREEMENTS AND STANDARDS

The huge harm that invasive alien species can do has resulted in legislation and policy on both an international and a national level.

The Convention on Biological Diversity mentions invasive alien species directly and devotes a number of decision documents to this subject. The Convention has a number of thematic programme areas associated with major global biomes, with associated cross-cutting work themes, one of which is invasive alien species.

A number of other Multilateral Environmental Agreements (MEAs) such as the The Convention on Trade in Endangered Species (CITES), The Convention on Migratory Species (CMS), and, the World Heritage Convention all have resolutions or decisions relating to invasive alien species.

The EU Wildlife Trade Regulations also lists in Annex B species which could constitute an ecological threat to wild indigenous fauna and flora [13]. However, as there have been questions about the appropriateness of using the EU Wildlife Trade Regulations to deal with the problem of invasive alien species, the EU is currently considering a dedicated legal instrument to deal with the issue [3].

The International Maritime Organisation (IMO) adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments which is not yet in force as it is awaiting ratification by the required number of states. The aim of the Convention is to prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens, which may become invasive alien species, through the control and management of ships' ballast water and sediments.

Many countries have national legislation controlling the movement of biological material for the purposes of avoiding the spread of invasive alien species. For example, The Hazardous Substances and New Organisms Act passed in New Zealand in 1996 aims to prevent harmful diseases and species arriving in New Zealand [14]. Legislation in the UK makes it an offence to cause the spread of certain known invasive alien species under the Wildlife and Countryside Act (1981). Nationally implemented regulations such as these highlight the importance of understanding restrictions within national borders

as well as across them. Globally, there are many species which are banned from import because of their known invasive behaviour in other parts of the world. Seven taxa have been banned from import into the EU on this basis [13].

Financial performance standards also refer to invasive alien species. The International Finance Corporation's (IFC) Performance Standard 6 recognises the presence of these species are pertinent to the definition of modified habitat and associated with the requirements for site management bio-control measures [15].

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The red lionfish (Pterois volitans), an alien invasive species in the Caribbean. Vudhikrai/Shutterstock.com

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Key terms: In depth

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