The IUCN Red List and invasive alien species: an analysis of impacts on threatened species and extinctions

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SSC Species Survival Commission

ISSG Invasive Species Specialist Group

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Executive summary

This report presents a simple analysis of the threats posed by invasive alien species (IAS) according to the IUCN Red List of Threatened Species™ (v2016.3). This analysis will be repeated and expanded upon in early 2021 using the most recent version of the IUCN Red List.

We have used IUCN Red List data (v. 2016.3) incorporating assessments for 85,604 species, including 33,115 species from comprehensively assessed groups, to understand how the threats posed by IAS compare to other threat categories, and how IAS threats differ across geographic regions and habitat types. We also identify the IAS most commonly associated with threatened species and species extinctions.

When looking at only the comprehensively assessed groups (i.e. all species assessed), we found that IAS are a major threat, impacting 25.5% of species assessed as threatened (i.e. Critically Endangered, Endangered, and Vulnerable). Only biological resource use, agriculture and aquaculture, and residential and commercial development affect more species, 68.5%, 63.5%, and 34.9% respectively. However, IAS are associated with the extinction (Extinct, or Extinct in the Wild) of more species than any other threat category, being a driver in 56.7% of all known extinctions. The closest other threat categories are biological resource use (46.4% of species extinctions), and agriculture and aquaculture (22%). In addition, IAS are the **only threat** attributed to 16% of all species extinctions.

Antarctica, North America and Oceania have the highest proportion of threatened species impacted by IAS; with 52%, 41.1%, and 38.8% respectively. Whereas, Oceania and the Caribbean Islands have the highest proportion of extinctions associated with IAS; with 60.9% and 43.9% respectively.

Habitats within the marine environment support the greatest proportion of threatened species impacted by IAS, the highest being *marine neritic* at 40.2%, *marine coastal/supratidal* 39%, and *marine oceanic* 39%. However this may be biased by the generic listing of IAS as a potential threat to all reef-building corals. Whereas, it is the terrestrial habitats that hold the highest proportion of extinctions associated with IAS, the highest being *caves and subterranean habitats* with 100%, followed by *shrubland* 85.5%, and *forest* 75.7%.

The IUCN Red List contains 791 IAS named at the species level (419 animals, 346 plants, 11 chromista, 9 bacteria, 6 fungi, 2 protozoa) coded as a threat. Of these, 564 IAS are listed as impacting threatened species, and 63 are listed against species that are Extinct or Extinct in the Wild. In terms of IAS most commonly associated with species extinctions, we found that rats (*Rattus* spp.), and the domestic cat (*Felis catus*) have been a (co-)driver of 95 and 73 species extinctions respectively, more than any other IAS. They are closely followed by the rosy wolfsnail (*Euglandina rosea*) which is linked to 43 species extinctions, goat (*Capra hircus*) 25 extinctions, and pigs (*Sus domesticus*). In terms of impacts to threatened species, rats and cats are again the top 2 IAS impacting 740 and 433 threatened species respectively. However, the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is third impacting 414 threatened species.

Contents

Data and methods

The IUCN Red List of Threatened Species™ is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species. The IUCN Red List Categories and Criteria (IUCN 2012) are used to classify a taxons risk of extinction using quantitative thresholds across five separate criteria (Figure 1). The criteria can be applied to any taxonomic unit at or below the species level. There is also sufficient range among the different criteria to enable the appropriate listing of taxa from the complete taxonomic spectrum, with the exception of micro-organisms (IUCN 2012).

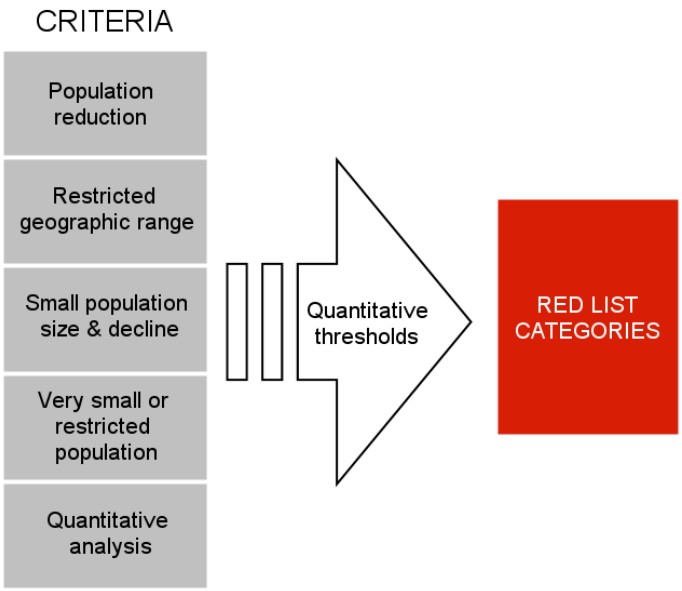

Figure 1. IUCN Red List criteria

The application of the IUCN Red List Categories and Criteria helps in the determining the relative risk of extinction across taxonomic groups, and identifying if a species is Extinct, threatened (Critically Endangered, Endangered or Vulnerable), Near Threatened, of Least Concern, or lacking sufficient basic data for assessment (Data Deficient) (Figure 2). The IUCN Red List also provides basic information on species taxonomy, distributions, habitat and ecology, threats, population trends, use and trade, and research and conservation priorities. The results of IUCN Red List assessments are published on www.iucnredlist.org.

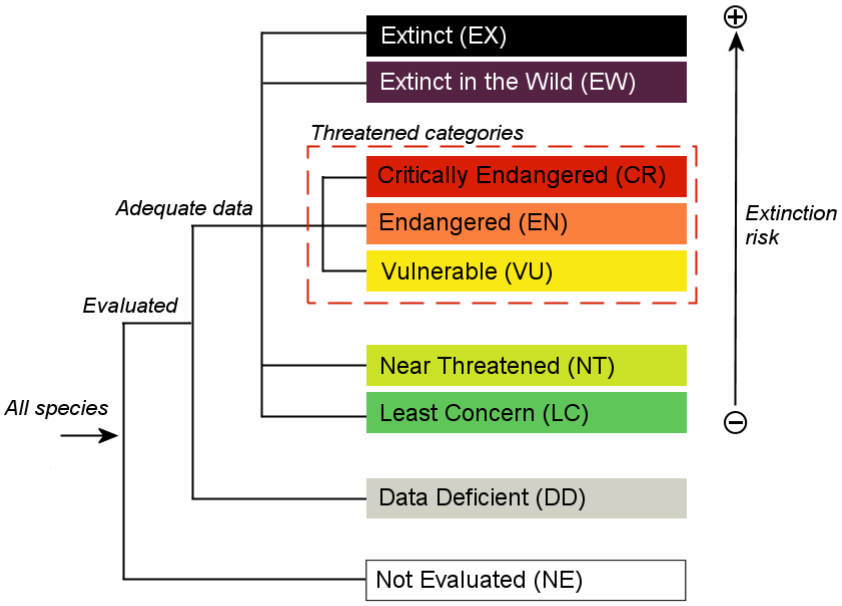

Figure 2. IUCN Red List categories

The IUCN Red List adopts the use of standardised **classification schemes**, to allow the underlying data to be analysed, and to ensure uniformity when describing the habitat in which a taxon occurs, the threats to a taxon, what conservation actions are in place or are needed, and whether or not the taxon is utilized. In terms of direct threats posed to a taxa, each Red List assessment records the threats according to the Threats Classification Scheme (Version 3.2)[1]. There are 12 separate threat categories, and the category (and sub-categories) that address invasive alien species is listed below. Note that only sub-categories 8.1 Invasive non-native/alien species/diseases is relevant for this analysis, as the other sub-categories cover problematic species, genes or disease that are not non-native/alien in origin. Where possible the IAS that is impacting a species is named as part of the Red List assessment (threat code 8.1.2.), this can be at a higher taxonomic level if the IAS (species level) is not known, e.g. as 'Herpestidae sp.', or 'Rattus sp.'.

8 Invasive & other problematic species, genes & diseases

- 8.1 Invasive non-native/alien species/diseases
  - 8.1.1 Unspecified species
  - 8.1.2 Named species
- 8.2 Problematic native species/diseases
  - 8.2.1 Unspecified species
  - 8.2.2 Named species
- 8.3 Introduced genetic material
- 8.4 Problematic species/diseases of unknown origin
  - 8.4.1 Unspecified species
  - 8.4.2 Named species

[1] The full Threats Classification Scheme (Version 3.2) can be found here: https://www.iucnredlist.org/resources/threat-classification-scheme

- 8.5 Viral/prion-induced diseases
  - 8.5.1 Unspecified "species" (disease)
  - 8.5.2 Named "species" (disease)
- 8.6 Diseases of unknown cause

We queried the IUCN Red List v2016.3 (IUCN 2016) and downloaded relevant data for all 85,604 species assessed. Then filtering for species that are part of a comprehensively assessed 'group' (with more than 150 species, see Table 1, and Annex I) totalling 33,115 species in total, we identified the % of all species, threatened species (CR, EN, VU), and extinction species (EX, EW) coded to each category of the threats classification scheme. Only comprehensively assessed taxa have been included in this part of the analysis to avoid bias resulting from taxa where only certain regions have been assessed, or from taxa where only those species perceived to be threatened have so far been assessed.

Table 1. Comprehensively assessed groups (>150 species)

Vertebrates	Invertebrates	Plants
Mammals	Freshwater crabs	Conifers
Birds	Freshwater crayfish	Cycads
Amphibians	Freshwater caridean shrimps	
Chameleons	Lobsters	
Sharks and rays	Cone snails	
Blennies	Reef-building corals	
Pufferfish		
Wrasses & parrotfishes		

*See Annex I for the taxonomic groups included within these taxa.

Then using data for all species on the IUCN Red List (85,604 species) we identified how IAS affect species across different geographic regions, and habitats[2]. We also identified which named IAS are most commonly recorded as impacting threatened species (CR, EN, VU), and extinctions (EX/EW).

Results and discussion

1. Threats to comprehensively assessed taxa

In relation to **all** comprehensively assessed species *biological resource use* is coded as a threat to more species than any other threat type, affecting 33.7% of species, followed by *agriculture and aquaculture* at 26.2% (Figure 1, Table 2). Whereas *IAS*[3] is ranked fifth overall, being coded as a threat to 10.2% of all species.

IAS are driving many species to a higher level of extinction risk, impacting 25.5% of species assessed as **threatened** (i.e. Critically Endangered, Endangered, and Vulnerable) (Figure 1, Table 2). Only *biological resource use*, *agriculture and aquaculture*, and *residential and commercial development* affect more threatened species; 68.5%, 63.5%, and 34.9% respectively.

[2] IUCN Red List Habitats Classification scheme https://www.iucnredlist.org/resources/habitat-classification-scheme

[3] IAS = Only threats coded as 8.1 *Invasive non-native/alien species/diseases*, i.e. this analysis excludes threats coded to 8.2, 8.3, 8.4 and 8.5 which are threats that are not of non-native/alien in origin.

However, *IAS* are associated with the **extinction** (i.e. Extinct, or Extinct in the Wild) of more species than any other threat category, being a (co-)driver in 56.7% of all known extinctions from the comprehensively assessed taxa. The closest other threat categories are *biological resource use* (46.4%), and *agriculture and aquaculture* (22%).

In fact *IAS* are the **only threat** attributed to 16% of all species extinctions (Figure 2), highlighting the major role IAS play in species extinctions.

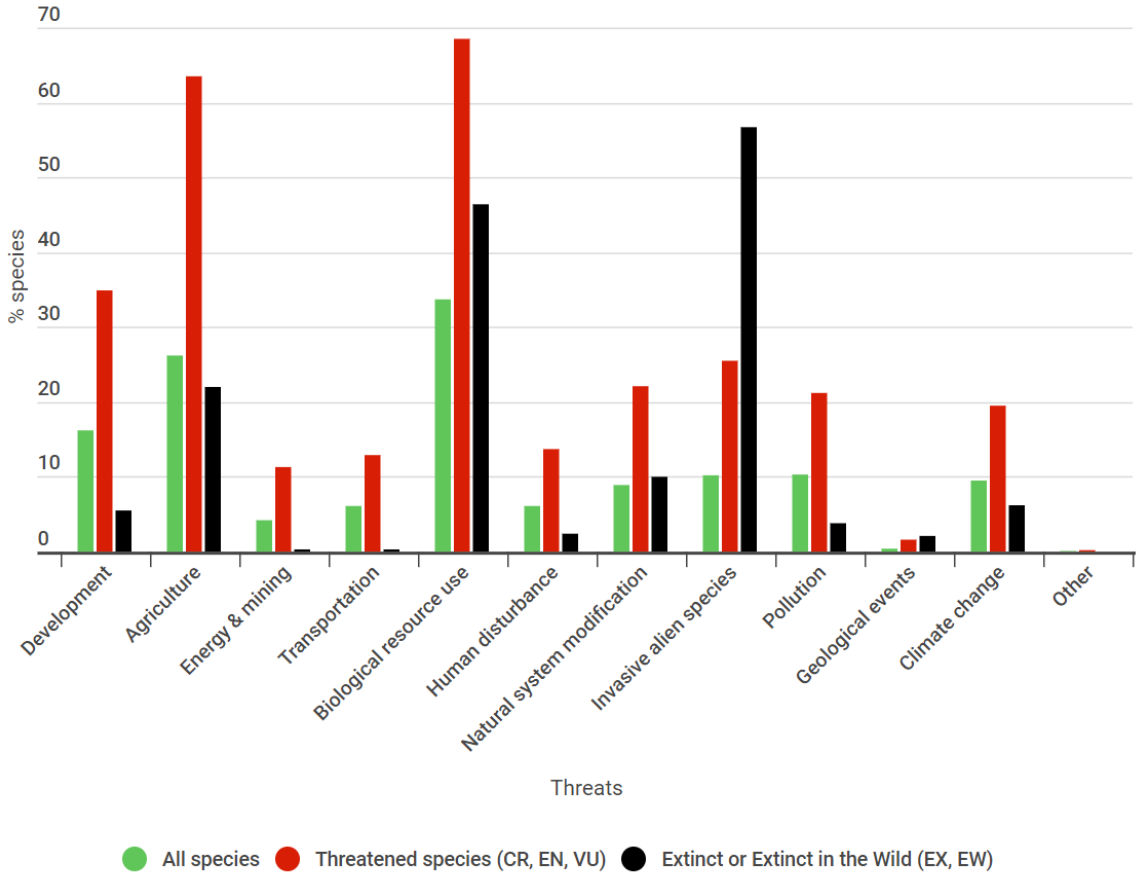

*Figure 1. Threats recorded to **all comprehensively assessed taxa** listed on the IUCN Red List (n=33,115)*

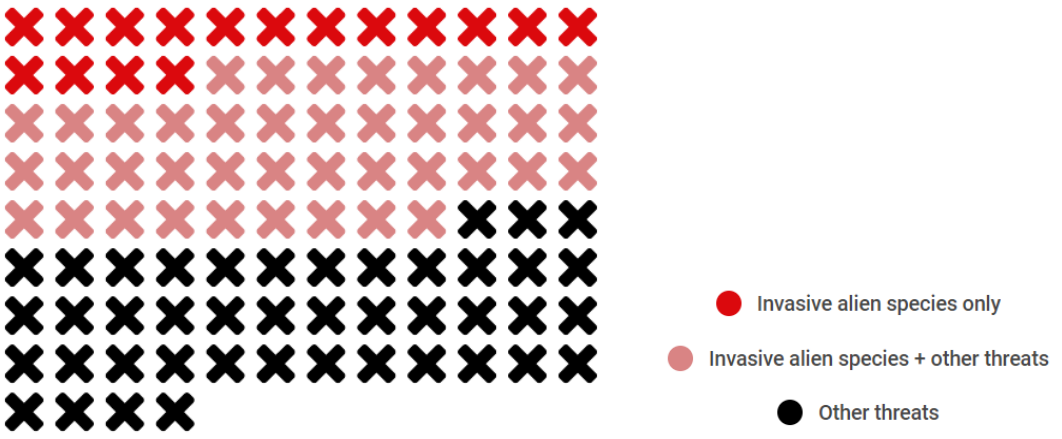

Figure 2. Proportion of species extinctions associated with IAS

*Table 2. Threats recorded to **all comprehensively assessed taxa** listed on the IUCN Red List (n=33,115)*

Note that only the sub-categories under threat code 8 have been expanded. Those threat codes in grey have been excluded so that the threats posed only by invasive alien species can be identified.

Code	Threat	ALL spp	% ALL	Rank ALL	Thr spp	% Thr	Rank Thr	EX/EW	% EX/EW	Rank EX/EW
1	**Residential & commercial development**	5,375	16.2	3.0	2,323	34.9	3.0	16	5.5	6.0
2	**Agriculture & Aquaculture**	8,675	26.2	2.0	4,229	63.5	2.0	64	22.0	3.0
3	**Energy production & mining**	1,393	4.2	10.0	752	11.3	10.0	1	0.3	10.0
4	**Transportation and service corridors**	2,011	6.1	9.0	859	12.9	9.0	1	0.3	10.0
5	**Biological resource use**	11,169	33.7	1.0	4,558	68.5	1.0	135	46.4	2.0
6	**Human intrusions & disturbance**	2,028	6.1	8.0	914	13.7	8.0	7	2.4	8.0
7	**Natural system modification**	2,948	8.9	7.0	1,474	22.1	5.0	29	10.0	4.0
8	**Invasive & other problematic species & genes**	3,917	11.8		1,948	29.3		169	58.1	
8.1	Invasive non-native/alien species	3,384	10.2	5.0	1,698	25.5	4.0	165	56.7	1.0
8.2	Problematic native species	1,520	4.6		610	9.2		16	5.5	
8.3	Introduced genetic material	34	0.1		9	0.1		0	0.0	
8.4	Problematic species/diseases of unknown origin	213	0.6		80	1.2		1	0.3	
8.5	Viral/prion-induced disease	148	0.4		79	1.2		3	1.0	
8.6	Diseases of unknown cause	15	0.0		9	0.1		0	0.0	
9	**Pollution**	3,409	10.3	4.0	1,411	21.2	6.0	11	3.8	7.0
10	**Geological events**	140	0.4	11.0	106	1.6	11.0	6	2.1	9.0
11	**Climate change & severe weather**	3,137	9.5	6.0	1,297	19.5	7.0	18	6.2	5.0
12	**Other**	29	0.1	12.0	12	0.2	12.0	0	0.0	12.0
	Total species	33,115			6,657			291		

2. IAS impacts across regions

The impacts from IAS differ across land regions. The regions with the highest proportion of threatened species impacted by IAS is *Antarctica* with 52% (22 of 42 threatened species), followed by *North America* 41.1% (637 of 1,548 threatened species), and *Oceania* 38.4% (873 of 2,274 threatened species) (Figure 3). IAS are recorded as a driver of more than 40% of extinctions for two regions; *Oceania* 60.9% (123 of 202 EX/EW species), and *Caribbean Islands* 43.9% (25 of 57 EX/EW species), highlighting the vulnerability of endemic island biodiversity to the impacts from IAS (Figure 3).

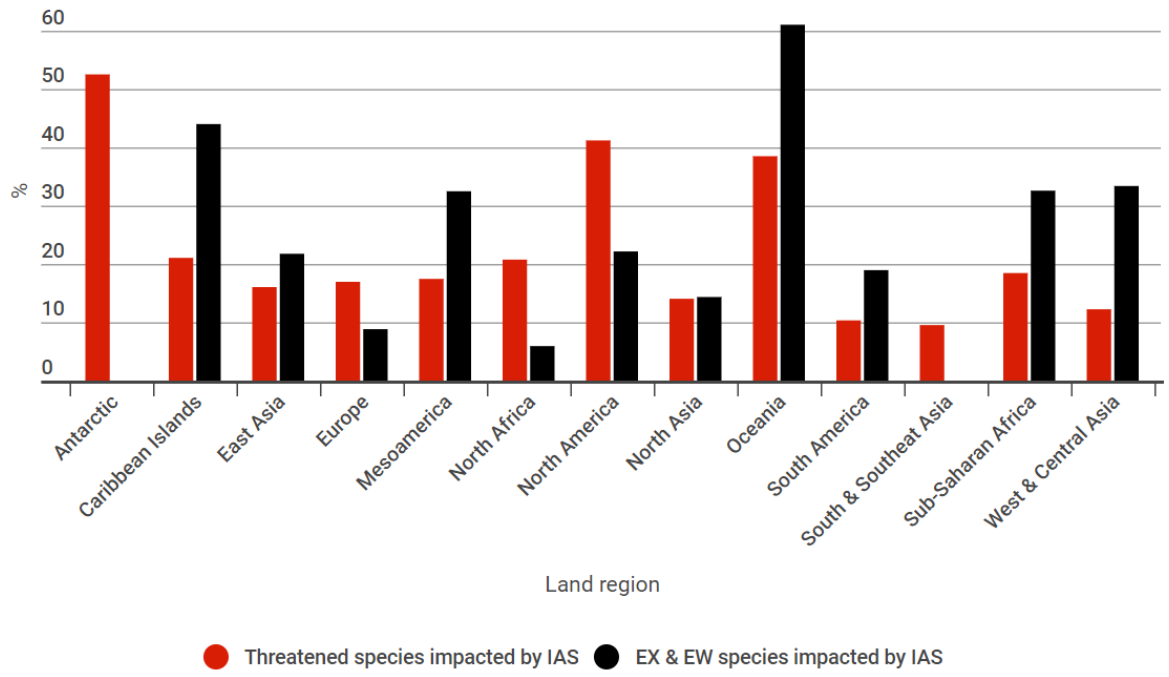

Figure 3. Percent of threatened and EX/EW species on the IUCN Red List that are impacted by IAS by land region.

3. IAS impacts across habitats

In terms of impacts of IAS to threatened species across the major habitat types, the marine environment is by far the most impacted. The top habitat types with the highest percentage of threatened species associated with impacts from invasive alien species are *marine neritic* at 40.2% (380 of 945 threatened species), *marine coastal/supratidal* 39% (169 of 433 threatened species), *marine oceanic* 39% (85 of 218 threatened species), and *marine intertidal* 29.3% (86 of 294 threatened species). However, it is important to note that the majority of the marine species that are threatened are reef building corals. All of which had the same six potential threats listed (Polidoro 2011): climate change (with temperature rise and ocean acidification the greatest threat), eutrophication, physical disturbance, overfishing, loss of habitat, sedimentation and competition and IAS (predation by crown-of-thorns starfish). Therefore this will introduce a probable bias into the dataset and overestimate the level of threat posed in the marine realm (SPREP 2016).

In relation to species extinctions associated with IAS, the habitats with highest proportion of Extinct or Extinct in the Wild species recorded as being impacted by IAS are from the terrestrial realm; *caves*

and subterranean habitats 100% (3 of 3 EX/EW species), followed by *shrubland* 85.5% (53 of 62 EX/EW species), *forest* 75.7% (181 of 239 EX/EW species), and *desert* 71.4% (10 of 14 EX/EW species) (Figure 5).

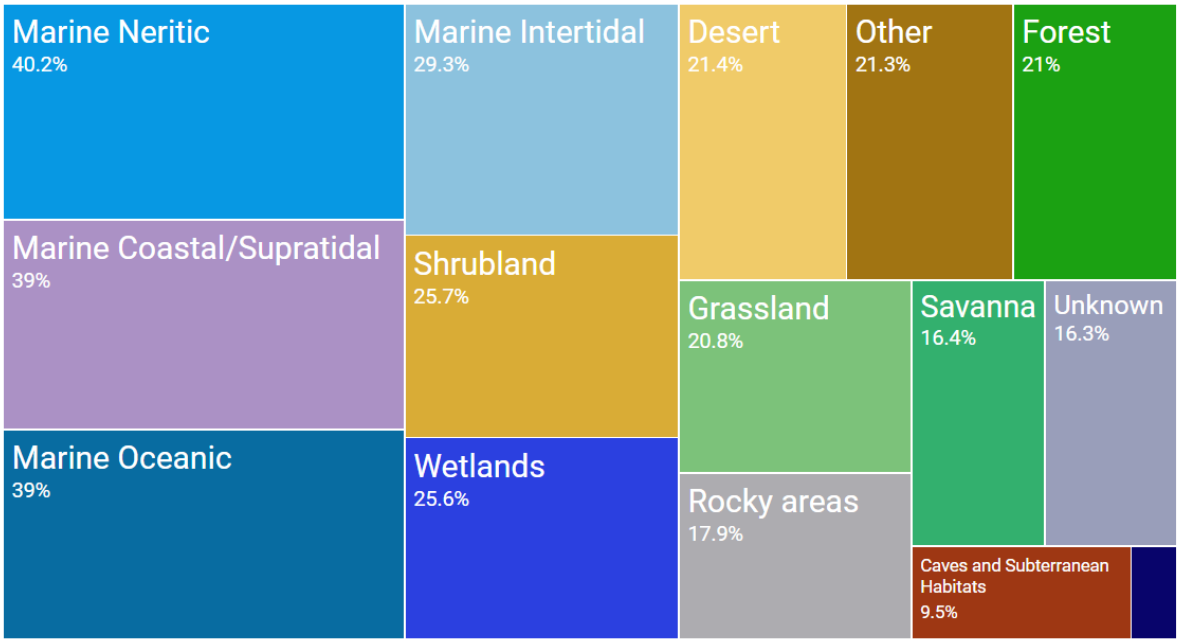

Figure 4. Percent of threatened species that are impacted by IAS, by habitat type.

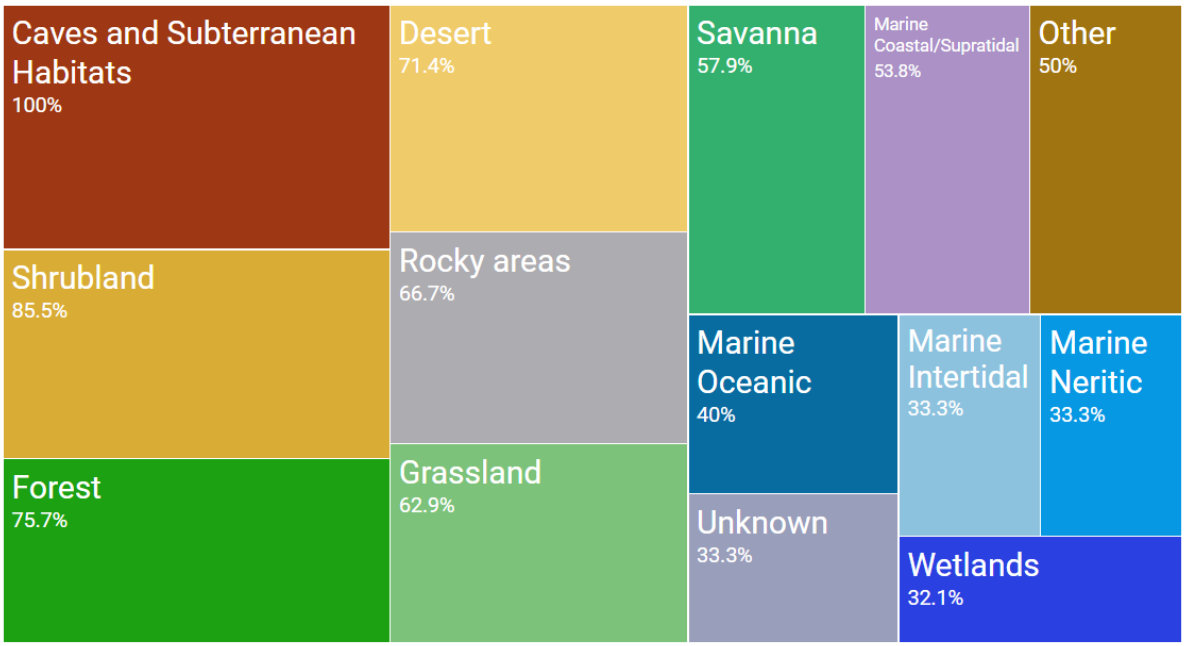

Figure 5. Percent of EX/EW species that are impacted by IAS, by habitat type.

4. Named IAS impacting threatened species and extinctions

The IUCN Red List (v2016.3) contains 791 IAS named at the species level (419 animals, 346 plants, 11 chromista, 9 bacteria, 6 fungi, 2 protozoa) coded as a threat under 8.1.2. Of these, 564 IAS are listed as impacting threatened species, and 63 are listed against species that are Extinct or Extinct in the Wild. Table 3 presents these named IAS by higher taxonomy. As noted above the IAS impacting a species cannot always be identified at a species level, therefore there are a number of higher taxonomic levels also recorded.

Tables 4 and 5 present the named IAS, including those listed at both a species level and at a higher taxonomy, that are most commonly recorded as a threat to species assessed on the IUCN Red List (v2016.3). In terms of IAS most commonly associated with species extinctions, rats (*Rattus* spp.), and the domestic cat (*Felis catus*) have been a (co-)driver of 95 and 73 species extinctions respectively, more than any other IAS. They are closely followed by the rosy wolfsnail (*Euglandina rosea*) which is linked to 43 species extinctions, goat (*Capra hircus*) 25 extinctions, and pigs (*Sus domesticus*). In terms of impacts to threatened species, rats and cats are again the top 2 IAS impacting 740, and 433 threatened species respectively. However, the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is third impacting 414 threatened species.

Table 3. Number of IAS named at the species level (i.e. excludes IAS named at a higher taxonomy), listed as a threat to native species on the IUCN Red List.

ANIMALIA	**419**
ARTHROPODA	**72**
ARACHNIDA	3
CHILOPODA	1
INSECTA	55
MALACOSTRACA	12
MAXILLOPODA	1
CHORDATA	**308**
ACTINOPTERYGII	126
AMPHIBIA	13
AVES	53
CEPHALASPIDOMORPHI	1
MAMMALIA	89
REPTILIA	26
CTENOPHORA	**1**
TENTACULATA	1
ECHINODERMATA	**1**
ASTEROIDEA	1
MOLLUSCA	**31**
BIVALVIA	7
GASTROPODA	24
NEMATODA	**4**
SECERNENTEA	4
PLATYHELMINTHES	**2**

CESTODA	1
TURBELLARIA	1
BACTERIA	**9**
ACTINOBACTERIA	**1**
ACTINOBACTERIA	1
FIRMICUTES	**3**
BACILLI	1
CLOSTRIDIA	1
ERYSIPELOTRICHIA	1
PROTEOBACTERIA	**5**
ALPHAPROTEOBACTERIA	1
GAMMAPROTEOBACTERIA	4
CHROMISTA	**11**
APICOCOMPLEXA	**3**
ACONOIDASIDA	1
CONOIDASIDA	2
OCHROPHYTA	**2**
BACILLARIOPHYCEAE	1
PHAEOPHYCEAE	1
OOMYCOTA	**6**
PERONOSPOREA	6
FUNGI	**6**
ASCOMYCOTA	**3**
NOT ASSIGNED	1
SORDARIOMYCETES	2
BASIDIOMYCOTA	**1**
PUCCIONIOMYCETES	1
CHYTRIDIOMYCOTA	**1**
CHYTRIDIOMYCETES	1
MICROSPORIDIA	**1**
DIHAPLOPHASEA	1
PLANTAE	**346**
BRYOPHYTA	**2**
BRYOPSIDA	2
CHLOROPHYTA	**2**
BRYOPSIDOPHYCEAE	2
TRACHEOPHYTA	**342**
LILIOPSIDA	89
MAGNOLIOPSIDA	231
PINOPSIDA	8
POLYPODIOPSIDA	14
PROTOZOA	**2**
CLIOPHORA	**1**
OLIGOHYMENOPHOREA	1
EUGLENOZOA	**1**
KINETOPLASTEA	1

Table 4. Named IAS listed as impacting more than 5 Extinct or Extinct in the wild species.

IAS named	No. EX/EW species
Rattus spp.	**95**
Rattus unspecified	49
R. rattus	30
R. exulans	8
R. norvegicus	8
Felis catus	**73**
Euglandina rosea	**43**
Capra hircus	**25**
Sus domesticus	**22**
Canis familiaris	**13**
Herpestidae spp.	**13**
Herpestidae unspecified	5
H. auropunctatus	4
H. javanicus	4
Oryctolagus cuniculus	**12**
Batrachochytrium dendrobatidis	**9**
Vulpes vulpes	**9**
Boiga irregularis	**7**
Ovis aries	**7**
Cinnamomum verum	**6**

Table 5. Named IAS listed as impacting more than 50 threatened species.

IAS named	No. threatened species
Rattus spp.	**740**
Rattus unspecified	276
R. rattus	295
R. exulans	105
R. norvegicus	63
Felis catus	**433**
Batrachochytrium dendrobatidis	**414**
Sus spp.	**489**
Sus domesticus	325
S. scrofa	105
Capra hircus	**352**
Formicidae spp.	**237**
Wasmannia auropunctata	68
Anoplolepis gracilipes	55
Cinnamomum verum	203
Cervidae	201
Cervidae unspecified	78
Rusa timorensis	63
Canis familiaris	149
Salmonidae spp.	137
Salmonidae unspecified	63
Herpestes spp.	123
H. auropunctatus	53

Psidium cattleianum	95
Euglandina rosea	83
Bos taurus	80
Lates niloticus	79
Oryctolagus cuniculus	78
Vulpes vulpes	77
Lantana camara	63
Clidemia hirta	60
Platydemus manokwari	57
Achatina fulica	56
Eucalyptus spp.	54
Gallus gallus ssp. domesticus	51

Future analysis

In early 2021 this analysis will be updated, and expanded, using the most recent version of the IUCN Red List (currently v2020.2) with the intention of publishing the results in a peer review journal. This future work will focus only on all comprehensively assessed groups (>150 species), and will aim to identify the threats posed by IAS (incl. named IAS) at a global level but also across different taxonomic groups, habitats, regions and countries. It will also identify differing levels of 'threat impact' (timing / scope / severity - according to the Red List threat classification scheme) from individual IAS, where this information is recorded.

References

IUCN. (2012). IUCN Red List Categories and Criteria: Version 3.1. Second edition. Gland, Switzerland and Cambridge, UK: IUCN. iv + 32pp.

IUCN. (2016). The IUCN Red List of Threatened Species. Version 201632. https://www.iucnredlist.org

Polidoro B.A., Elfes C.T., Sanciangco J.C., Pippard H. and Carpenter K.E. (2011). Conservation Status of Marine Biodiversity in Oceania: An Analysis of Marine Species on the IUCN Red List of Threatened Species. *Journal of Marine Biology,* 2011:247030. doi. org/10.1155/2011/247030.

SPREP. (2016). State of Conservation in Oceania: regional report. 2013. Pacific Regional Environment Programme (SPREP).

Annex 1. Comprehensively assessed taxa IUCN Red List 2016.3

Below lists the taxonomic groups that have been comprehensively assessed for the IUCN 2016.3. those taxonomic groups listed in green have more than 150 species, those in red have less than 150 species. Only the green taxonomic groups (>150 species) have been included in this analysis.

CLASSES

Mammals - "MAMMALIA"

Birds - "AVES"

Amphibians - "AMPHIBIA"

Sharks and rays - "CHONDRICHTHYES"

Hagfishes - MYXINI

Conifers - PINOPSIDA

Cycads - CYCADOPSIA

ORDERS

Sturgeon - "ACIPENSERIFORMES"

Tarpons & ladyfishes - "ELOPIFORMES"

FAMILIES

Chameleons Family: "CHAMAELEONIDAE"

Groupers - "EPINEPHELIDAE" ["EPINEPHELIDAE" or "LABRIDAE" or "ACANTHURIDAE" or "TETRAODONTIDAE" or "POMACANTHIDAE" or "CHAETODONTIDAE"]

Wrasses & parrotfishes - "LABRIDAE"

Surgeonfishes - "ACANTHURIDAE"

Pufferfishes - "TETRAODONTIDAE"

Angelfishes (86 spp) - "POMACANTHIDAE"

Butterfly fishes (128 spp) - "CHAETODONTIDAE"

Tunas and billfishes - "SCOMBRIDAE" or "ISTIOPHORIDAE" or "XIPHIIDAE"

Blennies - "BLENNIIDAE" or "CHAENOPSIDAE" or "CLINIDAE" or "DACTYLOSCOPIDAE" or "LABRISOMIDAE" or "TRIPTERYGIIDAE"

Seabreams, porgies & picarels - "SPARIDAE" or "CENTRACANTHIDAE"

Freshwater crabs - "GECARCINUCIDAE" Or "POTAMIDAE" Or "POTAMONAUTIDAE" Or "PSEUDOTHELPHUSIDAE" Or "TRICHODACTYLIDAE"

Freshwater crayfish - "ASTACIDAE" or "CAMBARIDAE" or "PARASTACIDAE"

Freshwater caridean shrimps - "ALPHEIDAE" or "ATYIDAE" or "DESMOCARIDIDAE" or "EURYRHYNCHIDAE" or "PALAEMONIDAE" or "TYPHLOCARIDIDAE" or "XIPHOCARIDIDAE"

Lobsters - "GLYPHEIDAE" Or "POLYCHELIDAE" Or "NEPHROPIDAE" Or "ENOPLOMETOPIDAE" Or "PALINURIDAE" Or "SCYLLARIDAE"

Cacti - "CACTACEAE"

GENUS

Cone snails - "Conus"

COMBINATIONS ACROSS TAXONOMIC HIERARCHY

Seasnakes

Family: "ELAPIDAE", genera: "Acalyptophis" Or "Aipysurus" Or "Astrotia" Or "Emydocephalus" Or "Enhydrina" Or "Ephalophis" Or "Hydrelaps" Or "Hydrophis" Or "Kerilia" Or "Kolpophis" Or "Lapemis" Or "Laticauda" Or "Parahydrophis" Or "Pelamis" Or "Thalassophina" Or "Thalassophis". AND
Family: "ACROCHORDIDAE", genus: "Acrochordus" AND
Family: "HOMALOPSIDAE" AND
Family: "NATRICIDAE", genus: "Anoplohydrus"

Reef-building corals -

Class: "HYDROZOA"
OR

Order: "HELIOPORACEA"
OR
Familes: "ACROPORIDAE" Or "AGARICIIDAE" Or "ASTROCOENIIDAE" Or "EUPHYLLIDAE" Or "FAVIIDAE" Or "FUNGIIDAE" Or "MEANDRINIDAE" Or "MERULINIDAE" Or "MUSSIDAE" Or "OCULINIDAE" Or "PECTINIIDAE" Or "POCILLOPORIDAE" Or "PORITIDAE" Or "RHIZANGIIDAE" Or "SIDERASTREIDAE" Or "TRACHYPHYLLIIDAE" Or "TURBINOLIIDAE"
OR
Genera: "Heterocyathus" Or "Balanophyllia" Or "Duncanopsammia" Or "Heteropsammia" Or "Turbinaria"

Seagrasses (70 or 72 spp)

Family: "CYMODOCEACEAE" OR "POSIDONIACEAE" OR "ZOSTERACEAE"
OR
Genera: "Enhalus"or "Halophila" or "Thalassia"or "Ruppia" or "Lepilaena"

Mangrove ecosystem plants - 68 species

friendly name (two lines to fit):
Acanthus ebracteatus Or "Acanthus ilicifolius" Or "Acanthus volubilis" Or "Avicennia alba" Or "Avicennia bicolor" Or "Avicennia germinans" Or "Avicennia integra" Or "Avicennia marina" Or "Avicennia officinalis" Or "Avicennia rumphiana" Or "Avicennia schaueriana" Or "Dolichandrone spathacea" Or "Tabebuia palustris" Or "Conocarpus erectus" Or "Laguncularia racemosa" Or "Lumnitzera littorea" Or "Lumnitzera racemosa" Or "Excoecaria agallocha" Or "Excoecaria indica" Or "Cynometra iripa" Or "Mora oleifera" Or "Pemphis acidula" Or "Sonneratia alba" Or "Sonneratia apetala" Or "Sonneratia caseolaris" Or "Sonneratia griffithii" Or "Sonneratia lanceolata" Or "Sonneratia ovata" Or "Brownlowia argentata" Or "Brownlowia tersa" Or "Camptostemon philippinense" Or "Camptostemon schultzii" Or "Heritiera fomes" Or "Heritiera globosa" Or "Heritiera littoralis" Or "Aglaia cucullata" Or "Xylocarpus granatum" Or "Xylocarpus moluccensis" Or "Aegiceras corniculatum" Or "Aegiceras floridum" Or "Osbornia octodonta"
OR
Nypa fruticans Or "Phoenix paludosa" Or "Aegialitis annulata" Or "Aegialitis rotundifolia" Or "Acrostichum aureum" Or "Acrostichum danaeifolium" Or "Acrostichum speciosum" Or "Bruguiera cylindrica" Or "Bruguiera exaristata" Or "Bruguiera gymnorhiza" Or "Bruguiera hainesii" Or "Bruguiera parviflora" Or "Bruguiera sexangula" Or "Ceriops australis" Or "Ceriops decandra" Or "Ceriops tagal" Or "Ceriops zippeliana" Or "Kandelia candel" Or "Kandelia obovata" Or "Rhizophora apiculata" Or "Rhizophora mangle" Or "Rhizophora mucronata" Or "Rhizophora racemosa" Or "Rhizophora samoensis" Or "Rhizophora stylosa" Or "Scyphiphora hydrophylacea" Or "Pelliciera rhizophorae"