



Status of global work on IAS:

*Classifying IAS by their environmental impact
IUCN policy on biodiversity conservation and
synthetic biology, ...*

Piero Genovesi

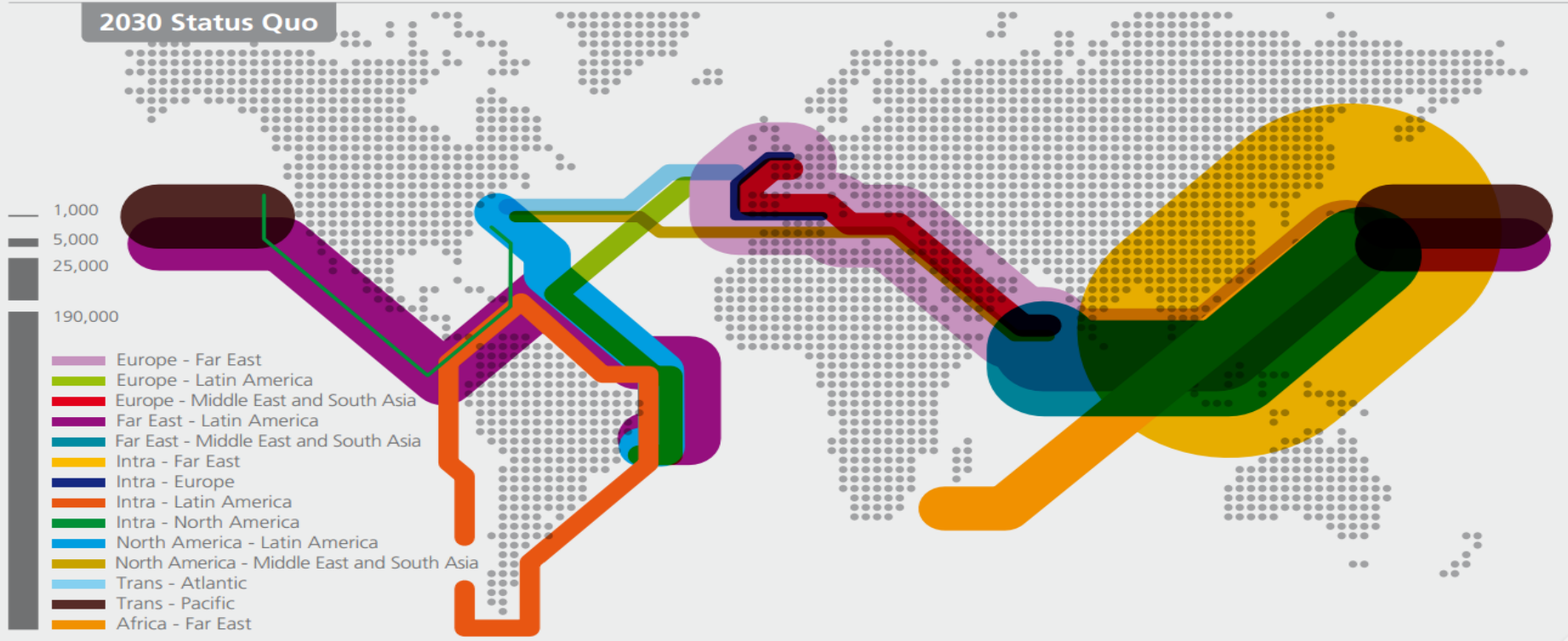
Chair IUCN SSC Invasive Species Specialist Group

Workshop on experiences on control and eradication of invasive alien species on islands
Funchal 1st June 2017

Pathway trends – shipping container trade

Fig. 62 Seaborne Container trade 2030 (thousand TEU)

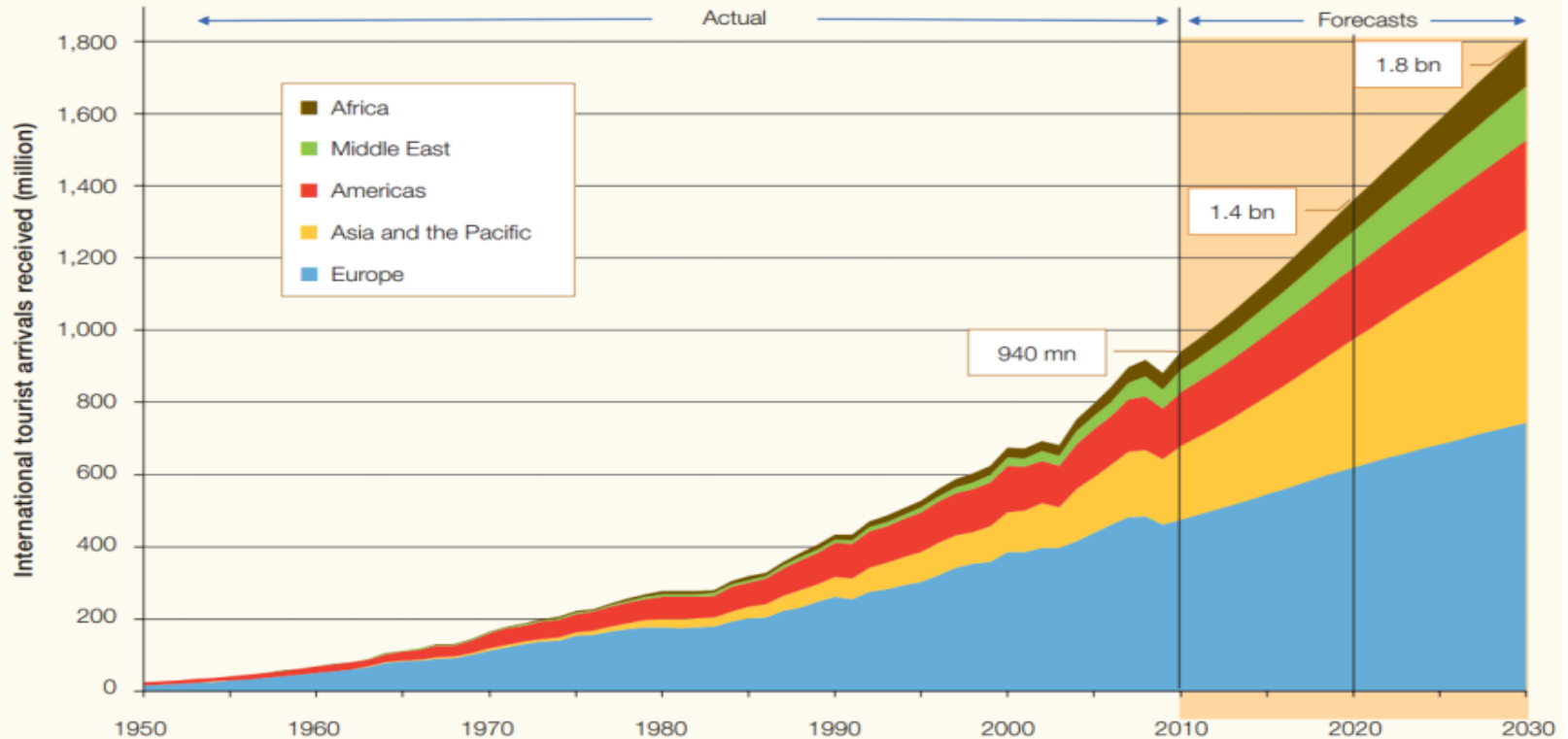
Source: MSI / LR



Pathway trends - tourism

between 2010 to 2030

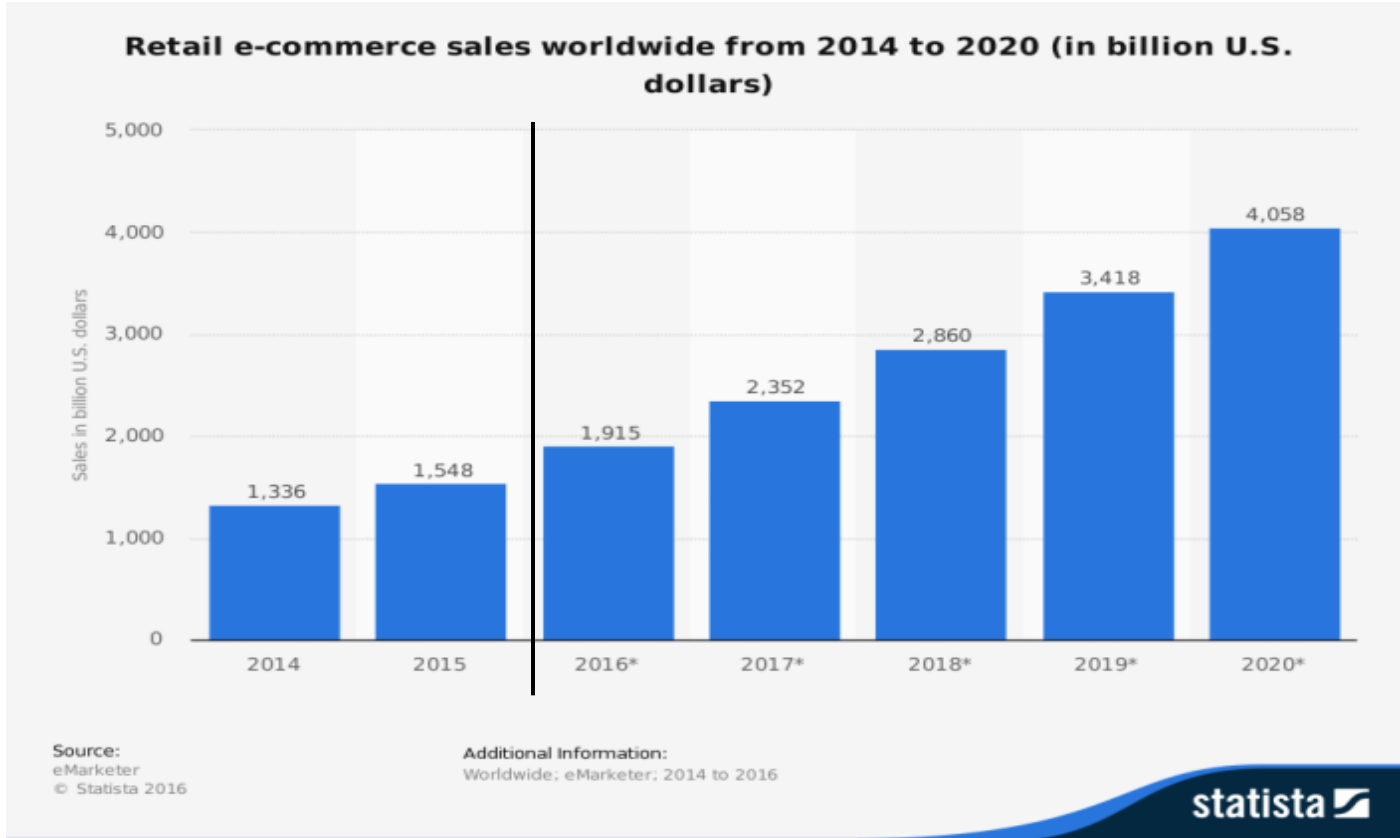
UNWTO Tourism Towards 2030: Actual trend and forecast 1950-2030



>double

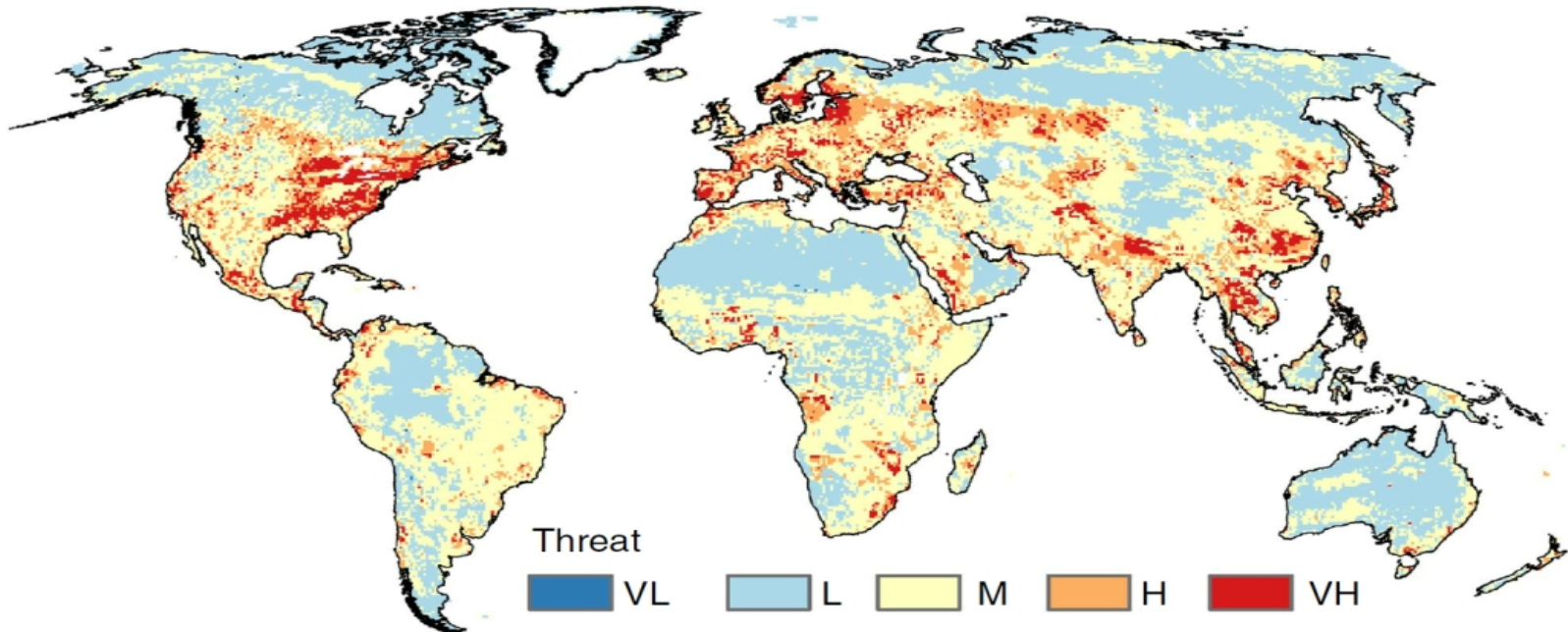
Pathway trends – e-commerce

between 2015 to 2020



1/6th land surface = Highly Vulnerable to invasion

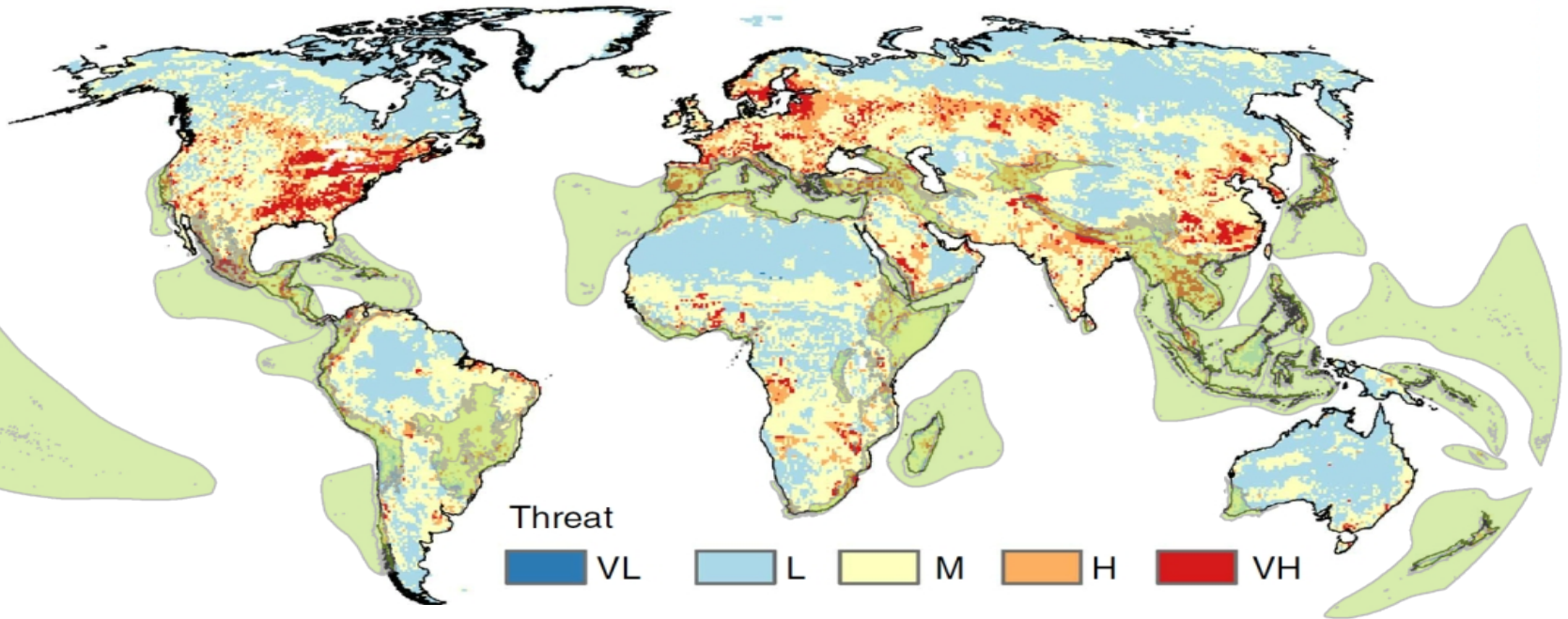
(a) Invasion threat



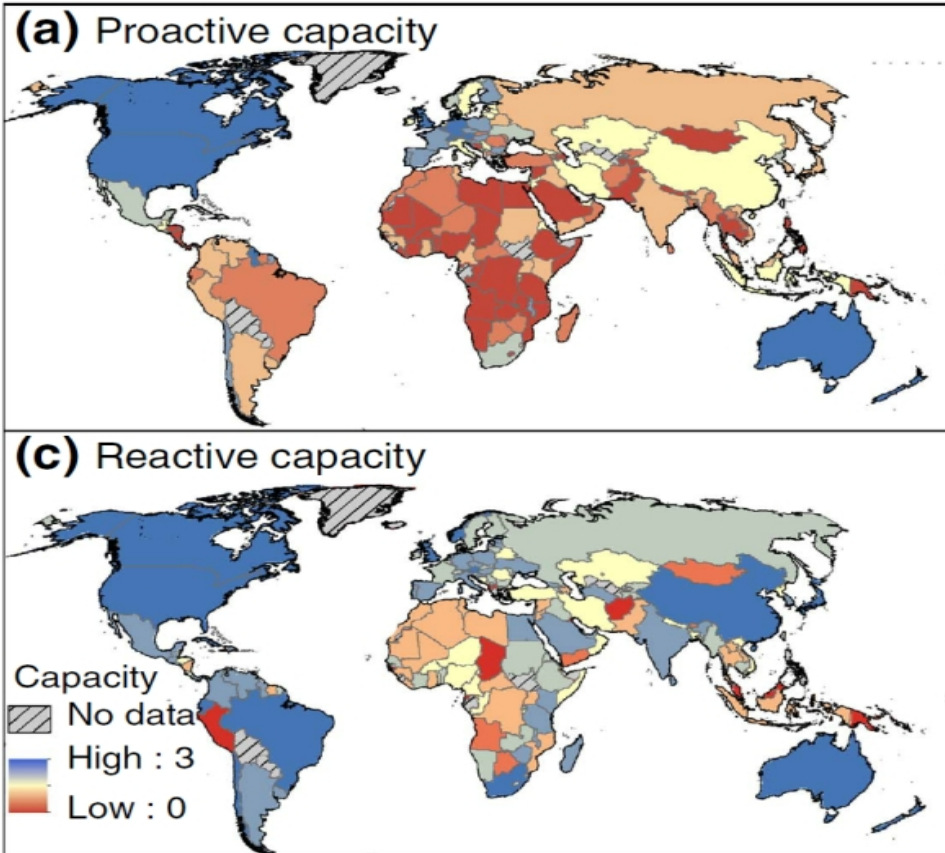
Future **introductions** (global trade etc.) + Disturbance = **establishment** (e.g. agric expansion, climate change etc.)

Overlap with biodiversity hotspots

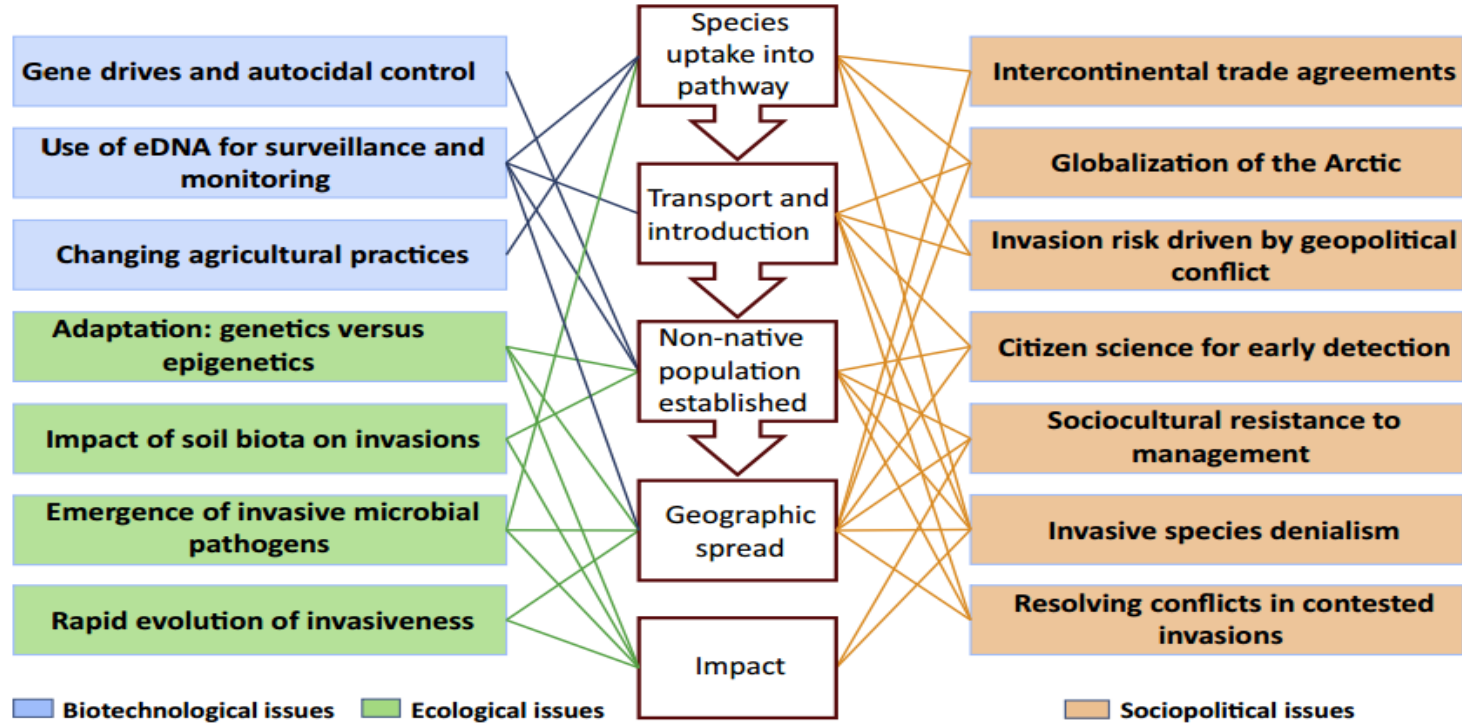
(a) Invasion threat



National capacities to respond to emerging IAS



Horizon scan – key issues



Trends in Ecology & Evolution

Figure 2. Horizon Scanning Topics and their Relevance to the Invasion Process and Impact.

T9 Progress

On track

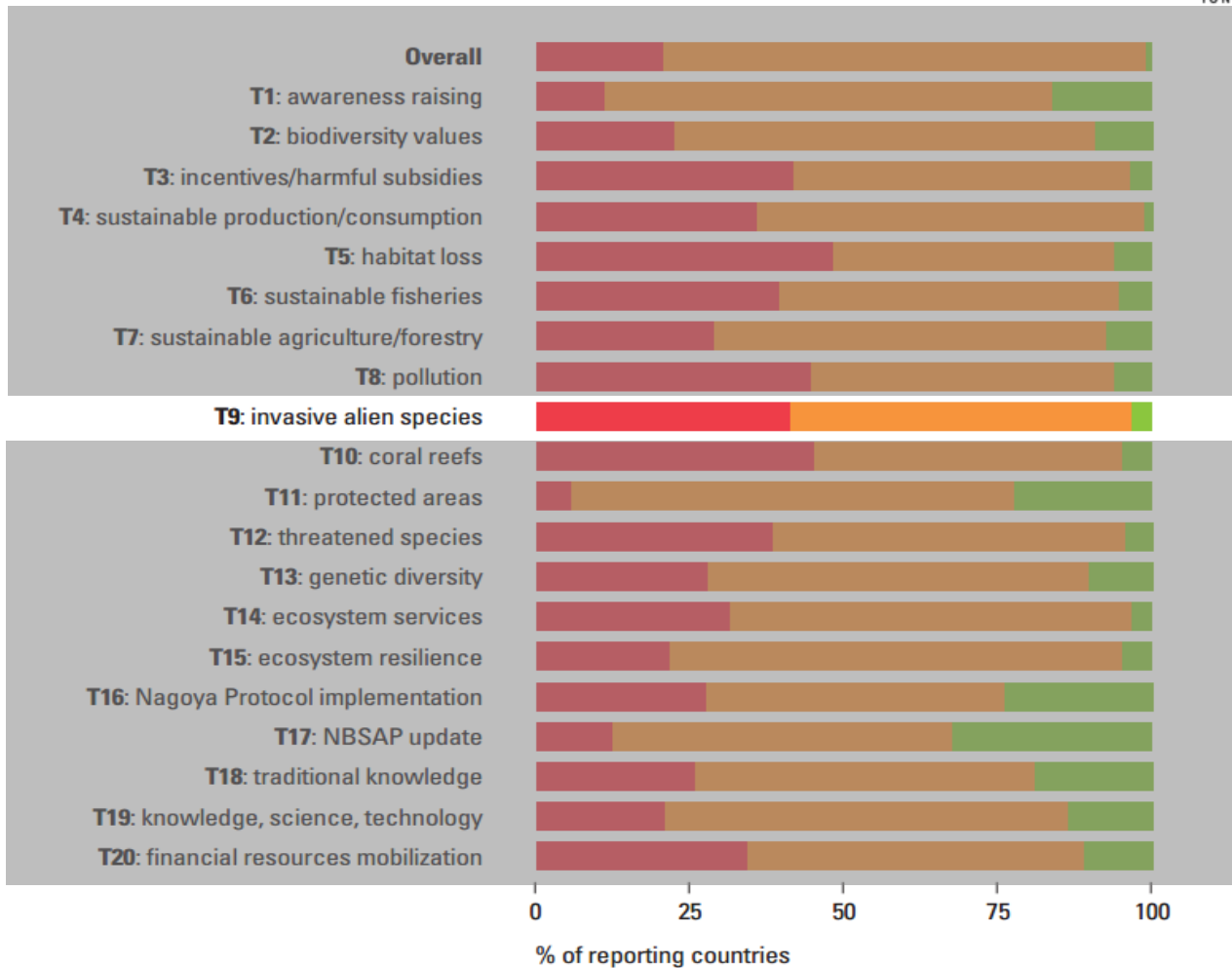
— 3%

Insufficient

— 48%



Progress of national targets towards the Aichi Targets





SUSTAINABLE DEVELOPMENT GOALS

& INVASIVE ALIEN SPECIES

2030 Agenda for Sustainable Development:

Stimulate action in critical areas of importance for humanity and the planet

17 Goals

169 Targets

1 Target on
invasive alien
species

15 LIFE ON LAND



Target 15.8:

By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species

However, **invasive alien species** can have significant negative **impacts** upon:

- native biodiversity,
- ecosystem services, and
- human well-being





IUCN IAS decision support tools

- Global Invasive Species Database (GISD)
 - **established**
- Global Register of Introduced and Invasive Species (GRIIS)
 - **recently launched**
- Environmental Impact Classification of Alien Taxa (EICAT)
 - **in development – to be part of GISD**
- Island Biodiversity and Invasive Species database (IBIS)
 - **in development**
- Pathways Resource
 - **in development**

Global Invasive Species Database (GISD)

- >850 IAS
 - Distribution
 - Impacts
 - Management information
 - Pathways of introduction
 - New structure/search functions

GLOBAL INVASIVE SPECIES DATABASE

HOME ABOUT THE GISD HOW TO USE CONTACTS

Lates niloticus [简体中文](#) [正體中文](#) System : Freshwater

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Perciformes	Centropomidae

[FULL ACCOUNT \(PDF\)](#)

GENERAL **DISTRIBUTION** **IMPACT** **MANAGEMENT** **BIBLIOGRAPHY** **CONTACT**

COMMON NAME persico del nilo (Italian), Nile perch (English), Nilbarsch (German), nijibaars (Dutch), sangara (Kiswahili), Victoria perch (English), victoriabars (Dutch), chengu (Kijita), mbuta (Kiluo), perche du nil (French), victoriabarsch (German), perca di nilo (Spanish), nilaborre (Swedish)

SYNONYM *Perca latus*, Geoffroy Saint-Hilaire, 1827
Lates niloticus, var. *macrolepidota* Pellegrin, 1922
Lates albertianus, Worthington, 1932
Lates niloticus rudoiffianus, Worthington, 1932

SIMILAR SPECIES

SUMMARY The Nile perch (*Lates niloticus*) is a large freshwater fish. Also known as capitaine, mputa or sangara, it can grow up to 200kg and two metres in length. It was introduced to Lake Victoria in 1954 where it has contributed to the extinction of more than 200 endemic fish species through predation and competition for food.

view this species on IUCN Red List

SPECIES DESCRIPTION
 Large perch-like predator. Dorsal fin deeply notched, giving the appearance of two separate fins; the first part completely spinous; third dorsal spine enlarged. Lateral line continuous. Pre-orbital and pre-opercular bones with spines; a large spine on operculum.

GENERAL IMPACTS
 The Nile perch is responsible through predation and competition for food for the decimation and possible disappearance of two hundred or more species of the unique flock of endemic haplochromine cichlids in Lake Victoria.

LIFECYCLE STAGES
 In Lake Victoria, male size at first maturity 50-55cm TL (ca. 2 years), females 67.5-85cm TL (2-4 years). Fifty percent maturity at 60-74cm TL for males and 102-110cm TL for females. Maturity sizes strongly decreasing in recent years.

MANAGEMENT INFO
 Eradication of the Nile perch in Lake Victoria is impossible in practice, and is also not an option because of its economic success.

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Perciformes	Centropomidae

FULL ACCOUNT (PDF)

GENERAL	DISTRIBUTION	IMPACT	MANAGEMENT	BIBLIOGRAPHY	CONTACT
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IMPACT INFORMATION

The Nile perch is responsible through predation and competition for food for the decimation and possible disappearance of two hundred or more species of the unique flock of endemic haplochromine cichlids in Lake Victoria.

Red List assessed species 145: CR = 51; EN = 2; VU = 17; DD = 62; LC = 13;

- Allochromis welcommei* VU
- Bagnrus docmak* LC
- Haplochromis acidens* DD
- Haplochromis antleter* CR
- Astatoreochromis alluaudi* LC
- Brycinus jacksonii* EN
- Haplochromis aelocephalus* CR
- Haplochromis apogonoides* CR
- Astatotilapia piceatus* CR
- Brycinus sadleri* LC
- Haplochromis altigenis* DD
- Haplochromis arcanus* DD

Brycinus jacksonii

<http://dx.doi.org/10.2305/IUCN.UK.2006.RLTS.T60748A12404838.en>



[Summary](#) [Classification Schemes](#) [Images & External Links](#) [Bibliography](#) [Full Account](#)

- GISD links to Red List species impacted

- Red List links to GISD threats to species

Classifications [\[top\]](#)

Habitats	Threats	Actions In Place	Actions Needed	Research Needed	Uses
----------	---------	------------------	----------------	-----------------	------

8. Invasive & other problematic species & genes -> 8.1. Invasive non-native/alien species -> 8.1.2. Named species [[↗ Lates niloticus](#)]

♦ **timing:**Ongoing

→ **Stresses**

[View species on the GISD](#)

- 2. Species Stresses -> 2.1. Species mortality
- 2. Species Stresses -> 2.3. Indirect species effects -> 2.3.2. Competition

9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.2. Soil erosion, sedimentation

♦ **timing:**Ongoing

→ **Stresses**

- 1. Ecosystem stresses -> 1.2. Ecosystem degradation

PATHWAYS OF ARRIVAL

Standard categorization of pathways

- Developed by IUCN SSC ISSG within the GIASIP, with support from CEH, CABI, CBD Secretariat
- Based on inputs from leading experts, and most updated scientific literature
- Tested with GISD, DAISIE and GBNNSP
- Mapped toward CBD decisions
- Presented at SBSTTA and COP of CBD
- CBD COP decision includes invitation to ISSG to “..continue and complete the work on pathway”

Table 1: Categories

Category	Code	Code
RELEASE INITIATOR (1)	Biological control	VE027
	Exotic control/ disease eradication (wildfires, blights, ...)	VE027, X028
	Fishing in the wild (including green fishing)	X028
	Hunting in the wild	VE027, X028, X029
	Landings/dredging/ "regeneration" in the wild	VE027, X028, X029
	Introduction for conservation purposes	VE027
	Release in nature for use (other than above, e.g., for transport, medical use)	VE027
	Other intentional release	VE027
	Agiculture (including horticultural backdrops)	X028
	Apiculture / aquaculture	VE027, D04
ESCAPE FROM CONFINEMENT (2)	Domestic garden/landscape (including domestic aquaria)	X028
	Park/amenity/landscape system (including live food for other species)	VE027, X028, X029
	Farmed animals (including animals left under locked enclosures)	VE027
	Forestry (including reforestation)	VE027
	For farms	VE027
	Horticulture	VE027
	Ornamental purposes other than horticulture	VE027
	Research and events breeding (in facilities)	VE027
	Live food and live bait	VE027
	Other escape from confinement	VE027
TRANSPORT - CONTAINERMENT (3)	Containerment material	VE027
	Containerment hull	VE027
	Fuel containerment (including live food)	VE027, X028
	Containerment on animals (except parasites, species transported by host/hosts)	X028
	Parasites on animals (including species transported by host and vectors)	X028
	Containerment on plants (except parasites, species transported by host/hosts)	X028
	Parasites on plants (including species transported by host and vectors)	X028
	Seed containerment	VE027
	Tanker leaks	VE027
	Transportation of habitat material (soil, vegetation, ...)	VE027
TRANSPORT - VECTOR A WAY (4)	Angling/fishing equipment	VE027
	Construction hulls	VE027
	Hitchhikers in or on airplanes	VE027, D04
	Hitchhikers on ship/board (including ballast water and hull fouling)	VE027
	Hitchhikers on equipment (in particular tourism)	VE027
	Organic packing material, in particular wood packaging	VE027
	Shipboard ballast water	VE027
	Shipboard hull fouling	VE027, D04
	Vehicle (car, train, ...)	VE027
	Other means of transport	VE027
CORRIDOR (5)	Unconstrained waterways/river/lake/sea	VE027
	Tunnels and land bridges	VE027
UNCLASSIFIED (6)	Natural dispersal routes/ barriers of extensive alien systems that have been introduced through pathways 1-5	VE027



According to your search criteria results will be returned



ADVANCED SEARCH OPTIONS

 TAXONOMY

 LOCATION

 SYSTEM

 PATHWAY

 THREATENED SPECIES

 IMPACT

 MANAGEMENT

 Release

 Release in nature for use

 Biological control

 Erosion control/ dune stabilization

 Fishery in the wild

 Hunting in the wild

 Landscape/flora/fauna improvement

 Conservation introduction

 Other Intentional release

 Subclass Undefined

 Escape

 Transport - Contaminant

 Transport - Stowaway

 Corridors

Table 1: Categorization of pathways for the introduction of

	Category	Subcategory	
MOVEMENT OF COMMODITY	RELEASE IN NATURE (1)	Biological control Erosion control/ dune stabilization (windbreaks) Fishery in the wild (including game fishing) Hunting in the wild Landscape/flora/fauna "improvement" in the wild Introduction for conservation purposes Release in nature for use (other than above, e.g. Other intentional release)	
	ESCAPE FROM CONFINEMENT (2)	Agriculture (including Biofuel feedstocks) Aquaculture / mariculture Botanical gardens/zoo/aquaria (excluding domes) Pet/aquarium/terrarium species (including live) Farmed animals (including animals left under 1) Forestry (including reforestation) Fur farms Horticulture Ornamental purpose other than horticulture Research and ex-situ breeding (in facilities) Live food and live bait Other escape from confinement	VIII/27
VECTOR	TRANSPORT - CONTAMINANT (3)	Contaminant nursery material Contaminated bait Food contaminant (including of live food) Contaminant on animals (except parasites, species transported by host/vector) Parasites on animals (including species transported by host and vector) Contaminant on plants (except parasites, species transported by host/vector) Parasites on plants (including species transported by host and vector) Seed contaminant Timber trade Transportation of habitat material (soil, vegetation,...)	VIII/27, XI/28 XIV/28 XIV/28 XIV/28 XIV/28 VIII/27
	TRANSPORT - STOWAWAY (4)	Angling/fishing equipment Container/bulk Hitchhikers in or on airplane Hitchhikers on ship/boat (excluding ballast water and hull fouling) Machinery/equipment People and their luggage/equipment (in particular tourism) Organic packing material, in particular wood packaging Ship/boat ballast water Ship/boat hull fouling Vehicles (car, train, ...) Other means of transport	VIII/27 VIII/27 VIII/27, IX/4 VIII/27 VIII/27 VIII/27 VIII/27, IX/4
SPREAD	CORRIDOR (5)	Interconnected waterways/shoals/muds Tunnels and land bridges	VIII/27
	UNAIDED (6)	Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5	


 Convention on
Biological Diversity

 Distr.
GENERAL

 UNEP/CBD/SBSTTA/18/9/Add.1
1 May 2014

ORIGINAL: ENGLISH

 SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Eighteenth meeting
Montreal, 23-28 June 2014
Item 5.2 of the provisional agenda*

 PATHWAYS OF INTRODUCTION OF INVASIVE SPECIES, THEIR PRIORITIZATION
AND MANAGEMENT

Note by the Executive Secretary

I. INTRODUCTION

1. The Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that threaten Ecosystems, Habitats and Species (the Guiding Principles) annexed to decision VI/23** provide all Governments and organizations with guidance for developing effective strategies to minimize the spread and impact of invasive alien species. In particular, the Guiding

● LAST ADDED INVAS

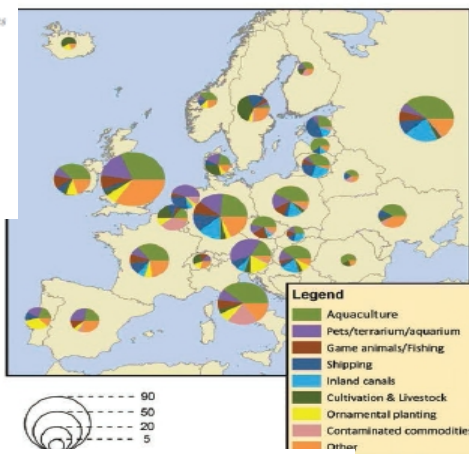
ANALYSIS OF PATHWAYS

BioScience Advance Access published July 15, 2015

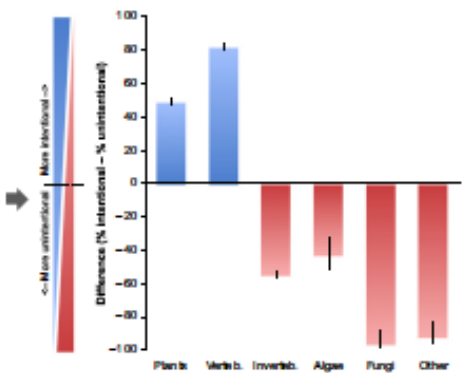
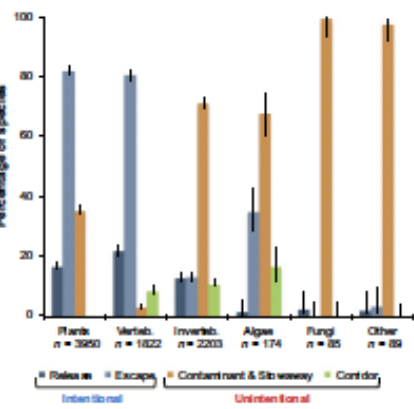
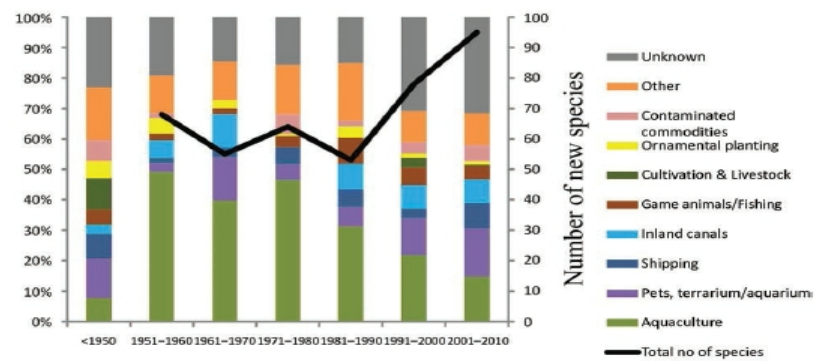
Overview Articles

Crossing Frontiers in Tackling Pathways of Biological Invasions

FRANZ ESSL, SVEN BACHER, TIM M. BLACKBURN, OLAF BOCK, GIUSEPPE BRUNDO, SARAH BRUNEL, ANA-CRISTINA CARDOSO, RENÉ ESCHEN, BELINDA GALLARDO, BELLA GAJLI, EMILI GARCÍA-BERTHO, PIERO GENOVESI, QUENTIN GROOM, COLIN HARROWER, PHILIP E. HULME, STELIOS KATSANEVAKIS, MARC KENIS, INGOLF KÜHN, SABRINA KÜMSCHICK, ANGELIKI F. MARTINO, WOLFGANG NENTWIG,



b Freshwater species



Assessing patterns in introduction pathways of alien species by linking major invasion data bases

Wolf-Christian Saul^{1,2,3,4}, Helen E. Roy⁵, Olaf Booy⁶, Lucilla Carnevali⁷, Hsuan-Ju Chen⁸, Piero Genovesi^{9,10}, Colin A. Harrower⁵, Philip E. Hulme¹¹, Shyama Pagad^{12,13}, Jan Pergl¹⁴ and Jonathan M. Jeschke^{1,2,3,4}

Global Register of Introduced & Invasive Species

- CBD mandated
- GIASI Partnership* product – led by IUCN
- Launched April 2016, to be completed mid 2017
- Annotated & **validated** country inventories
- Starting point for building national strategies NISSAPs

SEARCH

COUNTRY

- Afghanistan
- Albania
- Algeria
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Bangladesh
- Barbados
- Belarus
- Belgium
- Belize
- Benin
- Bhutan
- Bolivia
- Bosnia and Herzegovina

KINGDOM

ANIMALIA

PLANTAE

FUNGI

PROTOZOA

CHROMISTA

OTHERS

SYSTEM

[CLICK HERE TO DOWNLOAD THIS REPORT CSV / PDF](#)

Show 10 entries	Search: <input style="width: 100px;" type="text"/>								
Name	Authority	Country	Kingdom	System	Origin	Impact	Verified	Date	Source
<i>Cyclura eychilura leonata</i>	Barbour & Noble, 1916	Bahamas	Animalia	terrestrial	Alien		✓	2016	🟢
<i>Cyclura rileyi nuchalis</i>	Barbour & Noble, 1916	Bahamas	Animalia	terrestrial	Alien		✓	2016	🟢
<i>Diaphorina citri</i>	Kuwayama, 1908	Bahamas	Animalia	host	Alien		✓	2016	🟢
<i>Eiutherodactylus coqui</i>	Thomas, 1966	Bahamas	Animalia	terrestrial	Alien	Yes	✓	2016	🟢
<i>Epinephelus lanceolatus</i>	(Bloch, 1790)	Bahamas	Animalia	brackish/marine	Alien		✓	2016	🟢
<i>Equus asinus</i>	Linnaeus, 1758	Bahamas	Animalia	terrestrial	Alien		✓	2016	🟢
<i>Euglandina rosea</i>	(Ferussac, 1818)	Bahamas	Animalia	terrestrial	Alien	Yes	✓	2016	🟢
<i>Felis catus</i>	Linnaeus, 1758	Bahamas	Animalia	terrestrial	Alien		✓	2016	🟢
<i>Gastrophryne carolinensis</i>	(Holbrook, 1835)	Bahamas	Animalia	terrestrial/freshwater	Alien		✓	2016	🟢
<i>Hemidactylus garnotii</i>	Duméril & Bibron, 1836	Bahamas	Animalia	terrestrial	Alien		✓	2016	🟢

Showing 21 to 30 of 77 entries

Previous 1 2 **3** 4 5 ... 8 Next

YOUR SEARCH CRITERIA

COUNTRY

Bahamas

KINGDOM

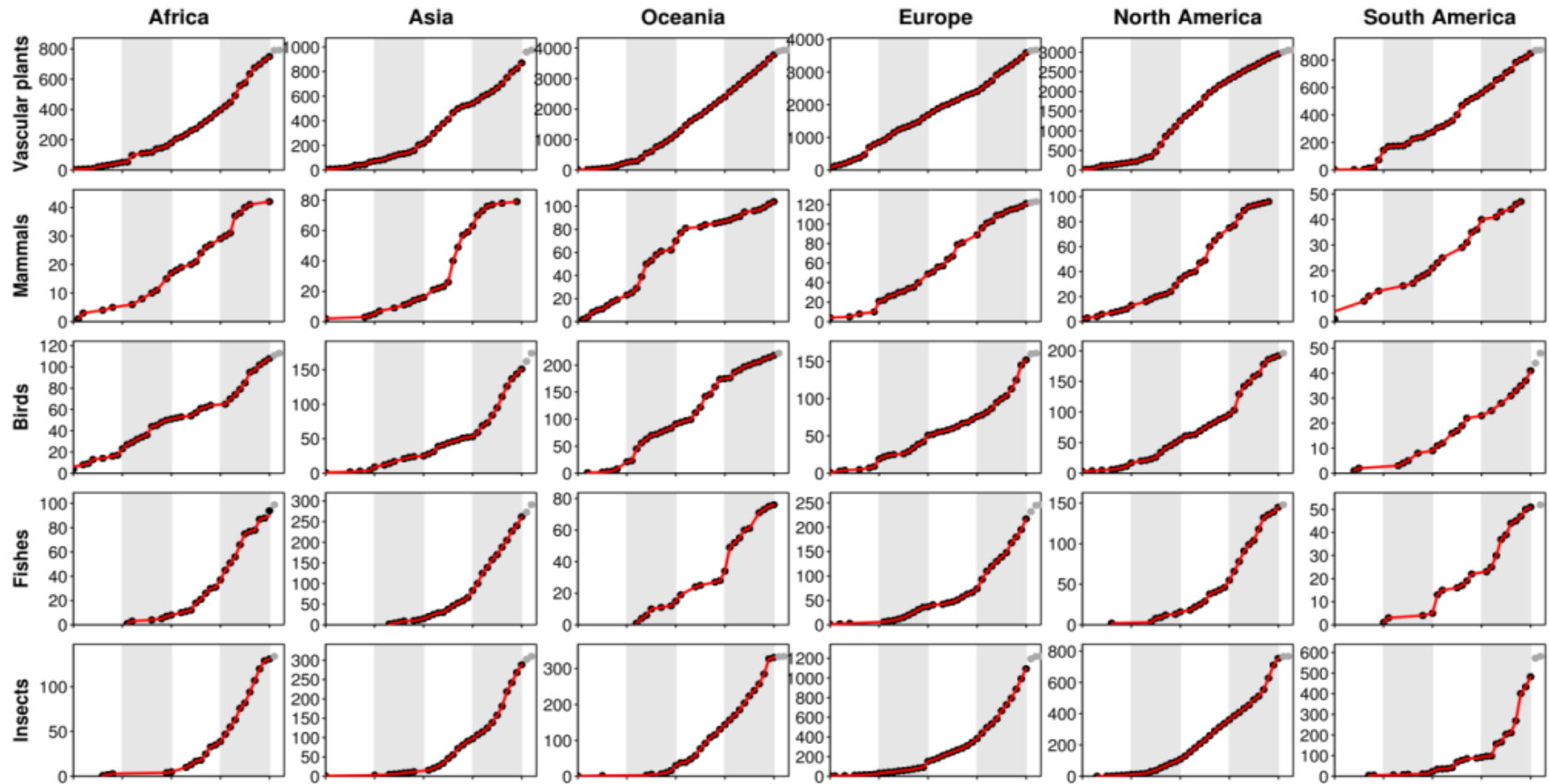
animalia

✖ MODIFY YOUR CRITERIA

✖ CLEAR YOUR CRITERIA

Basic stats

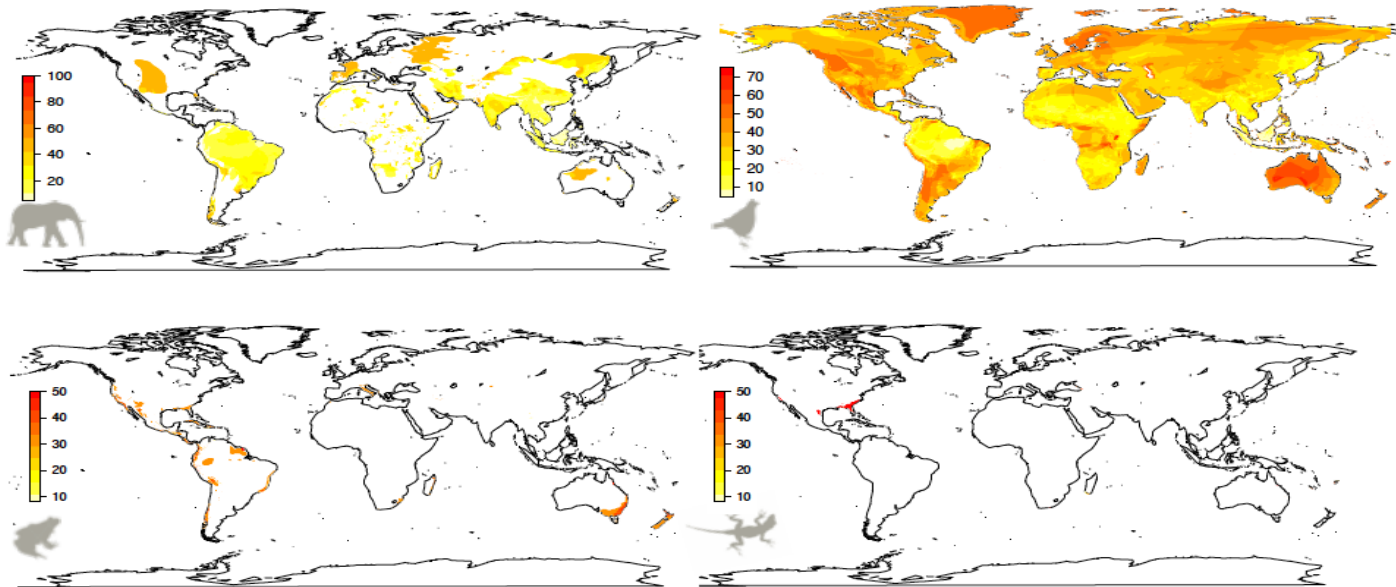
Category	No.
Countries	195
Records	81 650
Verified records	33 993 >40%
Species – all records included	22 582
IAS – all	4 833
IAS with documented evidence of impact	3 638



Seebens H, Blackburn TM, Dyer E, Genovesi P et al. (2017) No saturation in the accumulation of alien species worldwide. *Nature Communications*, 1–9.

ASSESSING PRIORITY REGIONS

IAS and Red List data to define the most vulnerable regions



Spatial distribution of the proportion of IAS-threatened species among other threats.

Environmental Impact Classification of Alien Taxa (EICAT)

- IUCN SSC ISSG requested by CBD COP¹ to develop *system for classifying invasive alien species based on the nature and magnitude of their impacts*
- EICAT methods published 2014 & 2015
- To be incorporated into GISD
- EICAT Resolution at IUCN Congress
- IUCN wide consultation 2017

¹COP XII Decision 17

OPEN ACCESS Freely available online

PLOS BIOLOGY

Essay

A Unified Classification of Alien Species Based on the Magnitude of their Environmental Impacts

Tim M. Blackburn^{1,2,3*}, Franz Essl⁴, Thomas Evans⁵, Philip E. Hulme⁶, Jonathan M. Jeschke⁷, Ingolf Kühn^{8,9}, Sabrina Kumschick¹⁰, Zuzana Marková^{11,12}, Agata Mrugala¹³, Wolfgang Nentwig¹³, Jan Pergl¹¹, Petr Pyšek^{11,13}, Wolfgang Rabitsch¹⁴, Anthony Ricciardi¹⁵, David M. Richardson¹⁶, Agnieszka Sendek⁹, Montserrat Vilà¹⁶, John R. U. Wilson^{16,17}, Marten Winter⁹, Piero Genovesi¹⁸, Sven Bacher¹⁹

Diversity and Distributions, (Diversity Distrib.) (2015) 1–4

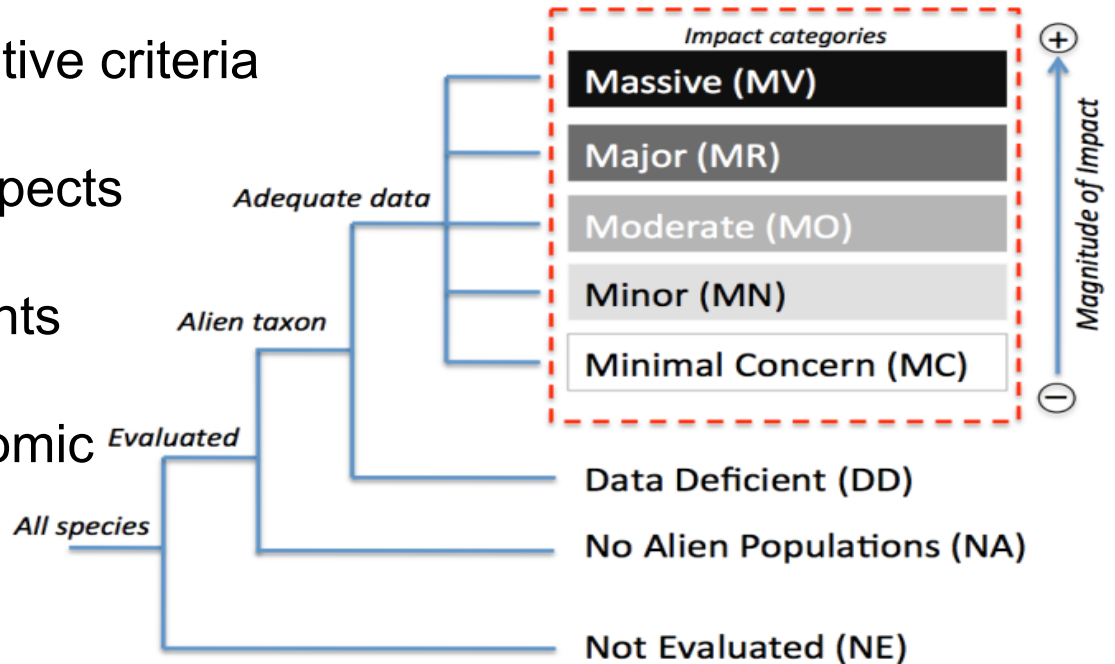


Framework and guidelines for implementing the proposed IUCN Environmental Impact Classification for Alien Taxa (EICAT)

Charlotte L. Hawkins¹, Sven Bacher², Franz Essl³, Philip E. Hulme⁴, Jonathan M. Jeschke^{5,6}, Ingolf Kühn^{7,8}, Sabrina Kumschick^{9,10}, Wolfgang Nentwig¹¹, Jan Pergl¹², Petr Pyšek^{12,13}, Wolfgang Rabitsch¹⁴, David M. Richardson¹⁵, Montserrat Vilà¹⁶, John R. U. Wilson^{16,17}, Piero Genovesi¹⁸ and Tim M. Blackburn^{17,18*}

Environmental Impact Classification of Alien Taxa

- Ranking invasive species by the **magnitude of their impact (to environment)**
- Based on semi-quantitative criteria
- Follows RL in many respects
- Global scale assessments
- Developing socio-economic impact scheme





100 OF THE WORST

Rattus rattus [简体中文](#) [正體中文](#)

System : Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Rodentia	Muridae

FULL ACCOUNT (PDF)

MA MR MO MI **< Minimal ML >** DD NA NE CG

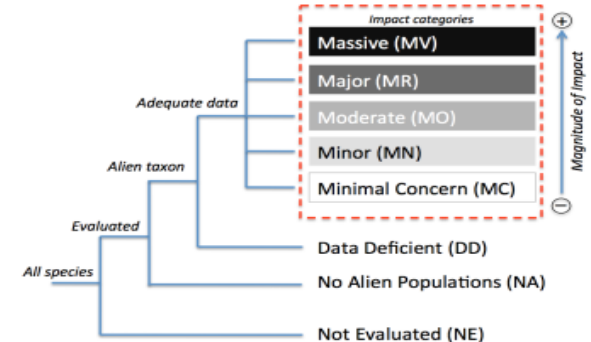
GENERAL DISTRIBUTION **IMPACT** MANAGEMENT BIBLIOGRAPHY CONTACT

COMMON NAME Hausratte (German), European house rat (English), bush rat (English), blue rat (English), ship rat (English), black rat (English)

SYNONYM *Mus rattus*, Linnaeus, 1758
Mus alexandrinus, Geoffroy, 1803
Musculus frugivorus, Rafinesque, 1814
Mus novaezelandiae, Buller, 1870

SIMILAR SPECIES *Rattus norvegicus*

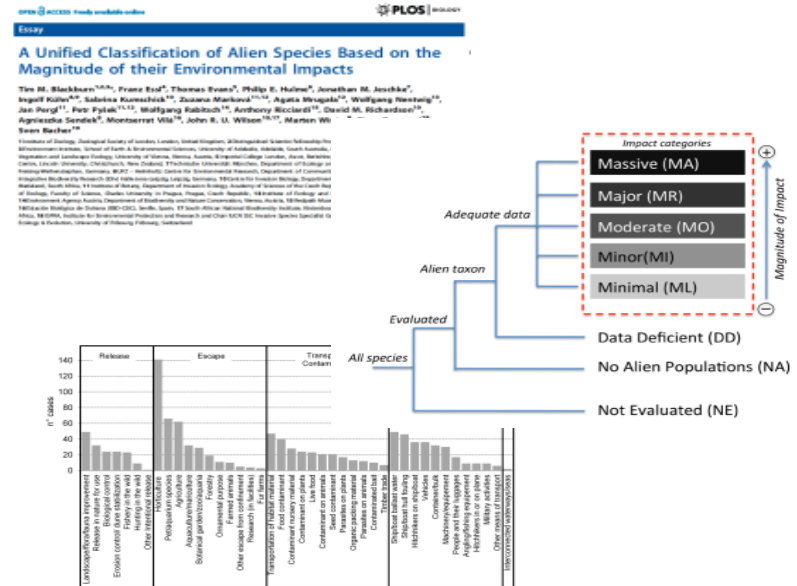
SUMMARY A native of the Indian sub-continent, the ship rat (*Rattus rattus*) has now spread throughout the world. It is widespread and is well adapted to living in and around buildings. It will feed on and damage almost any...



POTENTIAL OUTCOMES

Combining data on the most relevant pathways and on the most harmful IAS can enhance prioritization of action

- Aggregating **pathways** and **invasive specie ranks** can enhance prioritization of prevention and management actions



SYNTHETIC BIOLOGY

- Emerging field and industry, with a **growing number of applications** in the pharmaceutical, chemical, agricultural and energy sectors.
- While it may propose **solutions** to some of the greatest environmental challenges, such as climate change, scarcity of clean water, the introduction of novel, synthetic organisms may also pose a **high risk** for natural ecosystems

GENE DRIVE

Gene-editing tools, based on technologies (e.g.: CRISPR-Cas9) that are relatively cheap and easy to use

- Self-killing (autocidal) genes
- Blocking the possibility to spread diseases
- Can be used to create conditional lethality or sterility, or to create synthetic selfish genetic elements that drive genes into IAS populations

Trends in Ecology & Evolution

Review

Invasion Science: A Horizon Scan of Emerging Challenges and Opportunities

Anthony Ricciardi,^{1,22,*} Tim M. Blackburn,^{2,3} James T. Carlton,⁴ Jaimie T.A. Dick,⁵ Philip E. Hulme,⁶ Josephine C. Iacarella,⁷ Jonathan M. Jeschke,^{8,9,10} Andrew M. Liebhold,¹¹ Julie L. Lockwood,¹² Hugh J. MacIsaac,¹³ Petr Pyšek,^{14,15} David M. Richardson,¹⁶ Gregory M. Ruiz,¹⁷ Daniel Simberloff,¹⁸ William J. Sutherland,¹⁹ David A. Wardle,^{20,21} and David C. Aldridge^{19,22}



Can CRISPR-Cas9 gene drives curb malaria?

Luke Alphey

Gene drives in mosquitoes to reduce the spread of malaria move closer, though technical and regulatory hurdles remain.

FREE 2049 No. of Pages 2

Trends in Ecology & Evolution

Letter

Emerging Technologies to Conserve Biodiversity: Further Opportunities via Genomics. Response to Pimm *et al.*

Helen R. Taylor^{1,*} and Neil J. Gemmill¹

GENE DRIVE

Potential applications of gene drive:

Combating diseases such as malaria, dengue and the Zika virus, which account for more than 17% of all infectious diseases, and cause more than 1 million deaths annually. Tremendous costs: malaria alone is estimated to cost African countries USD \$12 billion a year.



GENE DRIVE

Control of invasive alien species for conservation purposes being investigated: invasive mosquitoes in Hawaii, European carp in Australia, removing the toxicity of Cane toads in Australia...

Based on current progress, products ready for field testing may be 5 years out.

Time to consider the important questions of regulation, risk assessment, ethics, and engagement, and to prepare for assessing an actual application.