Invasive alien species:

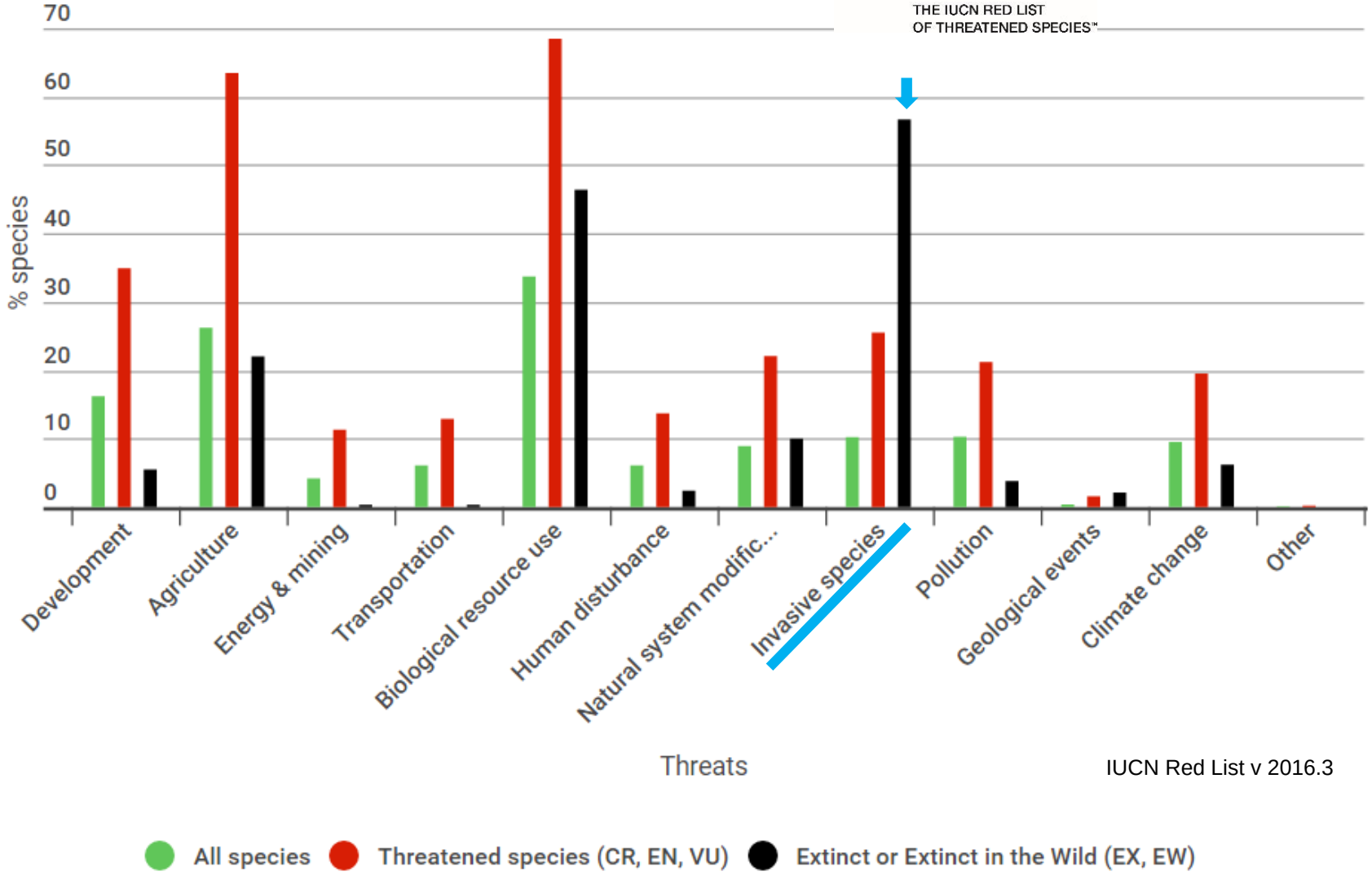
Reflections towards the conclusion of the UN Decade of Biodiversity

Piero Genovesi

Institute for Environmental Protection and Research

Chair of IUCN SSC Invasive Species Specialist Group

Comprehensively assessed groups (>150 spp)

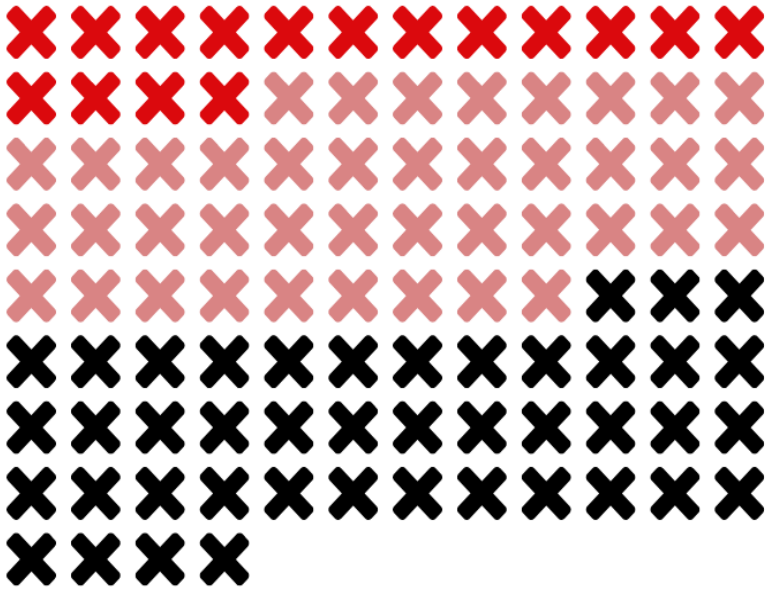


IUCN Red List v 2016.3

Comprehensively assessed groups (>150 spp)

THE IUCN RED LIST OF THREATENED SPECIES™

16.2% of extinctions are driven by **invasive alien species** ONLY



40.5% of extinctions are driven by **invasive alien species + other threats**

43% of extinctions are driven by **other threats**

Invasive species only

Invasive species + other threats

Other threats

IUCN Red List v 2016.3

IMPACT ON ECOSYSTEMS AND LIVELIHOOD

- Beaver introduced in Tierra del Fuego, established in over 7 Mln hectares
- *Prosopis* invading large areas of Africa, limiting access to land
- Water hyacinth impacting access to water and transport, and spreading malaria

AFFECT OUR HEALTH

- More than 100 known cases of invasive species with effects on health
- Pathogens, parasites, vectors of pathogens, producing toxins, allergenic, direct attacks or bites, indirect effects on other invasive species with impact on health, etc.

Ethology Ecology & Evolution, 2013
http://dx.doi.org/10.1080/03949370.2013.863225

Taylor & Francis

Biological invaders are threats to human health: an overview

G. Mazza [1,3], E. Tricarico [1], P. Genovesi [2] and F. Gherardi [1]

[1] *Dipartimento di Biologia, Università degli Studi di Firenze, Via Romana 17, 50125 Firenze, Italy*
[2] *ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale, and Chair IUCN SSC Invasive Species Specialist Group, Via Vitaliano Brancati 44, 00144 Roma, Italy*

CAUSE HUGE ECONOMIC LOSSES

Europe

€ Eradication/control

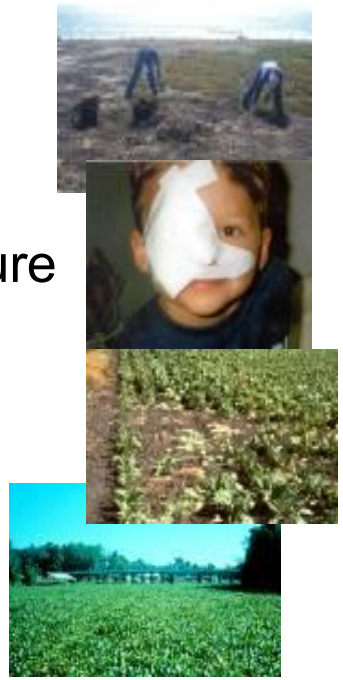
€ Damage to infrastructure

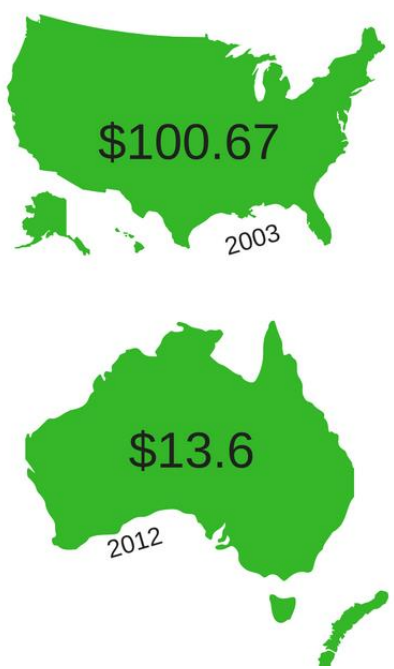
€ Damage to agriculture and forestry

€ Fishing

€ Human health

€ Research, prevention, monitoring, etc

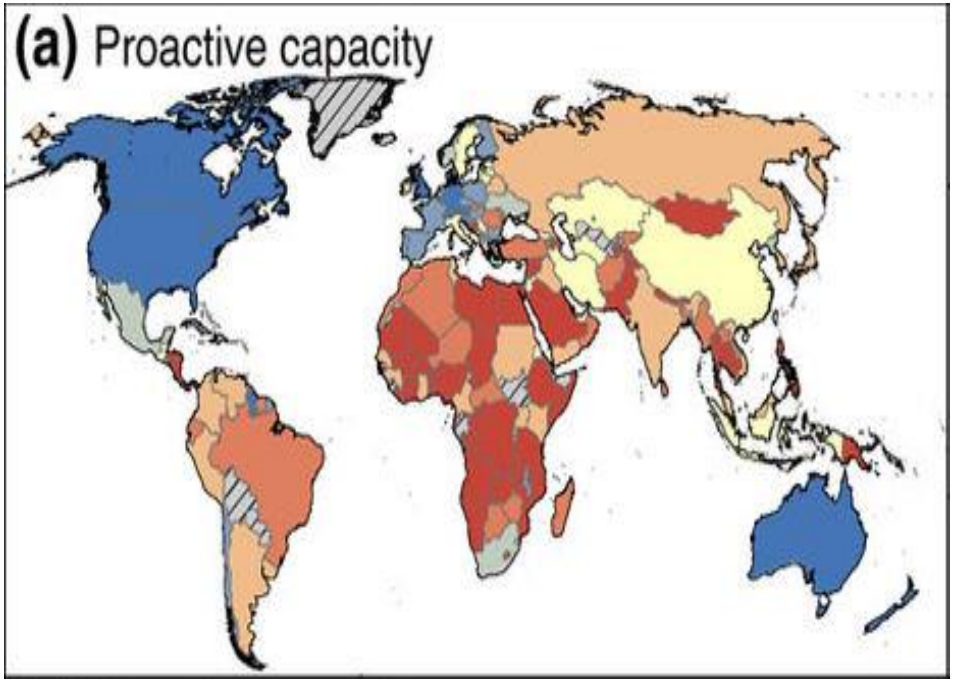


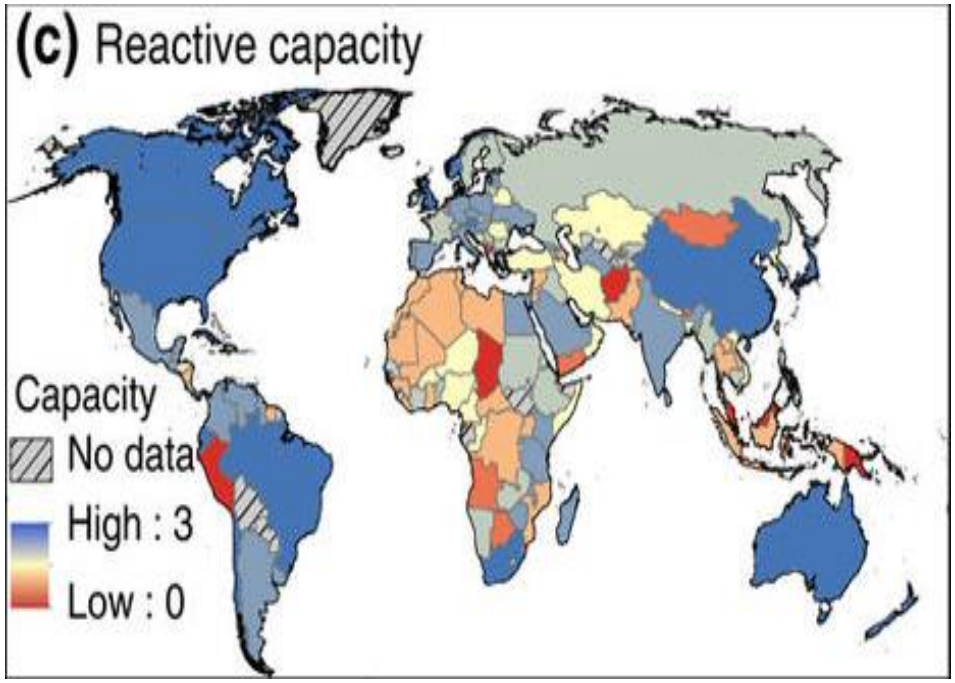


> € 12.5 billions/year

Kettunen, Genovesi, et al. 2008. Report for European Commission. IEEP

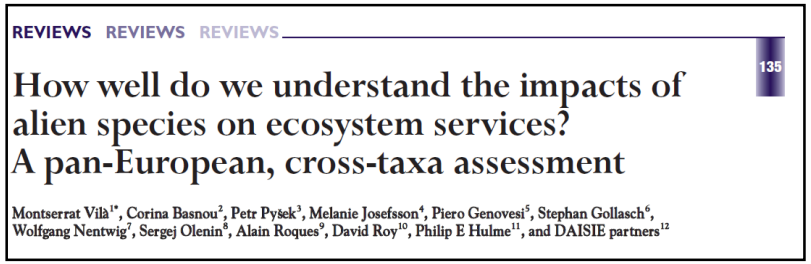
Hoffmann & Broadhurst. 2016. Neobiota





Early et al. 2016. Nature Communications, 7, 12485.

PROTECTING BIODIVERSITY SAFEGUARDS LIVELIHOOD



REVIEWS REVIEWS REVIEWS

135

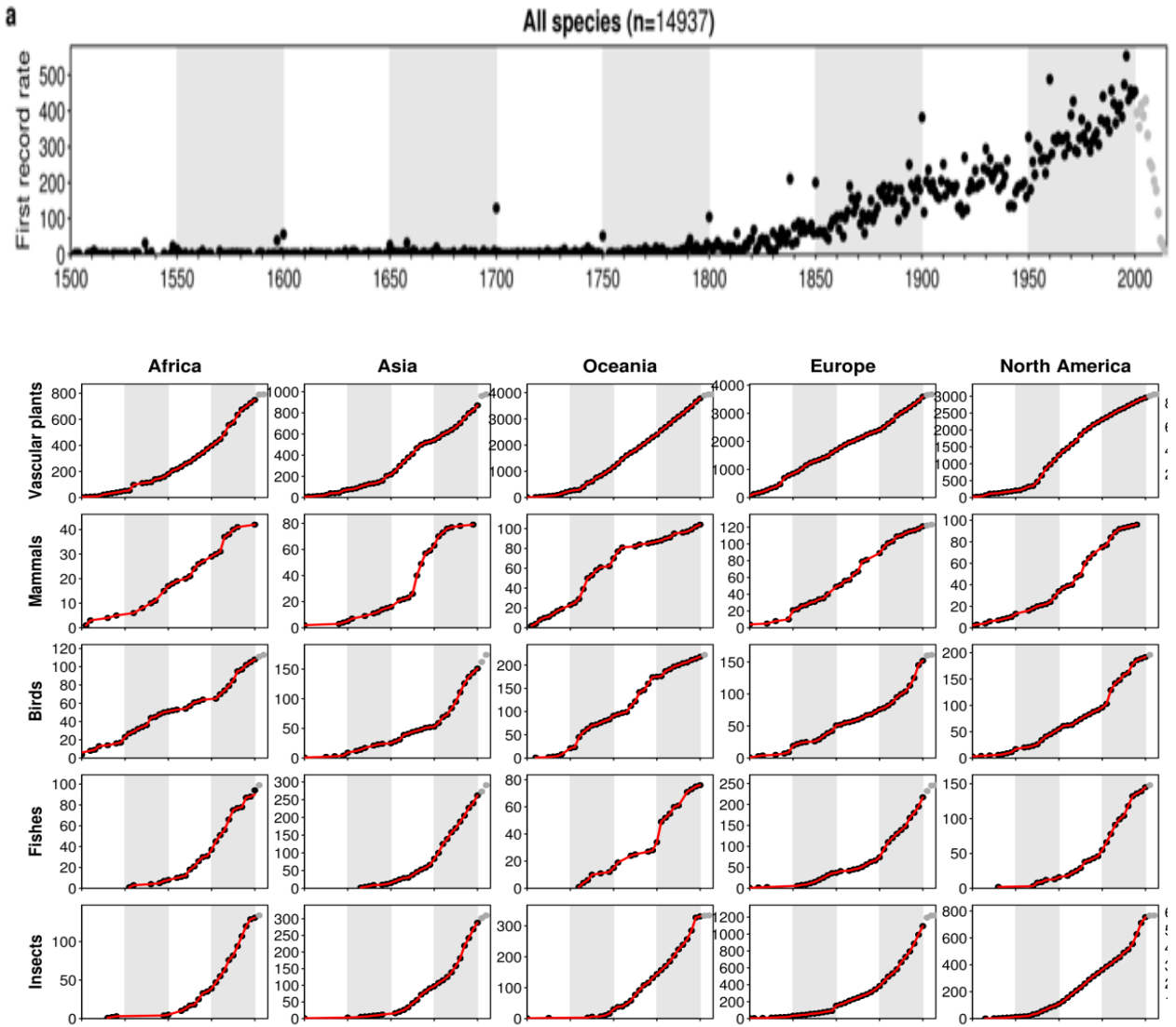
How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment

Montserrat Vilà[1*], Corina Basnou[2], Petr Pyšek[3], Melanie Josefsson[4], Piero Genovesi[5], Stephan Gollasch[6], Wolfgang Nentwig[7], Sergej Olenin[8], Alain Roques[9], David Roy[10], Philip E Hulme[11], and DAISIE partners[12]

	Total impacts		Ecological impacts		Economic impacts	
Aquatic marine	1076	134	12.45%	114	10.59%	
Aquatic inland	486	139	28.60%	107	22.02%	
Birds	172	46	26.74%	78	45.35%	
Terrestrial invertebrates	584	126	21.58%	180	30.82%	
Terrestrial mammals	112	55	49.11%	67	59.82%	
Terrestrial plants	6135	841	13.71%	745	12.14%	

No saturation

- Annual rate of first records worldwide is still increasing, both in mainland and on islands



Seebens H, Blackburn TM, Dyer E, Genovesi P et al. (2017). Nature Comm. 1–9.

POTENTIAL INVASIVES

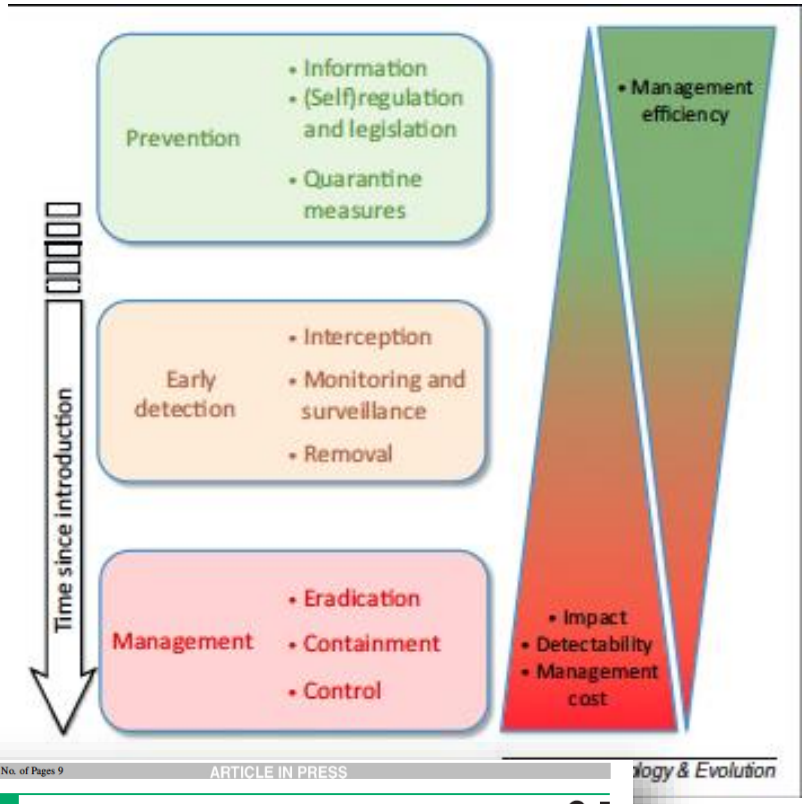


Metric	Birds	Crustaceans	Fishes	Insects	Mammals	Molluscs	Other invertebrates	Vascular plants
Estimated candidate species pool	625	1,565	1,354	20,611	499	1,289	3,268	26,048
No. of alien species in analysis	406	430	478	4,992	248	441	780	7,380
Percentage of established alien species, %	65	27	35	24	50	34	24	28
Reported total no. of alien species	971*	425†	944‡		445§	539†,¶		13,168#
Estimated true candidate species pool	1,494	1,574	2,697		890	1,585		47,029
Estimated total no. of native species on Earth‖	10,000	150,000	40,000		5,500	200,000		368,000
Percentage of potential alien species among all species worldwide, %	15	1	7		16	1		13

15% **1%** **7%** **16%** **1%** **13%**

Seebens H, Blackburn TM, Dyer E, Genovesi P et al. (2018). PNAS. 115, 10

HOW TO RESPOND?




TREE-1578; No. of Pages 9 ARTICLE IN PRESS

Review

Impacts of biological invasions: what's what and the way forward

Daniel Simberloff[1], Jean-Louis Martin[2], Piero Genovesi[3], Virginie Maris[2], David A. Wardle[4], James Aronson[2,5], Franck Courchamp[6], Bella Galil[7], Emili García-Berthou[8], Michel Pascal[9], Petr Pyšek[10,11], Ronaldo Sousa[12,13], Eric Tabacchi[14] and Montserrat Vilà[15*]

CBD guiding principles

- Prevention as the first line of defence
- Early detection rapid response
- Eradication when feasible
- Permanent management when appropriate

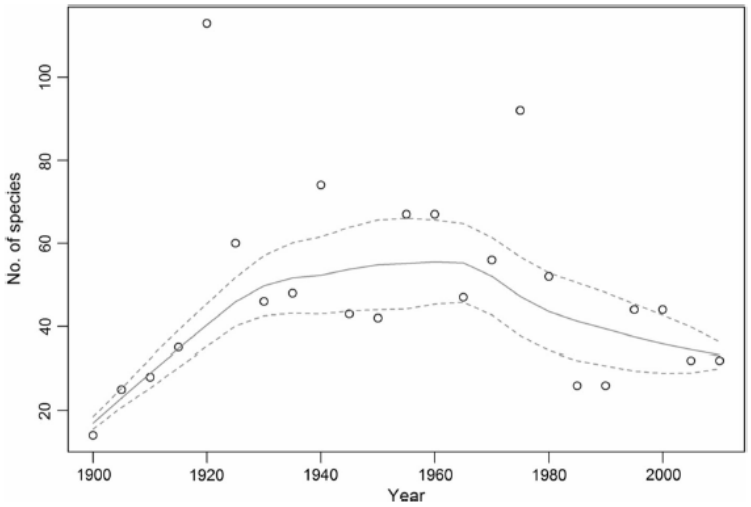
Decision VI/23 on Alien Species that threaten ecosystems, habitats and species; COPVI, The Hague, April 2002

CBD STRATEGIC PLAN 2011-2020

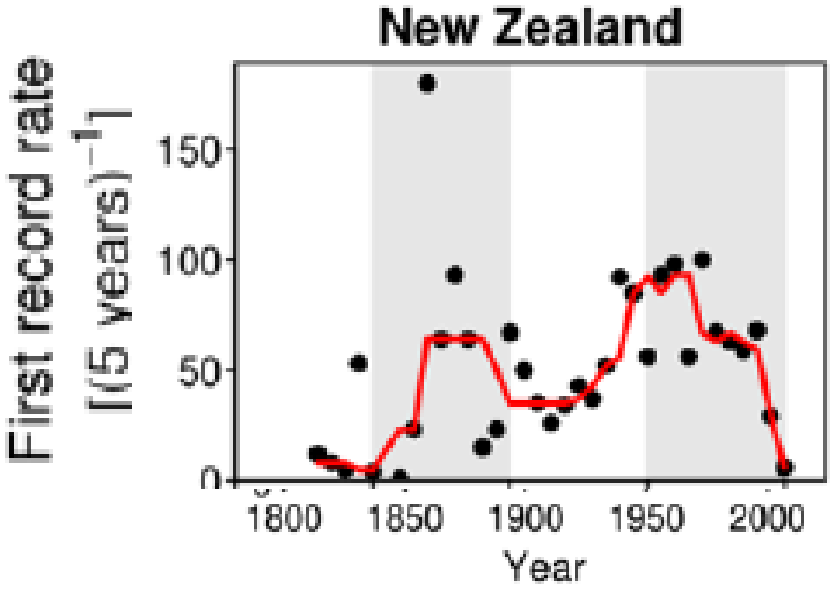
CBD strategic goal	CBD 2020 target Summarised from Report of the Ad Hoc Open-Ended Working Group on Review of Implementation of the Convention on the Work of its Third Meeting, document UNEP/CBD/COP/10/4, June 2010
A. Address underlying causes	1. Everyone is aware of the value of biodiversity and the steps they can take to conserve and use it sustainably
	2. Biodiversity is integrated into national and local development and planning processes
	3. Harmful incentives are eliminated or reformed and positive incentives are developed and applied
	4. Governments and businesses have achieved or implemented plans for sustainable production and consumption
B. Reduce pressures and promote sustainable use	5. Loss, degradation and fragmentation of forest and other habitats is at least halved
	6. Overfishing and destructive fishing practices are eliminated
	7. Agriculture, aquaculture and forestry are managed sustainably
	8. Pollution is reduced to levels that are not detrimental to ecosystem function and biodiversity
	9. Invasive alien species are identified, prioritised and controlled or eradicated, and measures are in place to control pathways of introduction
	10. Pressures on corals and other vulnerable ecosystems impacted by climate change or ocean acidification are minimised
C. Safeguard ecosystems, species and genes	11. Terrestrial, inland-water, coastal and marine areas, especially those of particular importance for biodiversity, are conserved through comprehensive, representative and well-connected systems of effectively managed protected areas
	12. Extinction and decline of threatened species is prevented and their status improved
	13. Loss of genetic diversity in crop, livestock and wild relatives is halted
D. Enhance benefits from biodiversity and ecosystems	14. Ecosystems that provide essential services and livelihoods are safeguarded and/or restored, with equitable access
	15. Ecosystem resilience and the contribution of biodiversity to carbon stocks is enhanced, through conservation and restoration, including 15% of degraded ecosystems
	16. Access to genetic resources is enhanced and benefits shared
E. Enhance implementation through planning, knowledge management and capacity building	17. All parties have implemented effective national biodiversity strategies and action plans
	18. Traditional knowledge and practices are protected and their contribution to biodiversity conservation is enhanced
	19. Knowledge and technologies relating to status, trends and value of biodiversity are improved and shared
	20. Human resources and financing for implementing CBD has increased.

***Target 9*: By 2020, **invasive alien species** and **pathways** are identified and **prioritized**, **priority species are controlled or eradicated**, and measures are in place to manage pathways to **prevent** their introduction and establishment**

BIOSECURITY CAN REDUCE INVASION RATES

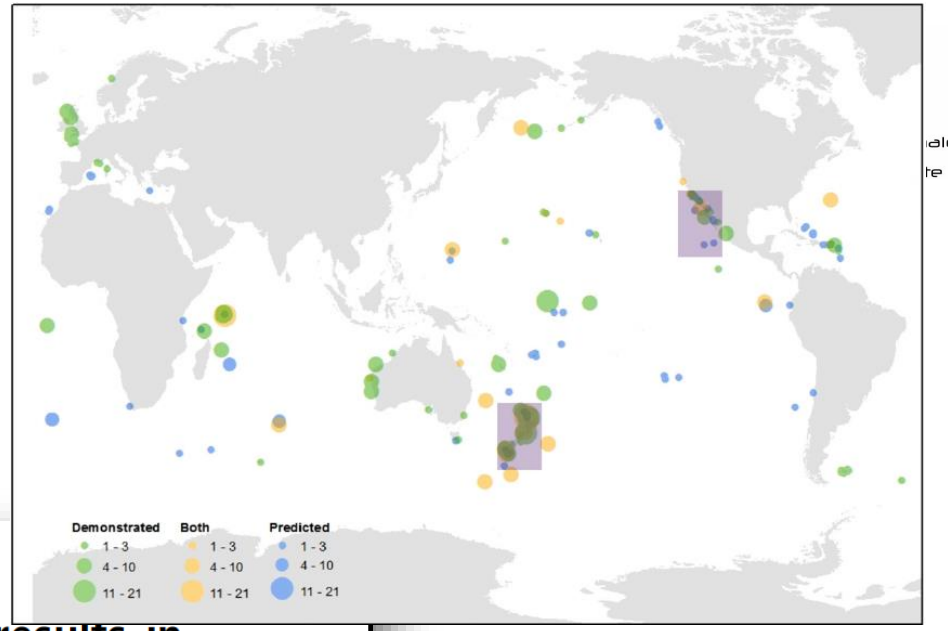


Edney-Browne et al. 2018. Biol. Inv. Establishment patterns of non-native insects in New Zealand



Seebens et al. 2018. Nature Communications

ERADICATIONS WORK



PNAS

Invasive mammal eradication on islands results in substantial conservation gains

Holly P. Jones[a,b,1], Nick D. Holmes[c], Stuart H. M. Butchart[d], Bernie R. Tershy[e], Peter J. Kappes[f], Ilse Corkery[g], Alfonso Aguirre-Muñoz[h], Doug P. Armstrong[i], Elsa Bonnaud[j], Andrew A. Burbidge[k], Karl Campbell[c,l], Franck Courchamp[j], Philip E. Cowan[m], Richard J. Cuthbert[n,o], Steve Ebbert[p], Piero Genovesi[q,r], Gregg R. Howald[c], Bradford S. Keitt[c], Stephen W. Kress[s], Colin M. Miskelly[t], Steffen Oppel[n], Sally Poncet[u], Mark J. Rauzon[v], Gérard Rocamora[w,x], James C. Russell[y,z], Araceli Samaniego-Herrera[h], Philip J. Seddon[aa], Dena R. Spatz[c,e], David R. Towns[bb,cc], and Donald A. Croll[e]

[a]Department of Biological Sciences, Northern Illinois University, DeKalb, IL 60115; [b]Institute for the Study of the Environment, Sustainability, Northern Illinois University, DeKalb, IL 60115; [c]Island Conservation, Santa Cruz, CA 95060; [d]BirdLife International, Cambridge CB2 3QZ, Unite [e]Ecology & Evolutionary Biology Department, Institute of Marine Sciences, University of California, Santa Cruz, CA 95060; [f]Oregon Cooperativ Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; [g]Zoology & Ecology, University Co Corcaigh, Ireland; [h]Grupo de Ecología y Conservación de Islas, A.C., Ensenada, C.P. 22800, Baja California, Mexico; [i]Wildlife Ecology Group, Ins Natural Resources, Massey University, Palmerston North 4474, New Zealand; [j]Laboratory of Ecology Systematics and Evolution, University Pari 91405, France; [k]Private address, Floreat, WA 6014, Australia; [l]School of Geography, Planning and Environmental Management, The Universit Queensland, St Lucia, QLD 4072, Australia; [m]Landcare Research, Lincoln 7608, New Zealand; [n]Centre for Conservation Science, Royal Society Protection of Birds, Cambridge CB2 3QZ, United Kingdom; [o]Wildlife Conservation Society, Goroka, Eastern Highlands Province, Papua New Gui National Maritime Wildlife Refuge, US Fish and Wildlife Service, Homer, AK 99603; [q]Institute for Environmental Protection and Research, I

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Home > Conservation Silver Bullet?

Conservation Silver Bullet?

Seychelles Magpie-robin benefited from invasive speces eradication on its island home image © Simon Stirrup

- 596 populations of 236 native species on 181 islands benefitted from eradications.

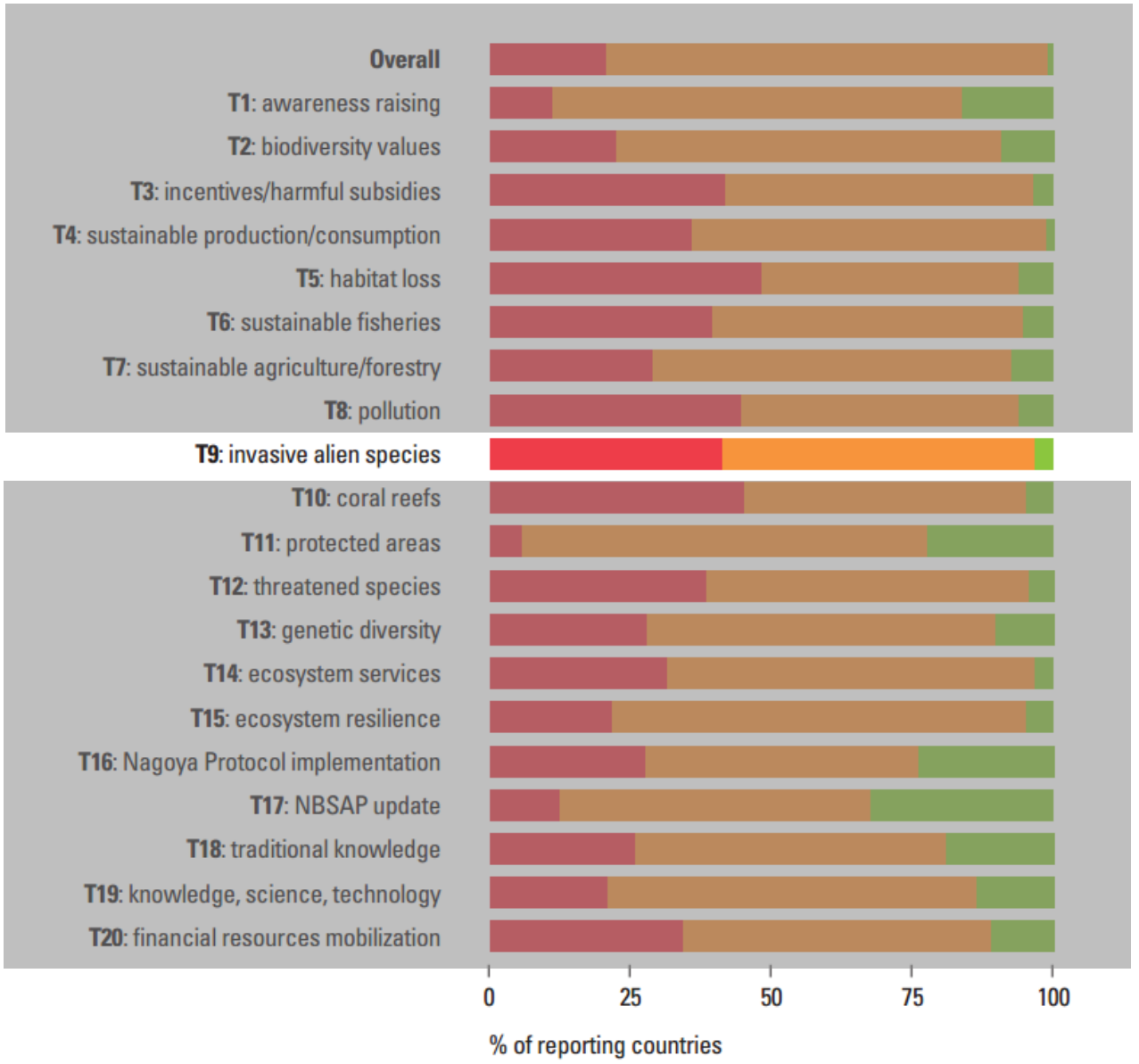
T9 Progress

On track

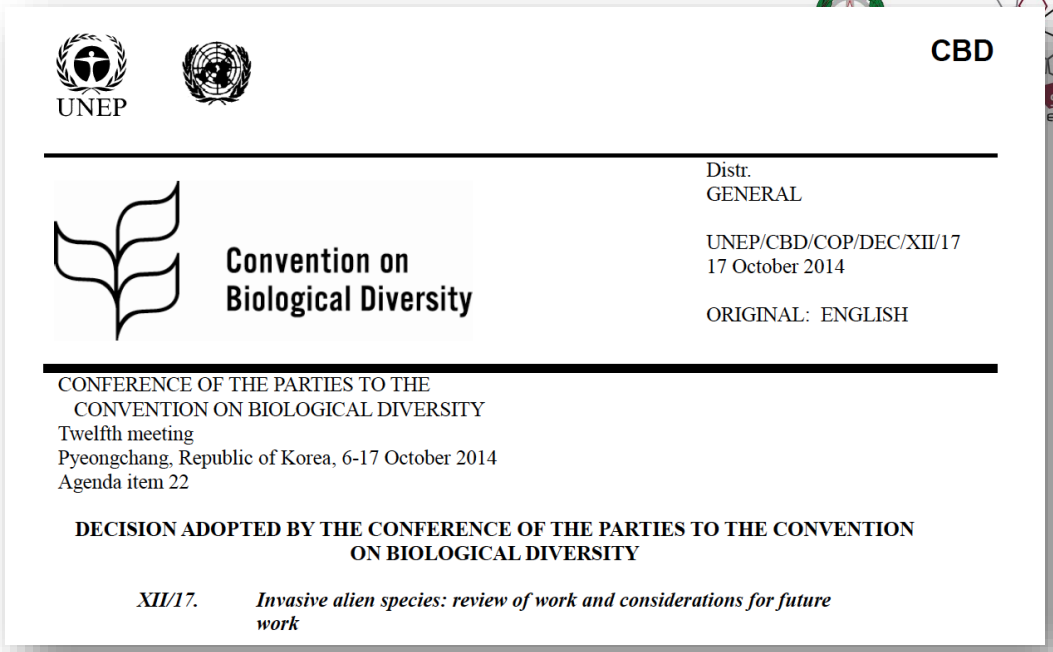
– 3%

Insufficient

– 48%



RSPB et al. 2016



UNEP

CBD

Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/COP/DEC/XII/17
17 October 2014

ORIGINAL: ENGLISH

CONFERENCE OF THE PARTIES TO THE
CONVENTION ON BIOLOGICAL DIVERSITY
Twelfth meeting
Pyeongchang, Republic of Korea, 6-17 October 2014
Agenda item 22

DECISION ADOPTED BY THE CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY

XII/17. Invasive alien species: review of work and considerations for future work

- *COP XII Decision 17: Invites* the Invasive Species Specialist Group of the International Union for Conservation of Nature and other technical partners to continue and complete the work on pathway analysis, and to continue to develop a system for classifying invasive alien species based on the nature and magnitude of their impacts;

- Reported on at SBSTTA

GLOBAL INVASIVE SPECIES DATABASE

ISSG Invasive Species Specialist Group

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100 OF THE W... DONATIONS

According to your search criteria results will be returned

ADVANCED SEARCH OPTIONS

- [x] TAXONOMY
- [ ] LOCATION
- [ ] SYSTEM
- [x] PATHWAY
- [ ] THREATENED SPECIES
- [ ] IMPACT
- [ ] MANAGEMENT

- [ ] Release
  - [ ] Release in nature for use
  - [ ] Biological control
  - [x] *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

LAST ADDED INVAS

Table 1: Categorization of pathways for the introduction of

	Category	Subcategory	
Movement of COMMODITY	RELEASE IN NATURE (1)	Biological control	
		Erosion control/ dune stabilization (windbreak	
		Fishery in the wild (including game fishing)	
		Hunting in the wild	
		Landscape/flora/fauna "improvement" in the w	
		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 garden/zoo/aquaria (excluding dome	
		Pet/aquarium/terrarium species (including live	
		Farmed animals (including animals left under	
		Forestry (including reforestation)	
		Fur farms	
		Horticulture	
		Ornamental purpose other than horticulture	
		Research and *ex-situ* breeding (in facilities)	VIII/27
		Live food and live bait	
		Other escape from confinement	
	TRANSPORT - CONTAMINANT (3)	Contaminant nursery material	
		Contaminated bait	
		Food contaminant (including of live food)	VIII/27; XI/28
		Contaminant on animals (except parasites, species transported by host/vector)	XI/28
		Parasites on animals (including species transported by host and vector)	XI/28
		Contaminant on plants (except parasites, species transported by host/vector)	XI/28
		Parasites on plants (including species transported by host and vector)	XI/28
		Seed contaminant	VIII/27
		Timber trade	
		Transportation of habitat material (soil, vegetation,...)	
VECTOR	TRANSPORT - STOWAWAY (4)	Angling/fishing equipment	VIII/27
		Container/bulk	VIII/27
		Hitchhikers in or on airplane	VIII/27, IX/4
		Hitchhikers on ship/boat (excluding ballast water and hull fouling)	
		Machinery/equipment	VIII/27
		People and their luggage/equipment (in particular tourism)	VIII/27
		Organic packing material, in particular wood packaging	
		Ship/boat ballast water	VIII/27
		Ship/boat hull fouling	VIII/27; IX/4
		Vehicles (car, train, ...)	
		Other means of transport	
SPREAD	CORRIDOR (5)	Interconnected waterways/basins/seas	VIII/27
		Tunnels and land bridges	
	UNAIDED (6)	Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5	

UNEP

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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


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Rattus rattus
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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 w
and woodlands as well as being able to live in and around buildings. It will feed on and damage almost any
IUCN
SSC
Species Survival Commission
ISSG
ISPRA
Institute for Environmental Protection and Research
The Global Invasive Species Databa
Group (ISSG) of the IUCN Species S
global initiative on invasive specie
(GISP), and has been redesigned in 2013 with support from the Abu Dhabi Environment Agency, the Italian Ministry of Environment and ISPRA - the Institute for Environmental Protection and Research, Italy. Conditions of use.
Impact categories
Massive (MV)
Major (MR)
Moderate (MO)
Minor (MN)
Minimal Concern (MC)
Magnitude of Impact
Adequate data
Alien taxon
Evaluated
All species
Data Deficient (DD)
No Alien Populations (NA)
Not Evaluated (NE)

COP Decision XIII/13; 17… Also requests the Executive Secretary… (a) To compile information on the potential **consequences of invasive alien species on social, economic and cultural values**..;

Received: 27 April 2017 | Accepted: 12 June 2017
DOI: 10.1111/2041-210X.12844

RESEARCH ARTICLE

Methods in Ecology and Evolution

Socio-economic impact classification of alien taxa (SEICAT)

Sven Bacher[1,2] | Tim M. Blackburn[3,4,5] | Franz Essl[6] | Piero Genovesi[7] | Jaakko Heikkilä[8] | Jonathan M. Jeschke[9,10,11] | Glyn Jones[12] | Reuben Keller[13] | Marc Kenis[14] | Christoph Kueffer[2,15] | Angeliki F. Martinou[16] | Wolfgang Nentwig[17] | Jan Pergl[18] | Petr Pyšek[18,19] | Wolfgang Rabitsch[20] | David M. Richardson[2] | Helen E. Roy[21] | Wolf-Christian Saul[9,10,11] | Riccardo Scalera[22] | Montserrat Vilà[23] |

TABLE 1 Constituents of human well-being and examples of their subcategories (after MEA, 2005). The overarching premise for all constituents is the freedom of choice and action, i.e. the opportunity to be able to achieve what a person values doing and being

Constituents of human well-being	Examples
Safety	Personal safety
	Secure resource access
	Security from disasters
Material and immaterial assets	Adequate livelihoods
	Sufficient nutritious food
	Shelter
	Access to goods
Health	Strength
	Feeling well
	Access to clean air and water
Social, spiritual and cultural relations	Social, spiritual and cultural practice
	Mutual respect
	Friendship

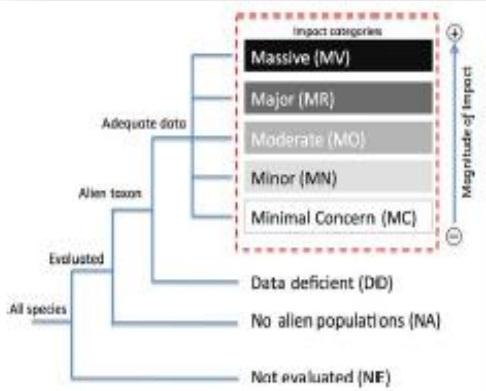


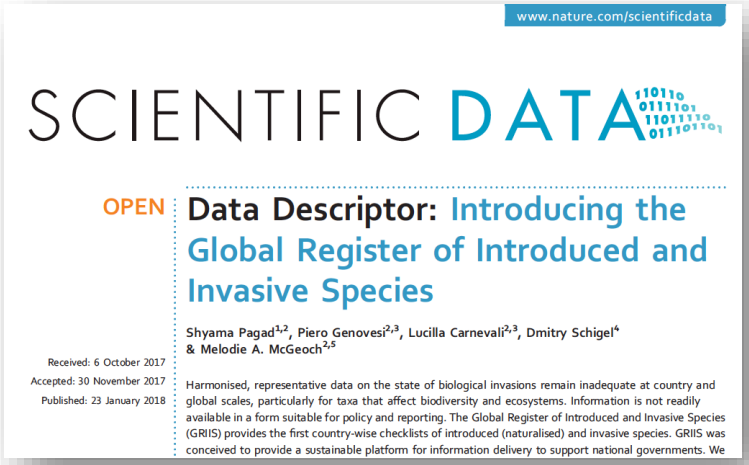
FIGURE 2 Socio-Economic Impact Classification of Alien Taxa (SEICAT) (after Blackburn et al., 2014; Hawkins et al., 2015). Detailed descriptions of the classes are given in Table 2

TABLE 2 Description of Socio-Economic Impact Classification of Alien Taxa (SEICAT) according to observed changes in peoples' activities

Impact classification	Description
Minimal concern (MC)	No deleterious impacts reported despite availability of relevant studies with regard to its impact on human well-being. Taxa that have been evaluated under the SEICAT process but for which impacts have not been assessed in any study should not be classified in this category, but rather should be classified as data deficient
Minor (MN)	Negative effect on peoples' well-being, such that the alien taxon makes it difficult for people to participate in their normal activities. Individual people in an activity suffer in at least one constituent of well-being (i.e. security; material and non-material assets; health; social, spiritual and cultural relations). Reductions of well-being can be detected through e.g. income loss, health problems, higher effort or expenses to participate in activities, increased difficulty in accessing goods, disruption of social activities, induction of fear, but no change in activity size is reported, i.e. the number of people participating in that activity remains the same
Moderate (MO)	Negative effects on well-being leading to changes in activity size, fewer people participating in an activity, but the activity is still carried out. Reductions in activity size can be due to various reasons, e.g. moving the activity to regions without the alien taxon or to other parts of the area less invaded by the alien taxon; partial abandonment of an activity without replacement by other activities; or switch to other activities while staying in the same area invaded by the alien taxon. Also, spatial displacement, abandonment or switch of activities does not increase human well-being compared to levels before the alien taxon invaded the region (no increase in opportunities due to the alien taxon)
Major (MR)	Local disappearance of an activity from all or part of the area invaded by the alien taxon. Collapse of the specific social activity, switch to other activities, or abandonment of activity without replacement, or emigration from region. Change is likely to be reversible within a decade after removal or control of the alien taxon. "Local disappearance" does not necessarily imply the disappearance of activities from the entire region assessed, but refers to the typical spatial scale over which social communities in the region are characterised (e.g. a human settlement)
Massive (MV)	Local disappearance of an activity from all or part of the area invaded by the alien taxon. Change is likely to be permanent and irreversible for at least a decade after removal of the alien taxon, due to fundamental structural changes of socio-economic community or environmental conditions ("regime shift")
Data deficient (DD)	There is no information to classify the taxon with respect to its impact, or insufficient time has elapsed since introduction for impacts to have become apparent

Global Register of Introduced & Invasive Species

- CBD mandated
- GIASI Partnership* product – led by IUCN
- Launched April 2016, published 2017
- Annotated & validated country data
- Starting point for building national strategies NISSAPs



PRIORITISING ACTION

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