





Invasive Alien Species: *Trends and patterns of invasion, global impacts, and possible responses*

Piero Genovesi

ISPRA Italy

Chair IUCN Invasive Species Specialist Group



Seminar organized by IPPC FAO, Rome 24 September 2015





International Union Conservation of Nature

 World's oldest and largest global environmental organization, with almost 1,300 members (Governments, GOs and NGOs) and more than 15,000 volunteer scientists and experts in 185 countries.

• Vision:

a just world that values and conserves nature











IUCN SSC Invasive Species Specialist Group

- Mission: is to reduce threats to biodiversity by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them
- ISSG core business is to:
 - bring credible knowledge and information to inform and influence policy at all levels
 - convene and build partnerships for action
 - ✓ bridge local and global policy and action
 - build capacity





IUCN SSC Invasive Species Specialist Group

- ISSG network
 - ✓~250 global core membership
 - ✓Aliens-L list membership ~1400
- Collaboration with the Convention on Biological Diversity, CMS, EEA, and other international *fora*
- Member of CBD Liaison Group on IAS with FAO, WTO, CITES, ...
- Global Invasive Species Database, oldest and most authoritative db on IAS





















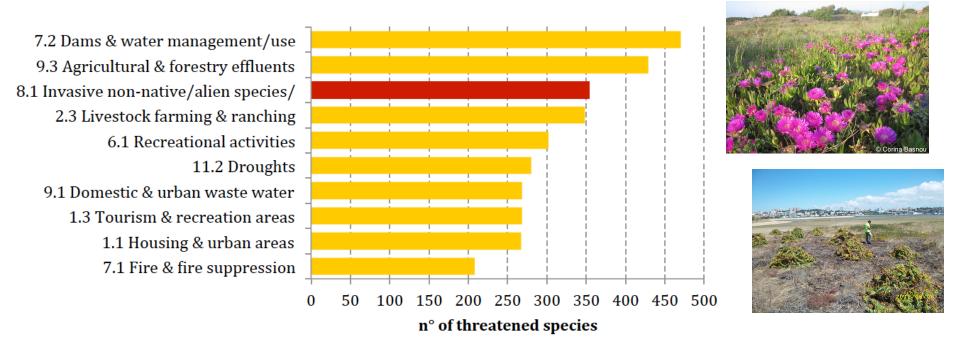


- Second driver of biodiversity loss after habitat destruction and fragmentation (Millenniun Ecosystem Assessment 2005)
- Invasives impact 33% of threatened amphibians, 25% of birds, 24% of mammals, 22% of reptiles, 20% of fish
- Key factor in 54% of known animals extinctions. Only factor of 20% of extinctions





- IAS 3rd most severe impact on threatened species in Europe
- 1 out of 5 threatened species in Europe directly affected by IAS

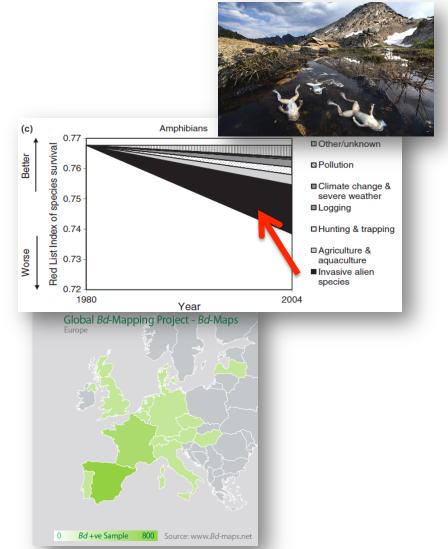


Genovesi et al. 2015. Mid-term review EU Biodiversity Strategy



CHYTDID FUNGUS IMPACT ON AMPHIBIANS

- Responsible for several extinctions of amphibians.
- Dramatic population and community declines on four continents.
- Detected in 17 EU countries, including Mediterranean islands.
- Europe hosts 88 amphibian species and 75% are endemic to it.





IMPACT ON ECOSYSTEMS

- 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







Bumble bees at risk

- More than 85% of flowering plants require an animal to move pollen, including 1/3 of all crop plants
- Pollinator dependent crops contain more than 90% of the vitamin C humans need
- Wild and managed bumble bees significant pollinators





Bumble bee trade

- European buff-tailed bumble used in at least 19 countries
- In 2004 total annual sales from ca 30 companies estimated at 1 million colonies. Today just one company boasts annual sales of 1 mln colonies (source: IUCN Bumble Bee Specialist Group)





Risk to wild bumble bees

- Spread of pathogens, competition, interbreeding
- Bombus dahlbornii, only native bumble bee of temperate forests of South America.
 Declined by 54% in the past 10 yrs due to pathogens from European bumble bees
- Similar declines of native bumble bees in Japan and USA







Yellow-legged hornet Vespa velutina nigrithorax

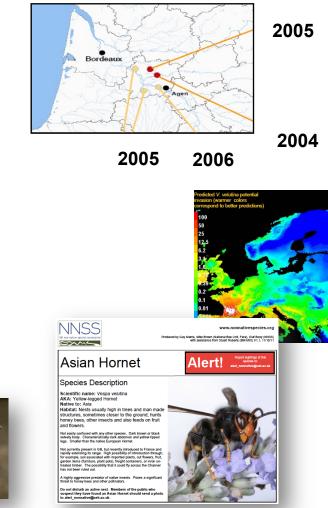
Arrived in France 2004. 89% of diet bees, wasps and other pollinators





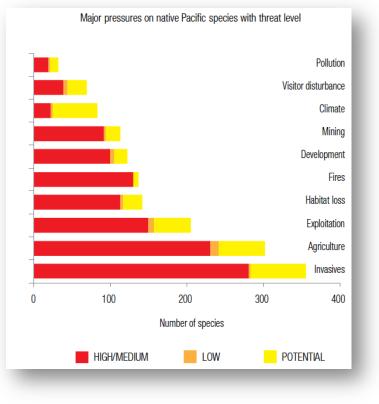
Yellow-legged hornet Vespa velutina nigrithorax

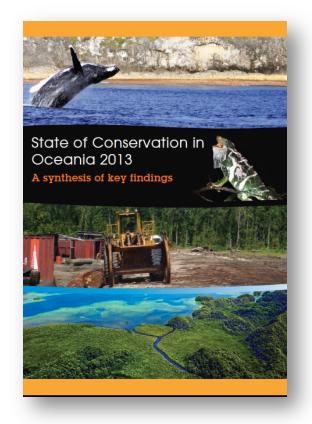
- Detected in France in 2004, but only reported in 2008
- Predicted to expand, especially towards South and East
- UK has an alert system in place, and a response strategy
- Arrived in Italy in November 2012, reported only in May 2013, no response yet





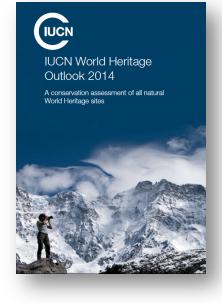
MAJOR IMPACTS Affecting all regions and on all taxonomic groups

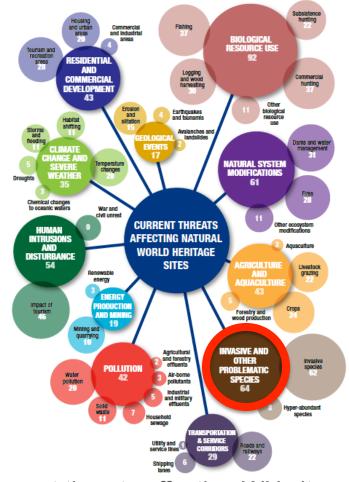






THREATENING GLOBAL PROTECTED AREAS





Current threats affecting WH sites (number of sites)



LOCAL PERCEPTION MAY BE MISLEADING

Hawaii hosted over 114 endemic species of birds.

At least 56 now globally extinct. 53 introduced species, almost all globally common and widespread



Local number of species not changed, global biodiversity significantly reduced.



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.

Tiger mosquito

 transmits 20 pathogens, including Dengue, West Nile, Chikungunia

Mazza et al., Ethol. Ecol. Evol. 2013





ALL ENVIRONMENTS Freshwater









 Invasives impact 33% of threatened amphibians, 20% of fish FRESHWATER BIODIVERSITY

OUT OF SIGHT - OUT OF MIND

64%

PROVIDES GOODS & SERVICES WORTH

© Michel Roggo / roggo.ch

IUCN

\$29



 $= GDP_{\times 2}$

INVEST IN US TO HELP



GUIDE CONSERVATION

ONLY 50% FRESHWATER SPECIES ASSESSED

of those that are...

SPECIES ARE THREATENED

IUCN River Bank: Identifying threatened species & important sites across the world ucn.org/species/freshwater © Michel Roggo / roggo.ch



ALL ENVIRONMENTS Freshwater

 Water hyacinth in Africa impacts on biodiversity, local livelihood, water stock and human health



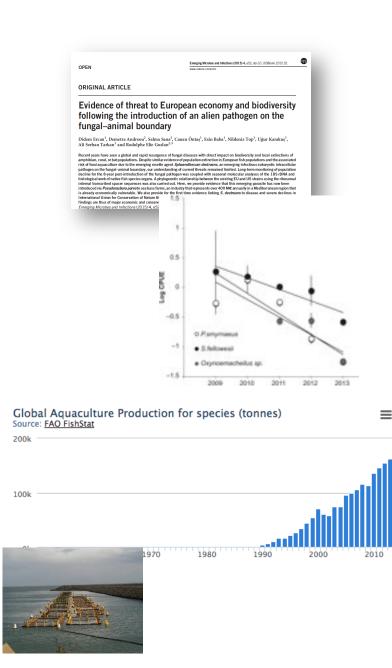






ALL ENVIRONMENTS Freshwater

- Introduction of Stone moroko *Pseudorasbora parva* 50 yrs ago in the Black Sea
 region healthy carrier of a fungal
 disease, the rosette agent
- Associated with the dramatic decrease of several endemic species
- Likely to impact commercially important marine species as well such as the European sea bass





ALL ENVIRONMENTS Marine

- Mediterranean invaded by hundreds of alien organisms. Suez Canal responsible for the arrival of 432 multicellular alien species, of which 117 invasive
- 45-mile parallel lane just opened, to allow many more ships to use the freight each day
- Increased traffic expected to have an immediate impact on the eastern, and in 20-30 yrs on the central Mediterranean





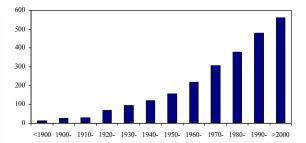


ALL ENVIRONMENTS Marine

- Constant increase of new invasions
- E.g. Silver-cheeked toad fish Lagocephalus sceleratus; extremely toxic.
 Fatal intoxications in Egypt and Israel, recently recorded in Italy



Cumulative number of alien species in the Mediterranean 1900-2007





Si riconosce dal dorso bruno-verdastro con macchie scure e ventre bianco.

Specie originaria del Mar Rosso, arrivata in Mediterraneo negli ultimi anni, è stata catturata anche in acque italiane (Isola di Lampedusa).

ATTENZIONE: le sue carni sono altamente tossiche.

NON VA ASSOLUTAMENTE MANGIATO



ALL ENVIRONMENTS Forests

 Beaver introduced in Tierra del Fuego, established in over 7 MIn hectares



Photos (1-4): Freir rew - Noja irregularis (byuyood arg/1234634/6. Rodo), Conartium riticolas (76/07-0000/F. Nort), Imperta Optionis (Buyoodo arg/12900/C.T. Bryso), Good rew - Halatos quinteemaris (Buyoodo arg/1234631/G. Nurma), Andatos Holia ((Buyoodo arg/1285817/G. K. Bulaisani), Anopaptara glabaptamia (G. Bulars), Burapholancha sylaphilas (Buyoodo arg/141234/J. (Buyoodo arg/15050/L. Tarsy); Fortuna Vegeta (Buso), Burapholancha (Buyoodo arg/1506/L. Buray), Buran Vegeta (Buyoodo arg/15050/L. Buray); Fortuna Vegeta (Buray), Buray (Buray),





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



Source: Kettunen, Genovesi, Gollasch, Pagad, Starfinger, ten Brink & Shine. 2008. Assessment of the impacts of IAS in Europe and the EU (Final module report for the European Commission). IEEP



PROTECTING BIODIVERSITY SAFEGUARDS LIVELIHOOD

Invasive species impact on both ecosystems and livelihood

135

REVIEWS REVIEWS REVIEWS

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

Montserrat Vilà^{1*}, Corina Basnou², Petr Pyšek³, Melanie Josefsson⁴, Piero Genovesi⁵, Stephan Gollasch⁶, Wolfgang Nentwig⁷, Sergej Olenin⁸, Alain Roques⁹, David Roy¹⁰, Philip E Hulme¹¹, and DAISIE partners¹²

	Total		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%	



CONSTANTLY INCREASING

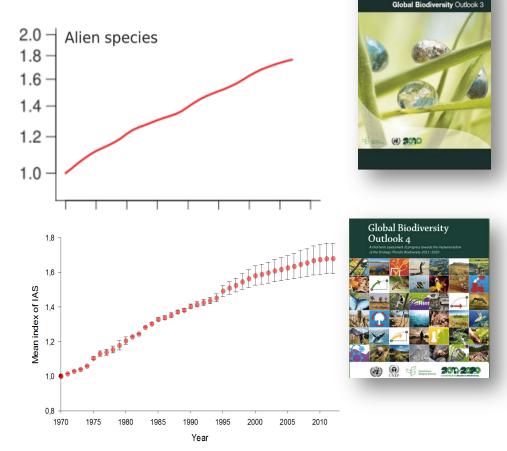
So far we failed to halt invasions

Number of alien species in Europe increased 76% in the 1970-2007 period

More recent analysis confirms this trend (1975-2012)

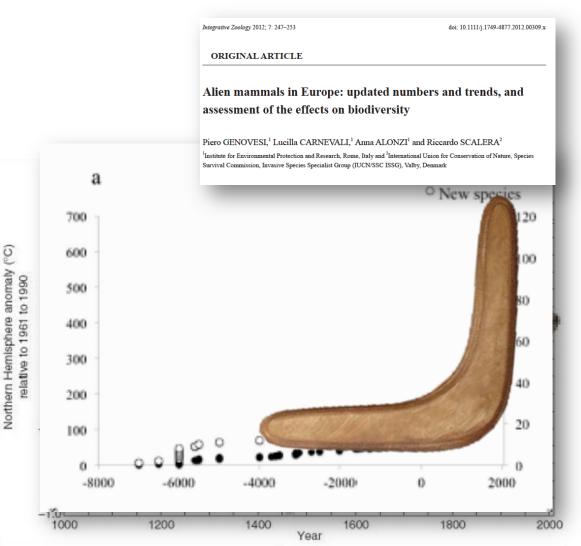
Global Biodiversity: Indicators of Recent Declines

28 MAY 2010 VOL 328 SCIENCE www.sciencemag.org





DRAMATIC PACE OF INCREASE



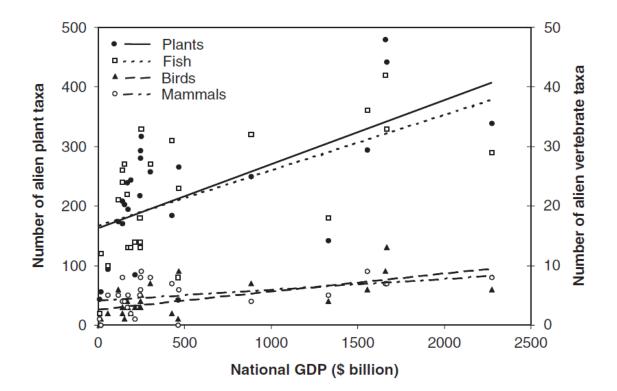
From ice hockey stick to boomerang? Urgent to act!



IT'S THE ECONOMY, STUPID!

Correlates of invasions

Economy is the most significant correlate of invasions



Hulme, 2007



IT'S THE ECONOMY, STUPID!

"Invasion debt"



Franz Essl^{a,b,1}, Stefan Dullinger^{c,d,1,2}, Wolfgang Rabitsch^a, Philip E. Hulme^b, Karl Hülber^{c,d}, Ingrid Kleinbauer^c, Fridolin Krausmann^g, Ingolf Kühn^h, Wolfgang Nentwigⁱ, Montserrat Vil Francesca Gherardi¹, Marie-Laure Desprez-Loustau^m, Alain Roquesⁿ, and Petr Pyšek^{e,f}

^aFnvironment Agency Austria 1090 Vienna Austria: ^bRio-Protection Research Centre, P.O. Rox 84. Lincoln University

- «Invasion debt», implies delayed effects of species introductions
- This inertia implies that the consequences of invasions are completely realized only after many decades

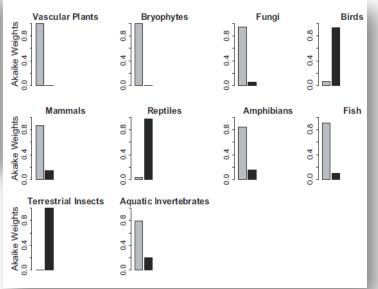


Fig. 2. Alien-species richness of 10 different taxonomic groups in 28 European countries as explained by current and historic socioeconomic models. Bars represent Akaike weights for spatial autoregressive models explaining the current distribution of established alien species across 28 European countries by either current or historical socioeconomic conditions. The predictors in the models are scores on the three axes of a principal component analysis using human population density, standardized per capita GDP, and share of exports in 1900 (gray), and 2000 (black) as input variables.



SYNERGY WITH CLIMATE CHANGE

Increased impacts

- Europe, N America, Oceania
- Some taxonomic groups

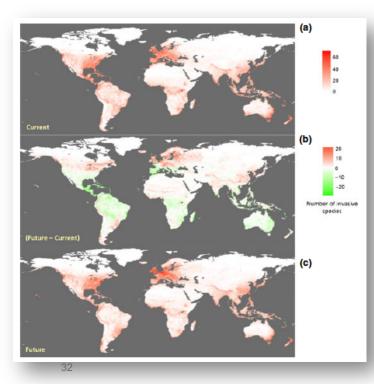
Global Change Biology

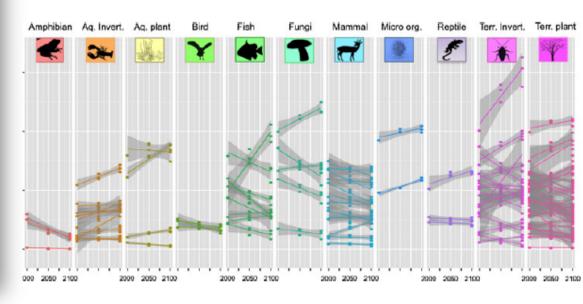
Global Change Biology (2013), doi: 10.1111/gcb.12344

Will climate change promote future invasions?

CELINE BELLARD*, WILFRIED THUILLER†, BORIS LEROY \$ \$, PIERO GENOVESI ¶, MICHEL BAKKENES || and FRANCK COURCHAMP*

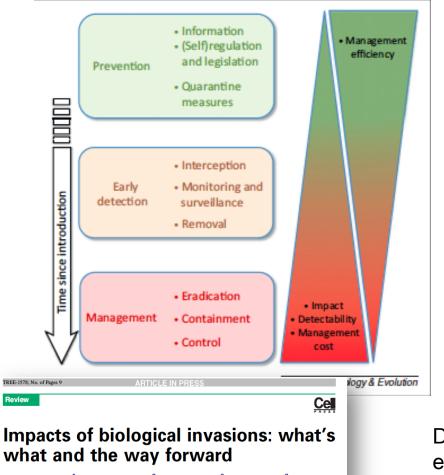
*Ecologie, Systématique & Evolution, UMR CNRS 8079, Univ. Paris-Sud, Orsay Cedex FR-91405, France, †Laboratoire d'Ecologie Alpine, UMR CNRS 5553 Université Joseph Fourier, Grenoble 1 BP 53, Grenoble Calex 9 FR-38041, France, ‡URUEM 420 Biodiversité et Gestion des Territoires, Université de Rennes 1, Campus de Beaulieu, Rennes Cedex 35042, France, §Service du Patrimoine Naturel, MNHN, Paris, France, ¶Institute for Environmental Protection and Research, Rome, Italy, ||Netherlands Environmental Assessment Agency (PBL), PO Box 303, Bilthoven 3720, The Netherlands







HOW TO RESPOND?



Daniel Simberloff¹, Jean-Louis Martin², Piero Genovesi³, Virginie Maris², David A. Wardle⁴, James Aronson^{2,5}, Franck Courchamp⁶, Bella Galil⁷, Emili García-Berthou⁸, Michel Pascal⁹, Petr Pyšek^{10,11}, Ronaldo Sousa^{12,13}, Eric Tabacchi¹⁴ and Montserrat Vila^{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 2020



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**

- Identify, prioritize, control species to mitigate impacts
- Identify, prioritize, manage pathways to enhance prevention



WHERE ARE WE

SCIENCE sciencemag.org 10

10 OCTOBER 2014 • VOL 346 ISSUE 6206

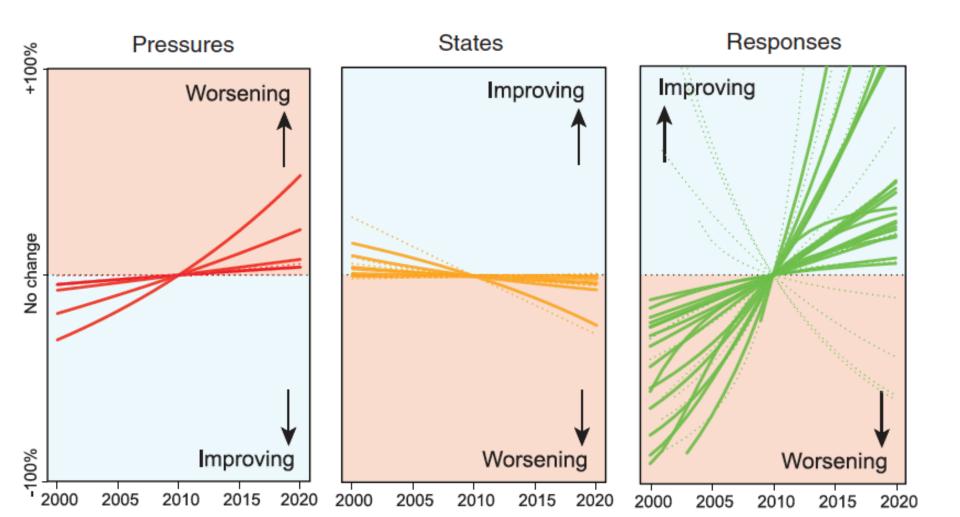
CONSERVATION TARGETS

A mid-term analysis of progress toward international biodiversity targets

Derek P. Tittensor,^{1,2*} Matt Walpole,¹ Samantha L. L. Hill,¹ Daniel G. Boyce,^{3,4} Gregory L. Britten,² Neil D. Burgess,^{1,5} Stuart H. M. Butchart,⁶ Paul W. Leadley,⁷ Eugenie C. Regan,¹ Rob Alkemade,⁸ Roswitha Baumung,⁹ Céline Bellard,⁷ Lex Bouwman,^{8,10} Nadine J. Bowles-Newark,¹ Anna M. Chenery,¹ William W. L. Cheung,¹¹ Villy Christensen,¹¹ H. David Cooper,¹² Annabel R. Crowther,¹ Matthew J. R. Dixon,¹ Alessandro Galli,¹³ Valérie Gaveau,¹⁴ Richard D. Gregory,¹⁵ Nicolas L. Gutierrez,¹⁶ Tim L. Hirsch,¹⁷ Robert Höft,¹² Stephanie R. Januchowski-Hartley,¹⁸ Marion Karmann,¹⁹ Cornelia B. Krug,^{7,20} Fiona J. Leverington,²¹ Jonathan Loh,²² Rik Kutsch Lojenga,²³ Kelly Malsch,¹ Alexandra Marques,^{24,25} David H. W. Morgan,²⁶ Peter J. Mumby,²⁷ Tim Newbold,¹ Kieran Noonan-Mooney,¹² Shyama N. Pagad,²⁸ Bradley C. Parks,²⁹ Henrique M. Pereira,^{24,25} Tim Robertson,¹⁷ Carlo Rondinini,³⁰ Luca Santini,³⁰ Jörn P. W. Scharlemann,^{1,31} Stefan Schindler,^{32,33} U. Rashid Sumaila,¹¹ Louise S.L. Teh,¹¹ Jennifer van Kolck,⁸ Piero Visconti,³⁴ Yimin Ye⁹

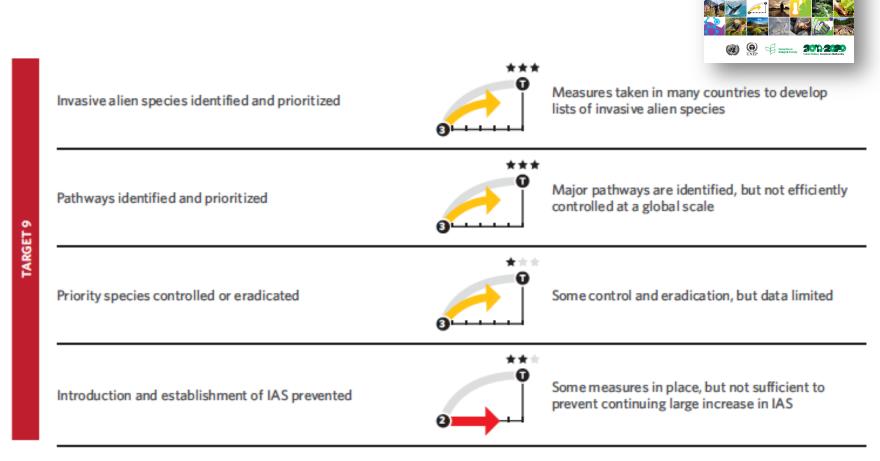


WHERE ARE WE





WHERE ARE WE



Global Biodiversity <u>Outlook 4</u>



NEED TO MOVE TOWARD IMPLEMENTATION

Diversity and Distributions, (Diversity Distrib.) (2010) 16, 95–108

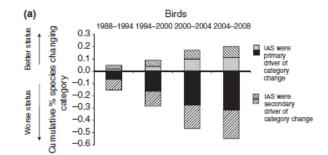


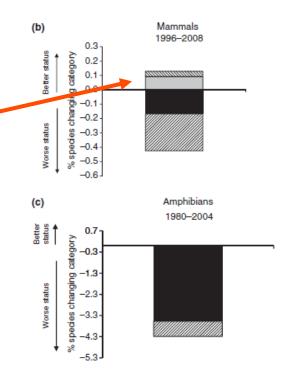
Global indicators of biological invasion: species numbers, biodiversity impact and policy responses

Melodie A. McGeoch^{1*}, Stuart H. M. Butchart², Dian Spear³, Elrike Marais³, Elizabeth J. Kleynhans³, Andy Symes², Janice Chanson⁴ and Michael Hoffmann^{5,6}

genuine IUCN Red List category changes driven by the impacts of IAS:

- conservation measures leading to improvements in status
- conservation status of 11 birds, 5 mammals and 1 amphibian improved because of eradication of IAS







PATHWAYS OF ARRIVAL

From physical vectors, to human activities, to e-commerce

Planting



Accidental transport



Tourism



Aquaculture





Ships



Pet trade



High Quality Ball Python Morphs

Home | Available Animals | Care & Information | Gallery | Testimonials | Terms | Contact Us

Online Store	Welcome to Boa
AVAILABLE ANIMALS	The Boa Barn is a privately owned I Here you will have access to our su with great emphasis on genetic div
Your cart	anywhere.
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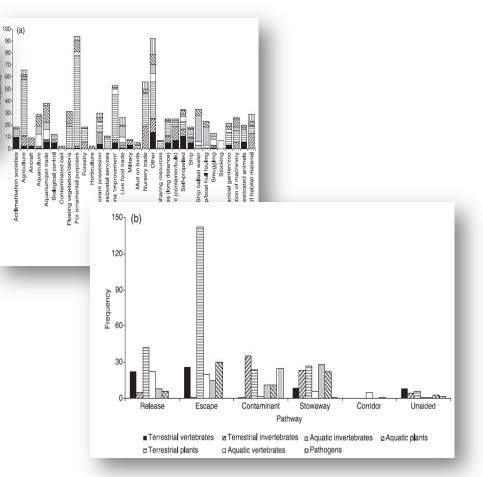
PATHWAYS OF ARRIVAL Improved understanding of pathways

Journal of Applied Ecology 2008, 45, 403-414

doi: 10.1111/j.1365-2664.2007.01442.x

Grasping at the routes of biological invasions: a framework for integrating pathways into policy

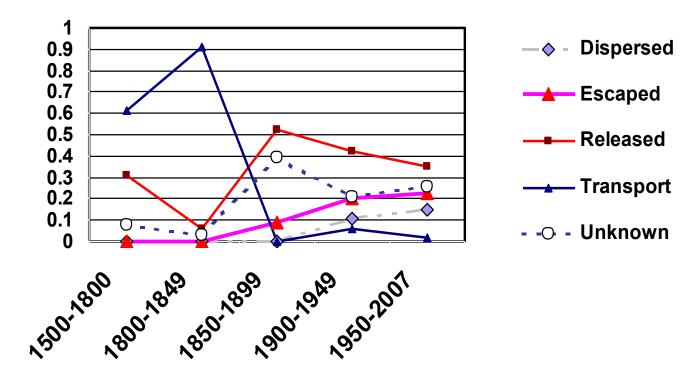
P. E. Hulme^{1,2*}, S. Bacher³, M. Kenis⁴, S. Klotz⁵, I. Kühn⁵, D. Minchin⁶, W. Nentwig³, S. Olenin⁷, V. Panov⁸, J. Pergl⁹, P. Pyšek^{9,10}, A. Roques¹¹, D. Sol¹², W. Solarz¹³ and M. Vilà¹⁴



Hulme et al. 2008



PATHWAYS CHANGE OVER TIME Mammals in Europe

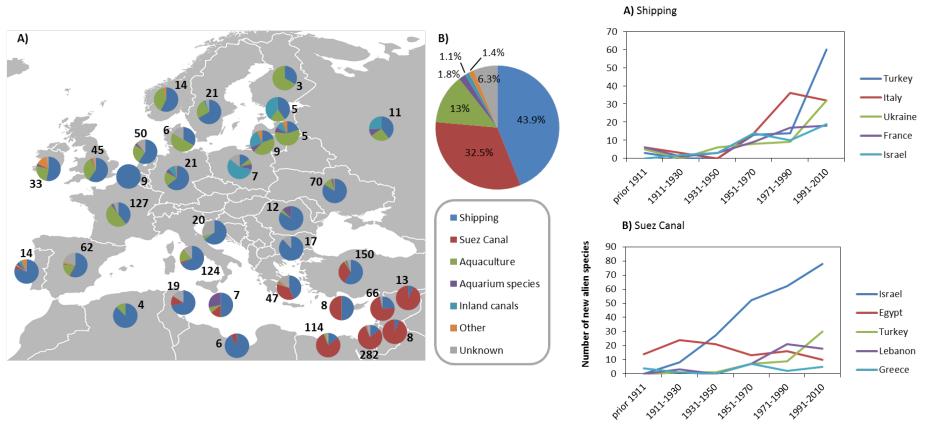


Genovesi et al., 2009. DAISIE handbook



PATHWAYS VARY GEOGRAPHICALLY

The example of marine species in Europe



Nunes et al., 2014. Alien marine species in Europe. Aquatic Invasions



SPEAKING THE SAME LANGUAGE

Common definitions crucial to allow comparison of data





STANDARD CATEGORIZATION OF PATHWAYS

Developed by IUCN SSC ISSG within the GIASIPartnership, in collaboration with CEH and CABI, and inputs from the CBD Secretariat

SPREAD

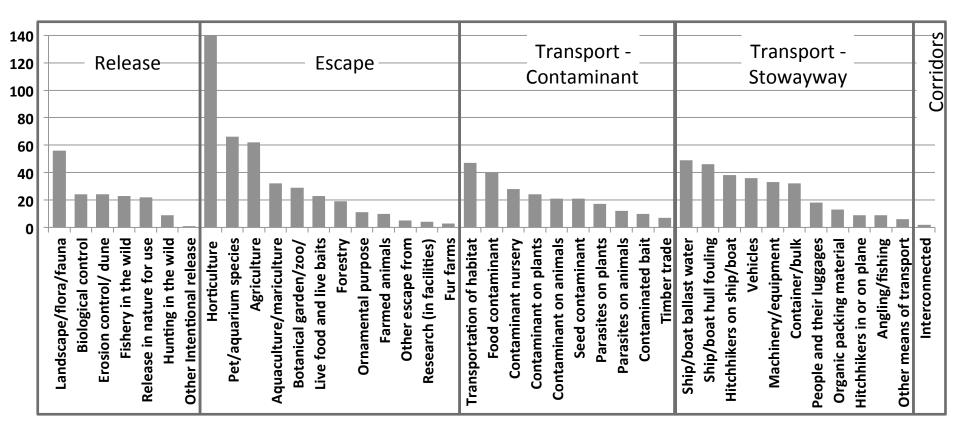
- Presented in a note by the Executive Secretary of CBD
- Based on inputs from leading experts, and the most updated scientific literature
- Tested with the IUCN SSC Global Invasive Species Database (over 800 invasive species globally)
- Mapped toward CBD decisions

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PATHWAYS OF ARRIVAL

Standard categorization of pathways



• In-depth analysis presented in Essl et al. 2015 BioScience

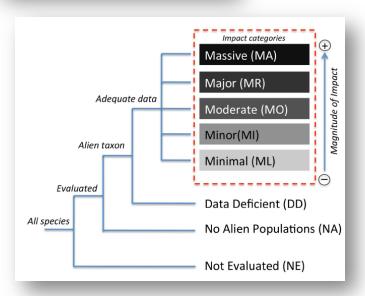


RANKING INVASIVE SPECIES BY THEIR IMPACT

Toward a standard method

- Presented in a paper by Blackburn et al. PLOS 2014
- Presented at SBSTTA 18, included in decision of the CBD COP: invitation to IUCN SSC ISSG to "..continue to develop a system for classifying alien species based on the nature and magnitude of their impacts...".

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RANKING INVASIVE SPECIES BY THEIR IMPACT

Discussed with key actors

- General approach approved by IUCN SSC Steering Committee
- Discussed with CBDS
- Workshop in March 2015 to discuss approach with leading experts, and CBDS, European Commission, IPPC, GBIF, Island Conservation, CABI
- Presented at CBD Liaison Group on IAS with WTO, FAO, IMO, CITES, etc



PRIORITIZATION TO ENHANCE BIOSECURITY

- Prioritizing pathways and species is essential for effective policy and management of biological invasions
- Key to achieve Aichi Target 9

McGeoch et al. submitted

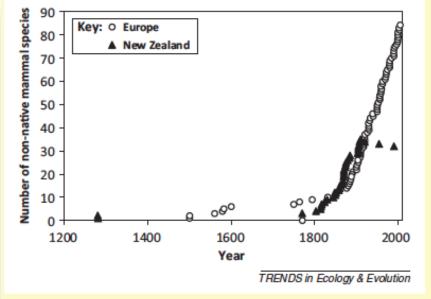


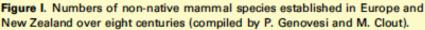
BIOSECURITY POLICIES CAN WORK

Regulation of IAS can prevent the impacts of invasions

- Stringent prevention measures
- Effective early warning rapid response
- Advanced management for several key IAS
- Worldwide champions in eradication science









BIOSECURITY POLICIES CAN WORK

EU Aquaculture regulation

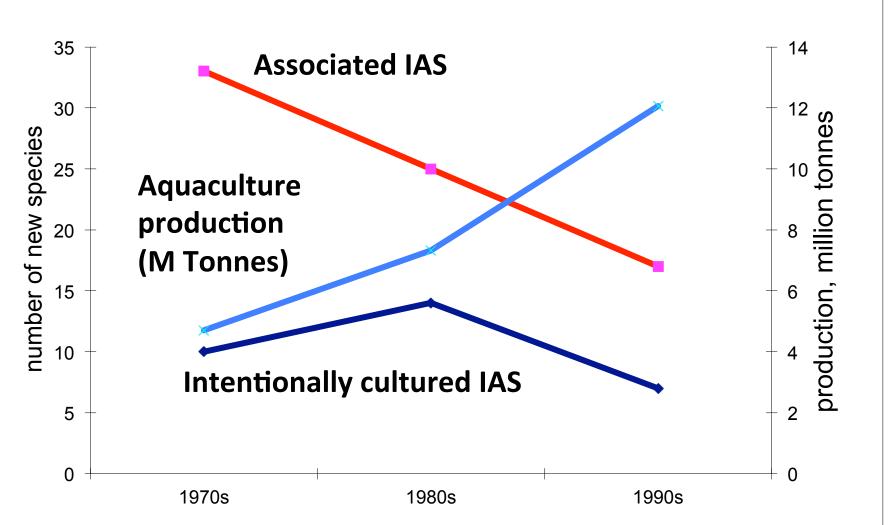
- Requires States to avoid adverse effects
- "White list" of permitted species
- Import requires a permit, based on Pest Risk Assessment
- Consultation with neighbouring States
- Possible regulation of containment facilities







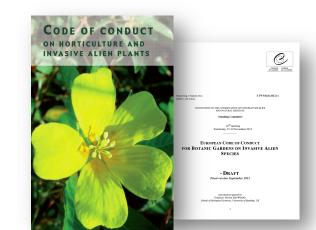
BIOSECURITY POLICIES CAN WORK

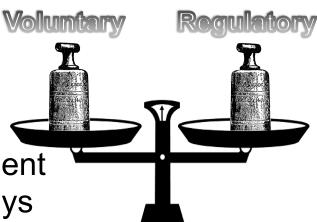




VOLUNTARY APPROACHES Involving the society

- IUCN ISSG has supported the development of several Codes of Conducts on pathways of introduction of IAS:
 - Pet trade
 - Horticulture
 - Botanical gardens
 - Hunting
 - Angling







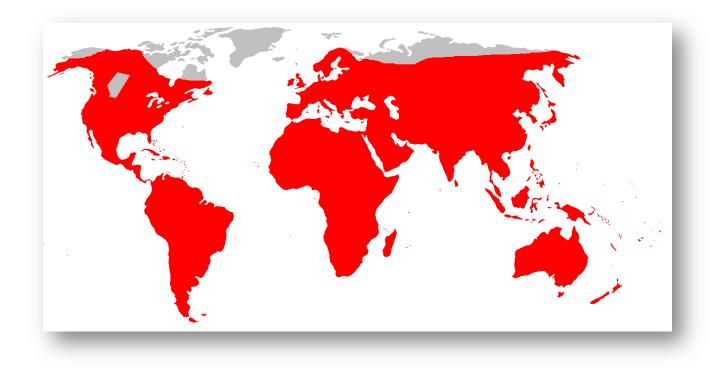


VOLUNTARY APPROACHES Engaging with local communities





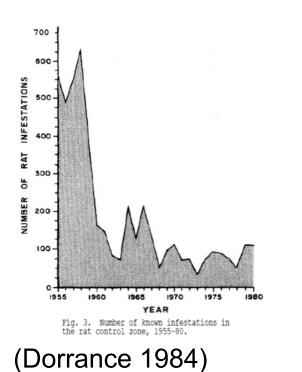
PUBLIC SUPPORT AND AWARENESS Alberta, a rat free province





PUBLIC SUPPORT AND AWARENESS Alberta, a rat free province

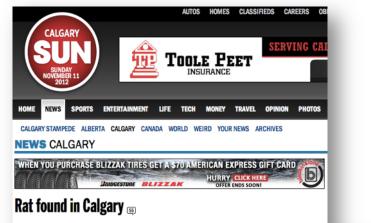
• Alberta started in the '50s a ratfree policy







PUBLIC SUPPORT AND AWARENESS Alberta, a rat free province













NEED TO TRACK PROGRESSES





TECHNOLOGICAL ADVANCES

Develop science-based solutions, improve information exchange





