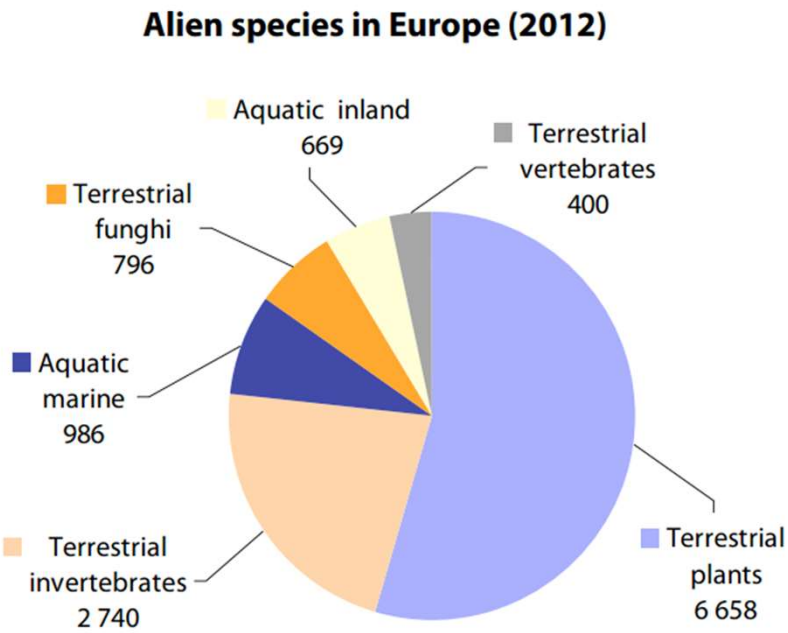
200 JAHRE
SENCKENBERG
SEIT 1817

InvaCost
The first public database on the costs of invasive alien species

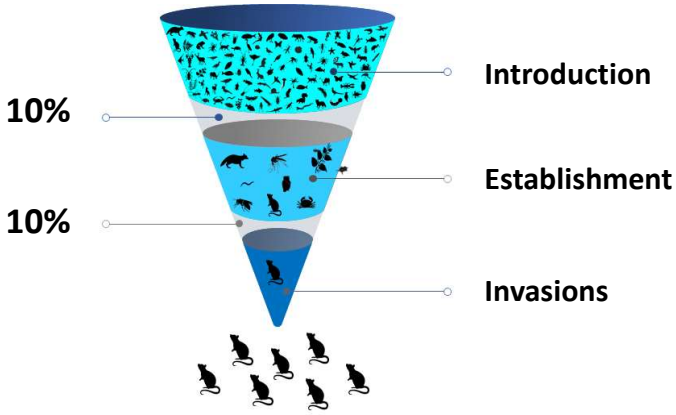
Phillip J. Haubrock, *Dr. ric*
Department of River Ecology and Conservation
Senckenberg Research Institute and Natural History Museum Frankfurt
Clamecystraße 12
63571 Gelnhausen
Tel.: ++49 +6051 61954-3125

Mitglied der Leibniz-Gemeinschaft



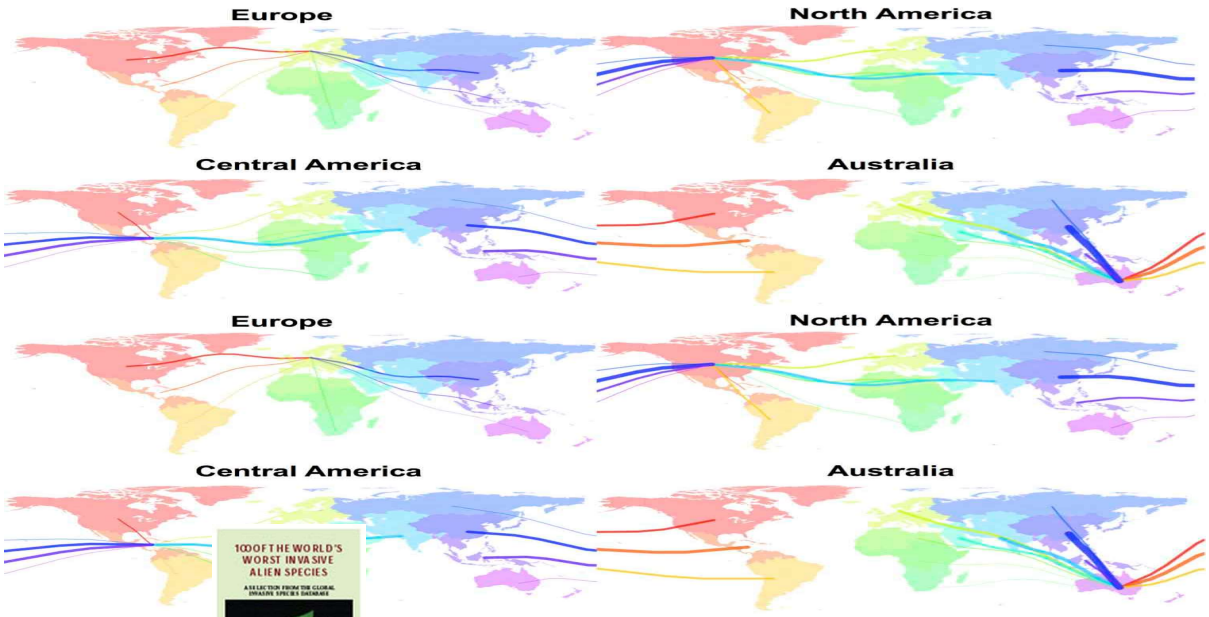
~14 000 alien species in Europe
Perhaps around 5 000 invasive

The 10% rule



But 1% of thousands of species is still a lot…

Tens of thousand of IAS in the world, from everywhere to everywhere



Origins of the "100 of the world's worst invasive alien species" – ISSG IUCN

Biological invasions are currently the **second threat on biodiversity**

PROCEEDINGS B

rspb.royalsocietypublishing.org

Global patterns in threats to vertebrates by biological invasions

C. Bellard[1,2], P. Genovesi[3] and J. M. Jeschke[4,5]

BIOLOGY LETTERS

rsbl.royalsocietypublishing.org

Conservation biology

Alien species as a driver of recent extinctions

Céline Bellard[1], Phillip Cassey[2] and Tim M. Blackburn[1,2,3,4]

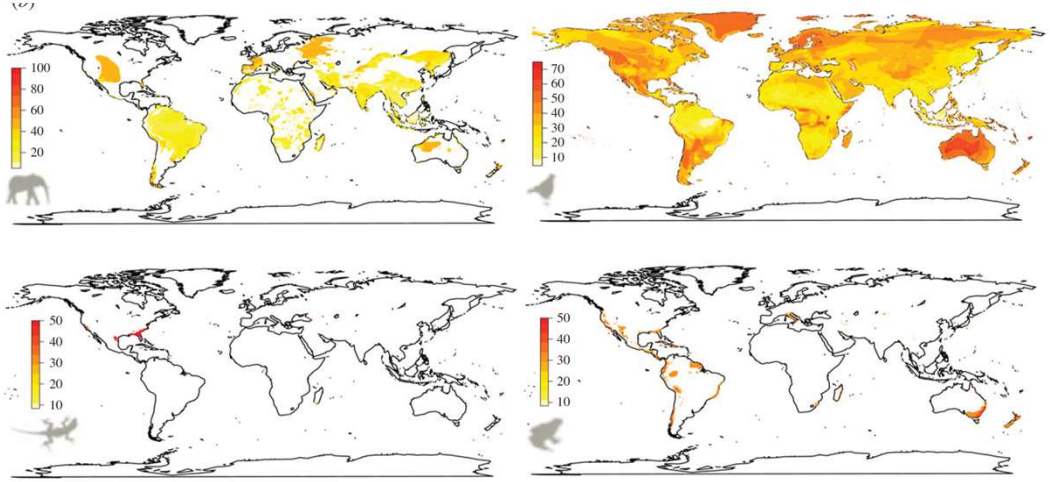


Figure 1. Spatial distribution of IAS-threatened (CR, EN and VU IUCN Red List) mammals, birds, reptiles and amphibians, in absolute number (*a*) and given as a proportion of all threatened species (*b*). For instance, a proportion of 50% for a given location means that 50% of the threatened species there are threatened by IAS.

Biological invasions have an impact on **human societies**

Sanitary costs

Allergies, bites, stings, …
Insect vector borne lethal diseases

Tens of thousands of deaths and millions of medical care worldwide each year

Biological invasions have an impact on **human societies**

Economic costs

- Agricultural losses (beekeeping, horticulture, viticulture, fisheries, aquaculture…)
- Forestry losses
- Real estate and infrastructure losses
- Tourism losses
- …

Paradox of biological invasions

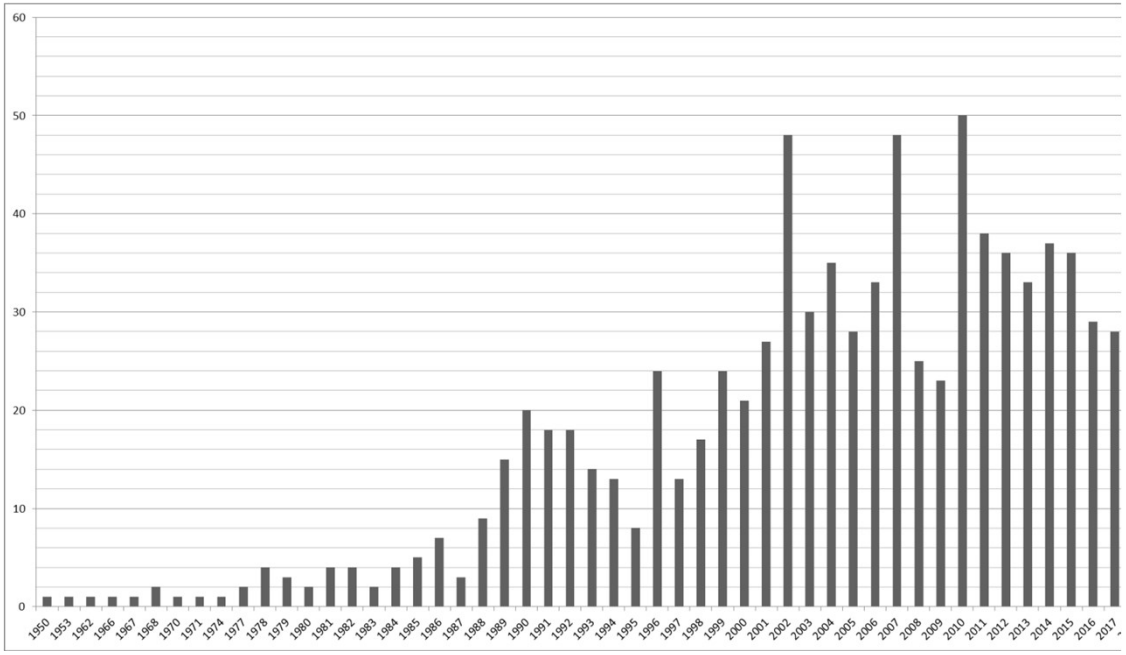
Neither the public, nor decision makers are really aware of the issue

One way to quantify impacts, but also to touch non-scientists is to use a metrics that they are familiar with: **currencies**

SENCKENBERG

There are studies on the economic costs of biological invasions

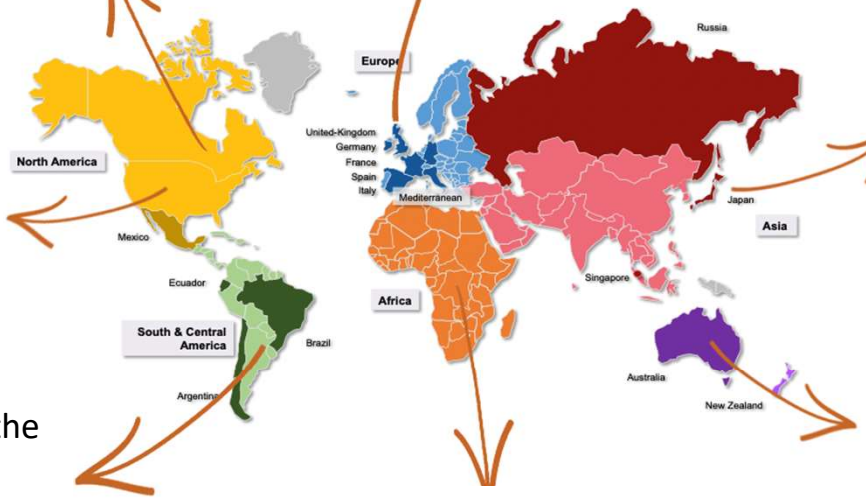
➔ **even increasing worldwide**



SENCKENBERG

Damages by the zebra and quagga mussels in Canadian lakes from 1991 to 1997

Yield losses in agriculture and health costs due to Ambrosia in Western Europe from 2012 to 2017



Management costs of invasive mammals in Japanese islands in 2005

100,000 yearly hospitalisations due to the Red Imported Fire Ant in the USA

Control program of the invasive tiger mosquitoe in South America from 1990 to 2030

Waterways blocked by the floating primrose-willow in 14 African countries since 1995

Potential cost of the Brown Tree Snake if it were to invade Australia

SENCKENBERG

Damages by the zebra and quagga mussels in Canadian lakes from 1991 to 1997

Yield losses in agriculture and health costs due to Ambrosia in Western Europe from 2012 to 2017

No possible **compilation**
No possible **comparison**
No possible **synthesis**

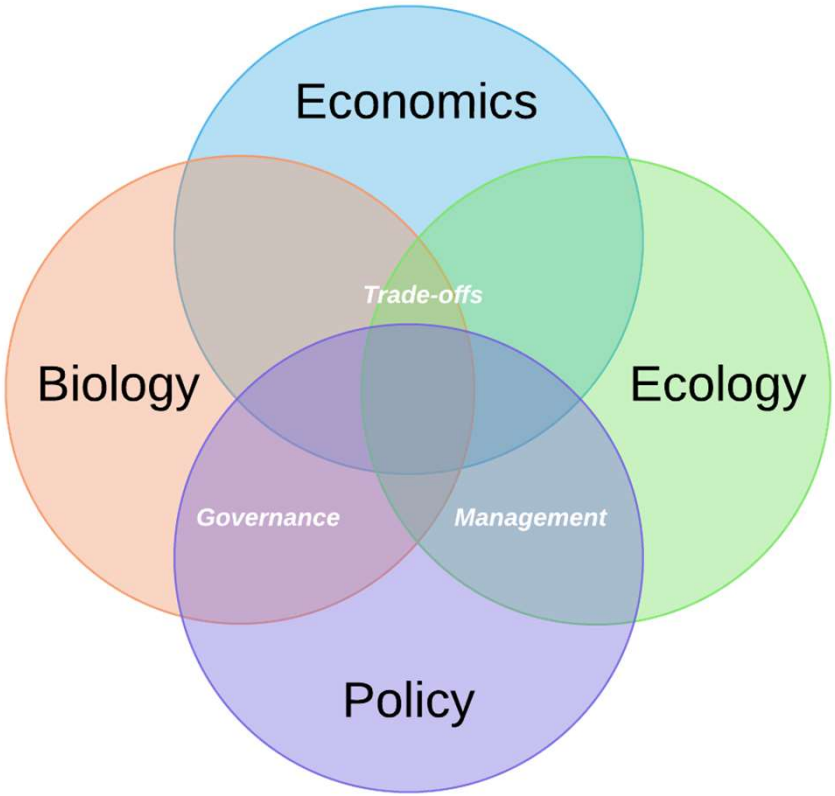
Management costs of invasive mammals in Japanese islands in 2005

100 000 yearly

th
90 to

Waterways blocked by the floating primrose-willow in 14 African countries since 1995

Potential cost of the Brown Tree Snake if it were to invade Australia


Economics
Biology
Ecology
Policy
Trade-offs
Governance
Management

InvaCost = the first global compilation of published economic costs of biological invasions

INVACOST

ESE Écologie Systématique Évolution

cnrs dépasser les frontières

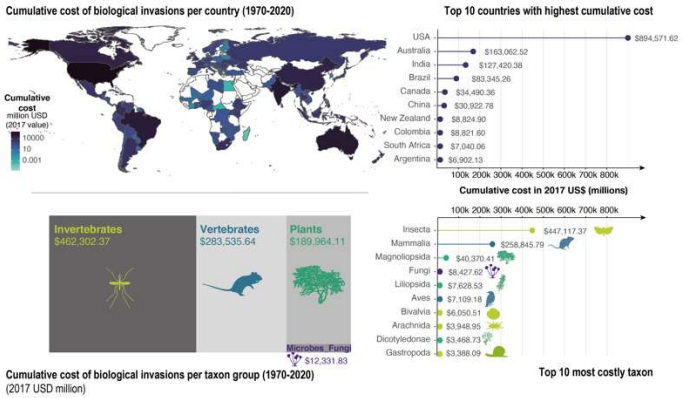
université PARIS-SACLAY

Outputs

InvaCost is an Open Science project:
all sources and all outputs are available for all online
They can be found here: **www.invacost.fr**

Here you will find **the resources**:

- ✓ the database itself
- ✓ The "starting set"
  (to analyse the database yourself)
- ✓ The R package
- ✓ The FAQ file
- ✓ the methodological article
  (that describes the database)



https://invacost.fr/en/resources/

Here you will find **the outcomes**:

- ✓ The **references and links** to all the publications
- ✓ A "**living figure**" linked to the latest version of
- ✓ InvaCost, and thus with the latest values
- ✓ A compacted file with the **PDF** of all published
- ✓ articles

https://invacost.fr/en/outcomes/

Aims

- Create an open, updatable database of the economic costs of biological invasions
- Increase awareness of biological invasions by :

  1- alerting on their massive economic costs

  2- using a common metrics and standardization methodology to compile costs

→ **raise** public awareness and **compel** policymakers

→ **support** efficient and cost-effective **decision-making**

→ **help** prioritaize invasions in the **global** environmental **agenda**

15 different languages

إثراء اللغات غير الإنجليزية للمعرفة العلمية: التكاليف الاقتصادية للغزو البيولوجي نموذ

非英语数据能够完善科学知识：以生物入侵造成的经济损失为例

非英語言語が科学的知識を強化する:外来種の侵入の経済コストの事例

Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions

Γλώσσες πέραν της αγγλικής εμπλουτίζουν την επιστημονική γνώση: παράδειγμα από τα οικονομικά κόστη βιολογικών εισβολών

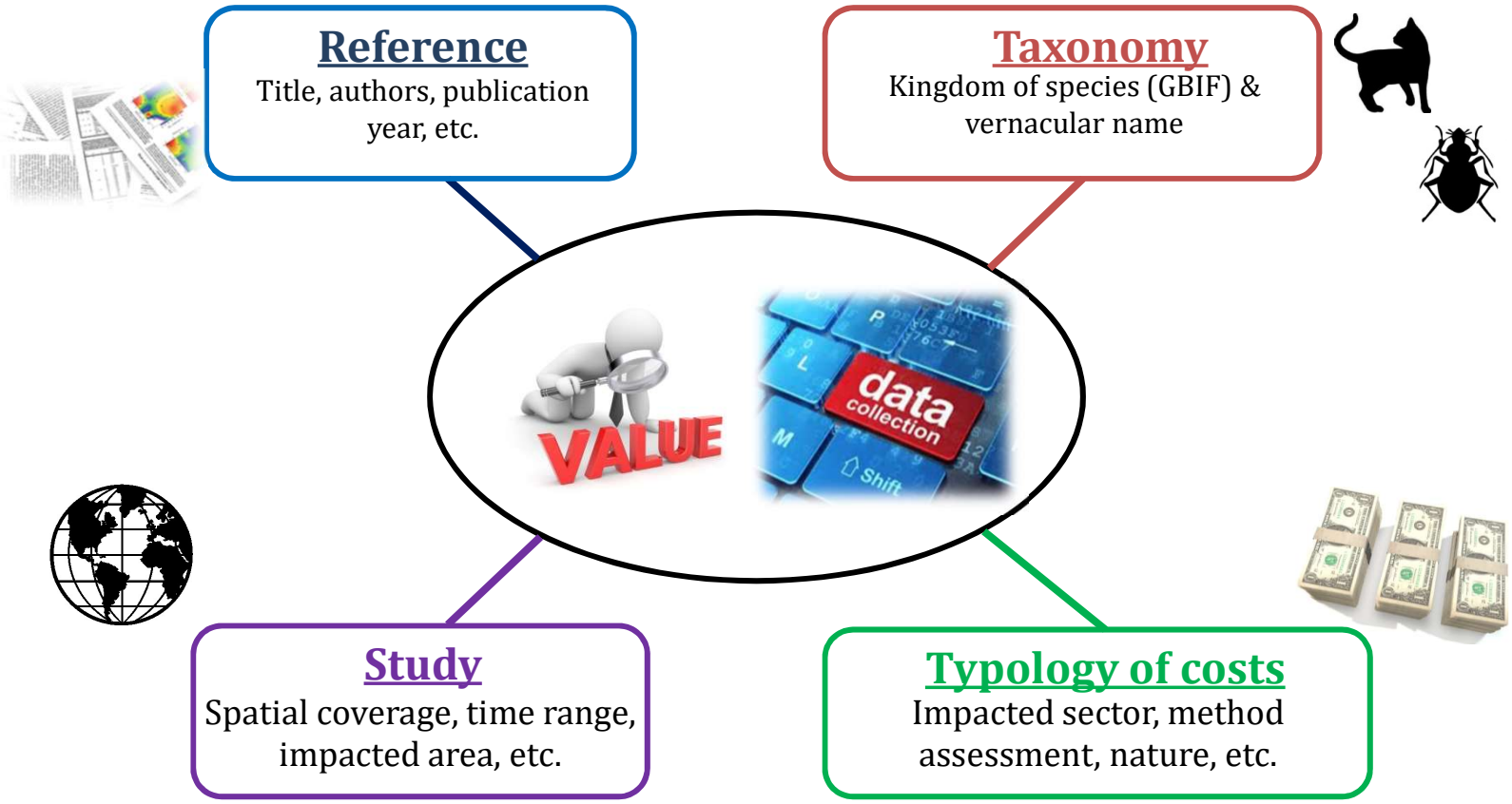
Неанглійські мови збагачують наукові знання: приклад економічних збитків від біологічних інвазій.

Neengleski jezici obogaćuju znanstveno znanje: primjer ekonomskih troškova bioloških invazija

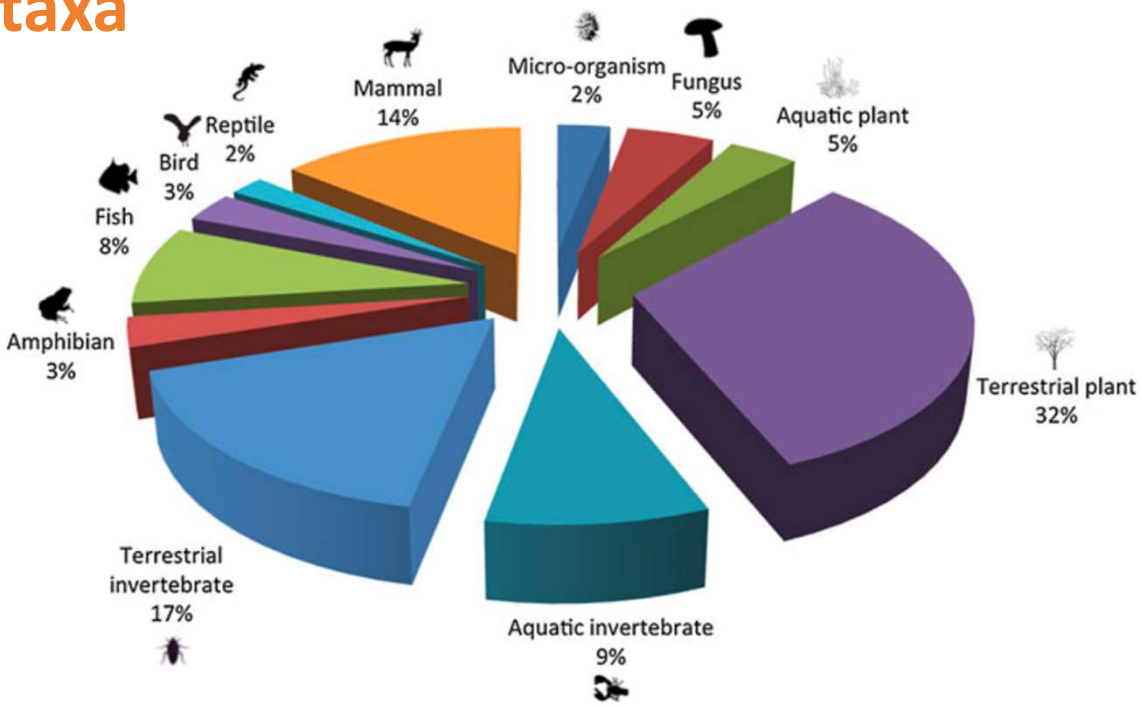
Conversion into a single currency

United States Dollars

2017


Reference
Title, authors, publication year, etc.
Taxonomy
Kingdom of species (GBIF) & vernacular name
VALUE
data collection
Study
Spatial coverage, time range, impacted area, etc.
Typology of costs
Impacted sector, method assessment, nature, etc.

Cost from major taxa



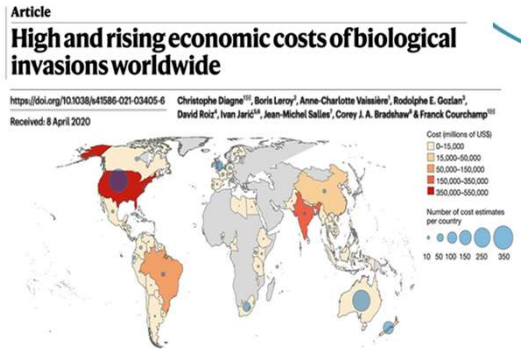
11 detailed studies

SENCKENBERG

23 detailed studies

The costs are **massive**

(a million millions $)


Article

High and rising economic costs of biological invasions worldwide

https://doi.org/10.1038/s41586-021-03405-6

Received: 8 April 2020

Christophe Diagne, Boris Leroy, Anne-Charlotte Vaissière, Rodolphe E. Gozlan, David Roiz, Ivan Jarić, Jean-Michel Salles, Corey J. A. Bradshaw & Franck Courchamp

Cost (millions of US$)
0–15,000
15,000–50,000
50,000–150,000
150,000–350,000
350,000–550,000

Number of cost estimates per country
10 50 100 150 250 350

nature

Invasive species cost globally a minimum of

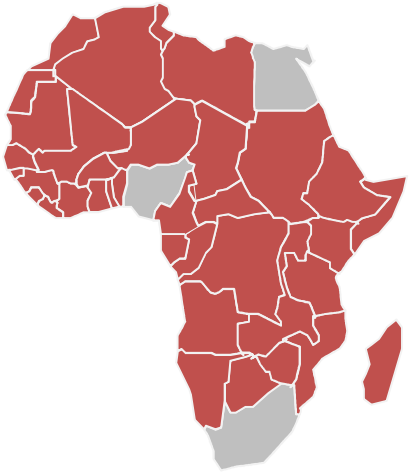
1,288 trillion $

(1970-2017)

Average annual cost: 162.7 billion $ in 2017

This average annual cost largely exceeds the GDP of 50 out of 54 countries on the African continent in 2017

162.7 billion $ in 2017



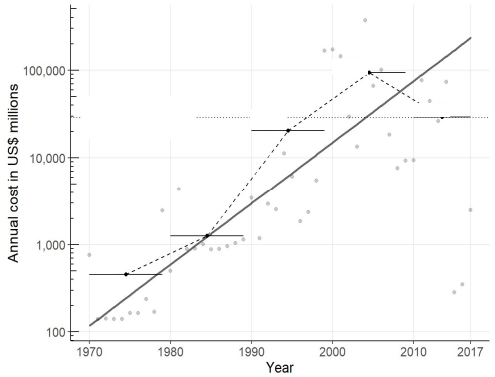
World Health Organization

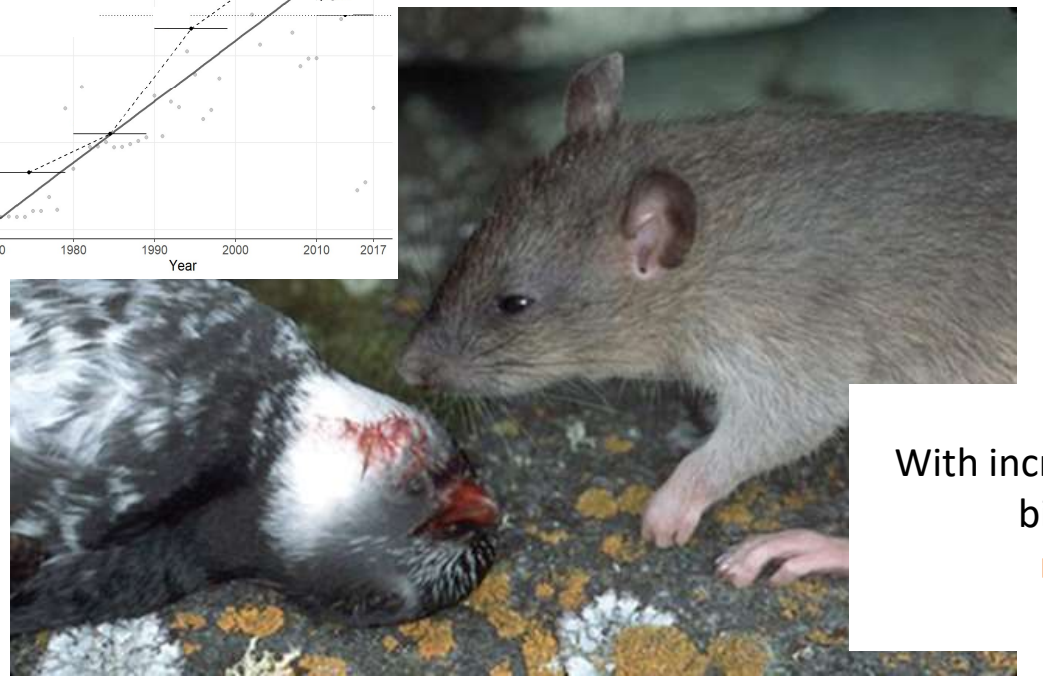
UNITED NATIONS

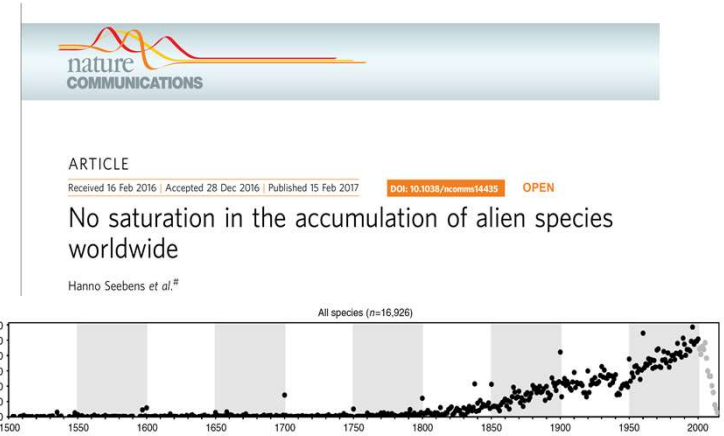
and is >20 times higher than the total funds available for the World Health Organization and the United Nations combined

The costs have been **increasing**

(about x3 every decade)






nature COMMUNICATIONS

ARTICLE

Received 16 Feb 2016 | Accepted 28 Dec 2016 | Published 15 Feb 2017 DOI: 10.1038/ncomms14435 OPEN

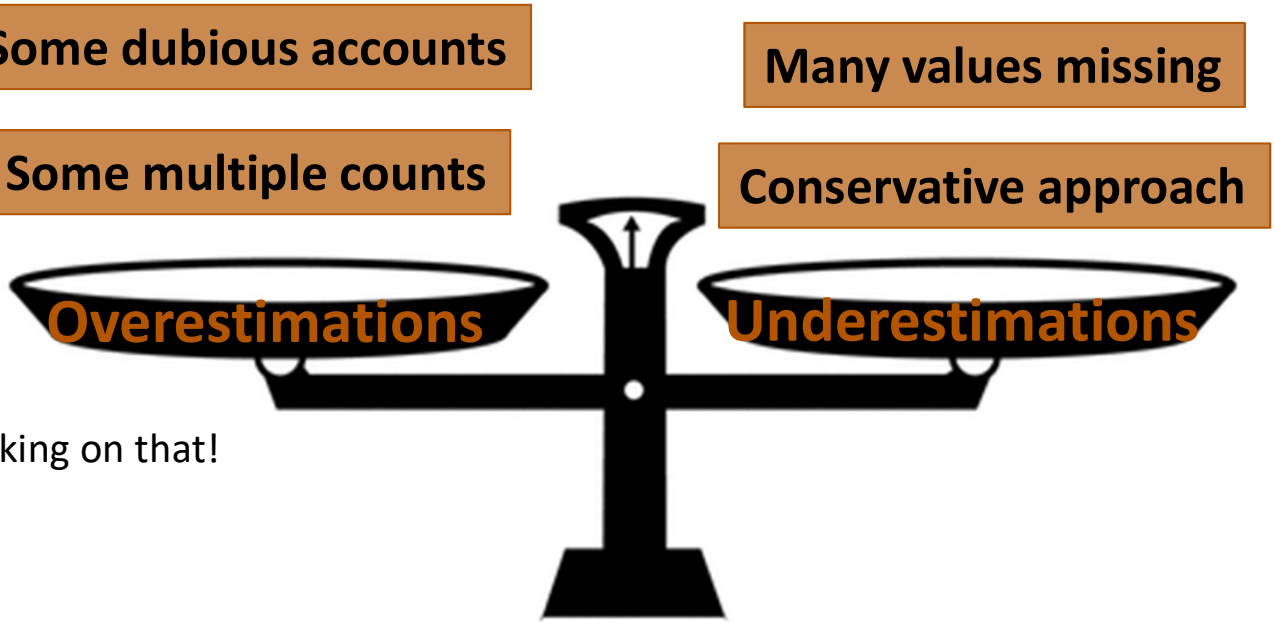
No saturation in the accumulation of alien species worldwide

Hanno Seebens *et al.*#

With increased **global trade** and **climate change**, biological invasions are likely to be **more frequent and widespread**

Accurate estimate?

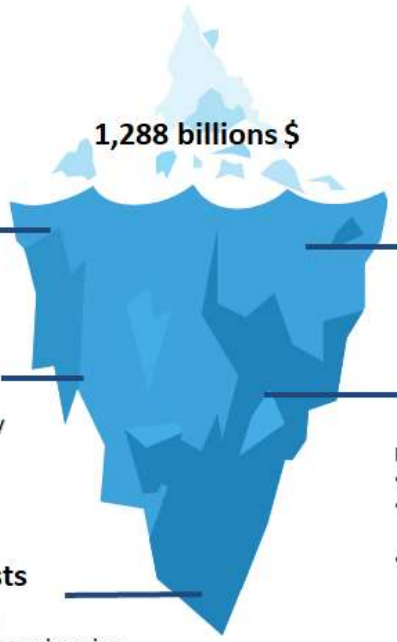
No, but….



We have been working on that!

but the costs are **massively underestimated**

5 sources of under-estimation



Less robust costs

- Less reliable costs
- Extrapolated costs

Missing costs

- Taxonomic gaps
- Geographic gaps
- Temporal gaps
- General biases in research efforts ...

Unaccessible costs

- Unaccessible documentation
- Confusion in invasive terminology (ie pest vs invasive)
- Unindentified reports / articles

Non monetized costs

For example, for health:

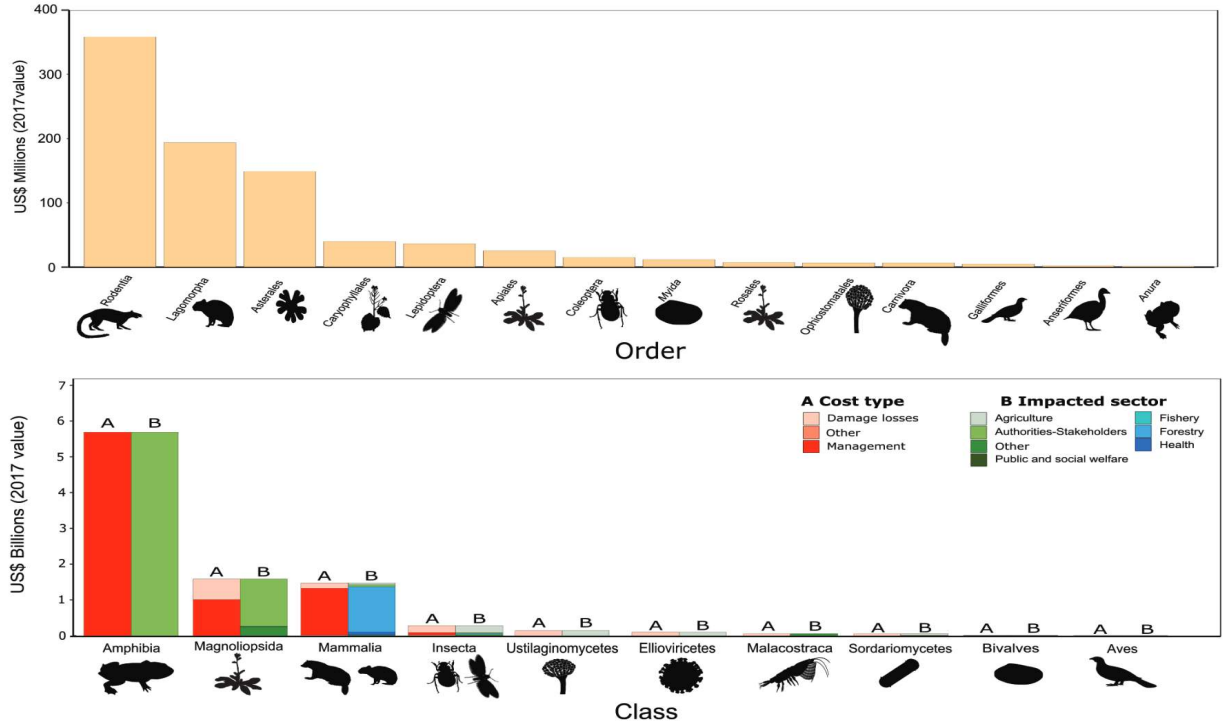
- Revenue losses
- Salary of health and research staff
- Education losses

Non-monetizable costs

Non-market costs, for example:

- Value of a species impacted by an invasion
- Value of an ecosystem disturbed by an invasion

What about Germany?



28 species Overall: US$ 9.8 billion (US$ 8.9 billion in potential costs)

Conclusion

Economic costs of biological invasions are **massive**

Economic costs of biological invasions are **massively underestimated**

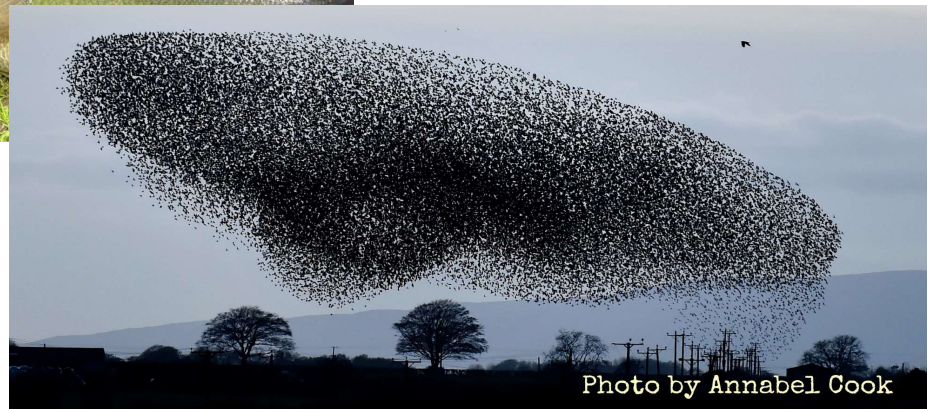
Economic costs of biological invasions are **diverse & heterogeneous**

Economic costs of biological invasions are **likely to keep increasing**

SENCKENBERG

We need more and better studies that estimate the
economic costs of alien invasive species

- More **invasive species**
- More **regions**
- More **types of costs**
- More **standardized**



Biological invasions are really problematic, and should be **prevented, managed and studied**

It's not all about **money**

Biodiversity losses are a major concern