The paradox of biological invasions

Vectopole Sud

Corum,
Montpellier
06.12.2021

Christophe Diagne & Franck Courchamp

Biological invasions / Invasive alien species (IAS)

¨Process by which non-native species are introduced and successfully establish in a new ecosystem where they may cause detrimental impacts" (CBD, 2009)

Convention on Biological Diversity

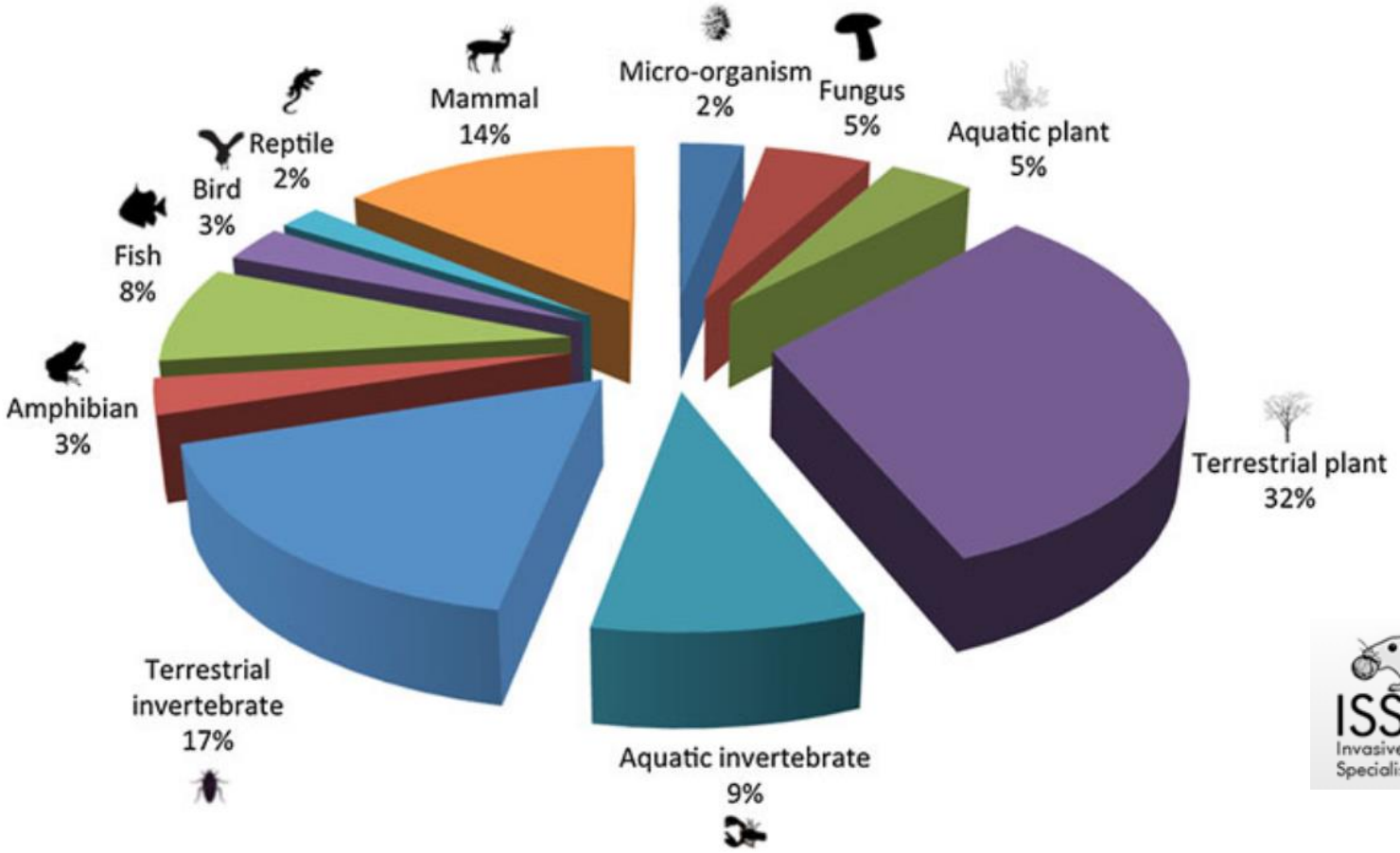
human activities

Habitat loss, alteration and fragmentation

Climate change

global change

Biological invasions: which species, where?



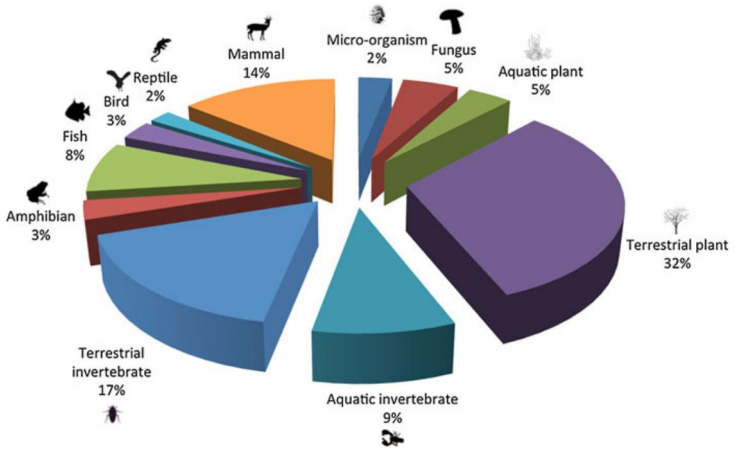
ISSG Invasive Species Specialist Group

GLOBAL INVASIVE SPECIES DATABASE

HOME ABOUT THE GISD HOW TO USE CONTACTS

883 IAS recorded

Biological invasions: which species, where?



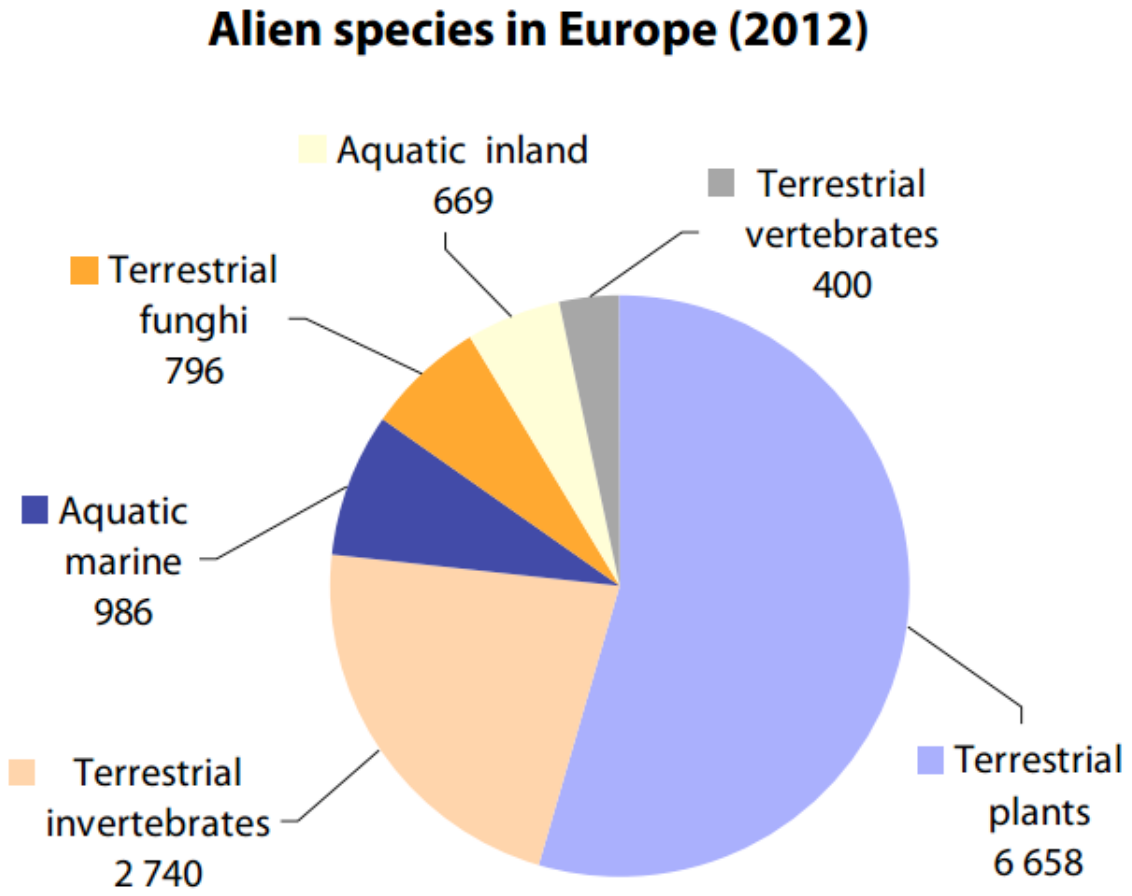
SCIENTIFIC DATA

OPEN

Data Descriptor: Introducing the Global Register of Introduced and Invasive Species

Shyama Pagad[1,2], Piero Genovesi[2,3], Lucilla Carnevali[2,3], Dmitry Schigel[4] & Melodie A. McGeoch[2,5]

~ 3,182 exotic species (France)



~ 14,000 exotic species

Biological invasions: which species, where?

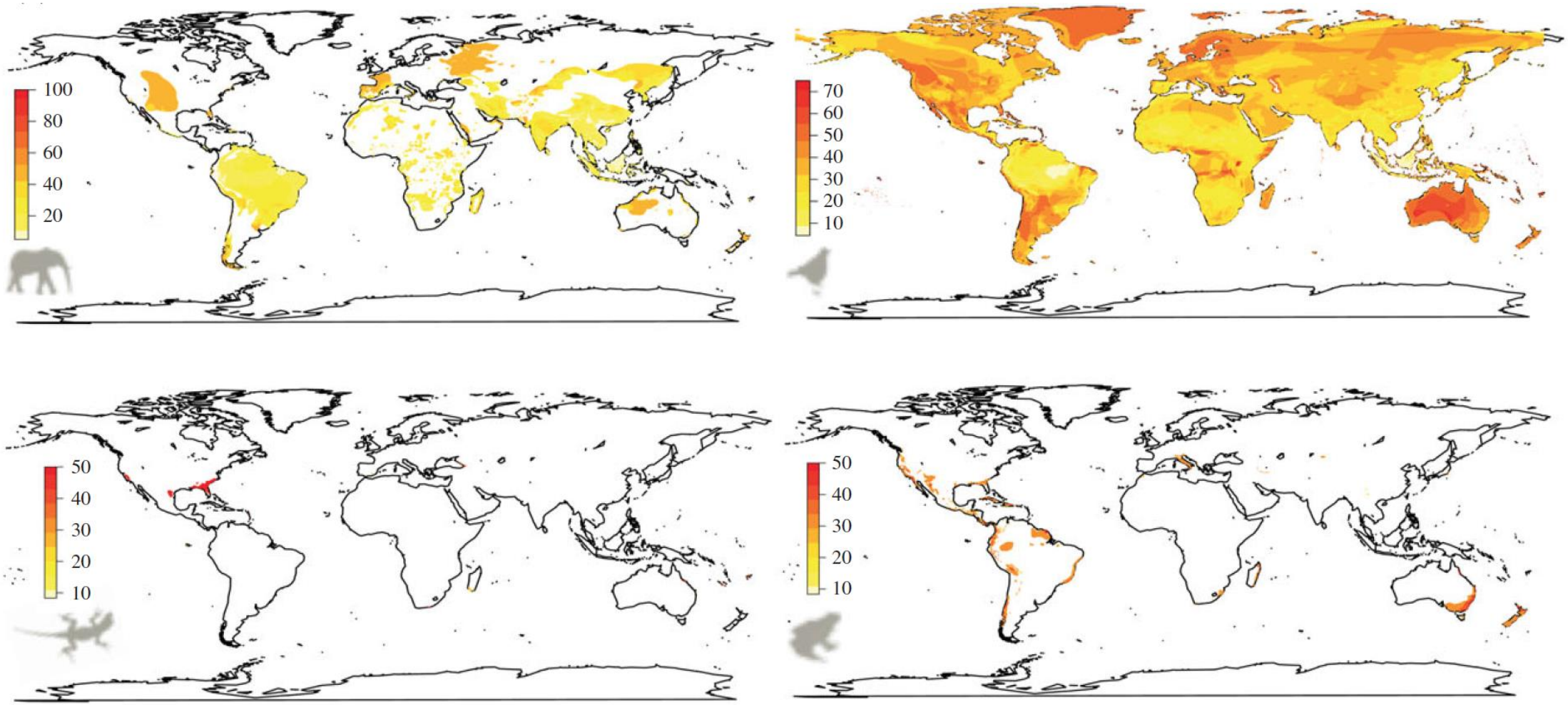
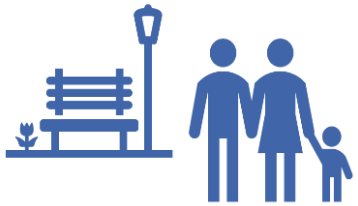


Figure 1. Spatial distribution of IAS-threatened (CR, EN and VU IUCN Red List) mammals, birds, reptiles and amphibians, in absolute number (*a*) and given as a proportion of all threatened species (*b*). For instance, a proportion of 50% for a given location means that 50% of the threatened species there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

Invasive alien species: detrimental impacts worlwide

biodiversity and ecosystems

public health



human well-being

socio-economic activities

Invasive alien species: detrimental impacts worlwide

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BIOLOGY LETTERS

rsbl.royalsocietypublishing.org

Screenshot

Conservation biology

Alien species as a driver of recent extinctions

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

competition, predation, habitat destruction, overconsumption, disease transmission,...

- major cause of recent extinctions
- 2nd most important threat on biodiversity

Invasive alien species: detrimental impacts worlwide

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Tiger mosquito
(*Aedes albopictus*)

- vector of human diseases (e.g. yellow fever virus, dengue, Chikungunya and about thirty other viruses)

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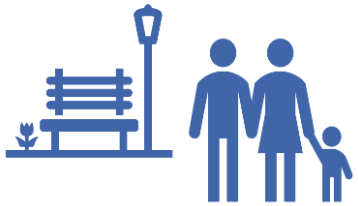
public health



human well-being

socio-economic activities

Brown tree snake
(*Boiga irregularis*)

- expensive power outages and electrical damage

Invasive alien species: detrimental impacts worlwide

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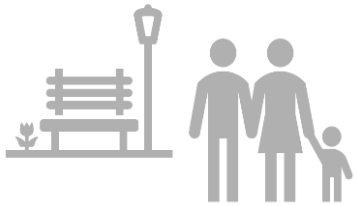
public health



human well-being

socio-economic activities

- damage to food stocks and crops
- economic losses to industries

Invasive alien species: detrimental impacts worlwide

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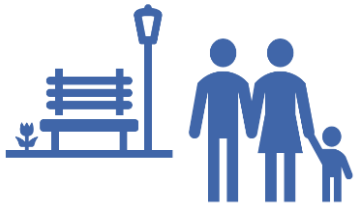

human well-being

socio-economic activities

Red fire ant
(*Solenopsis invicta*)

- impacts on biodiversity, agriculture, cattle breeding, and anaphylactic shocks

Invasive alien species have huge and multidimensional impacts worldwide

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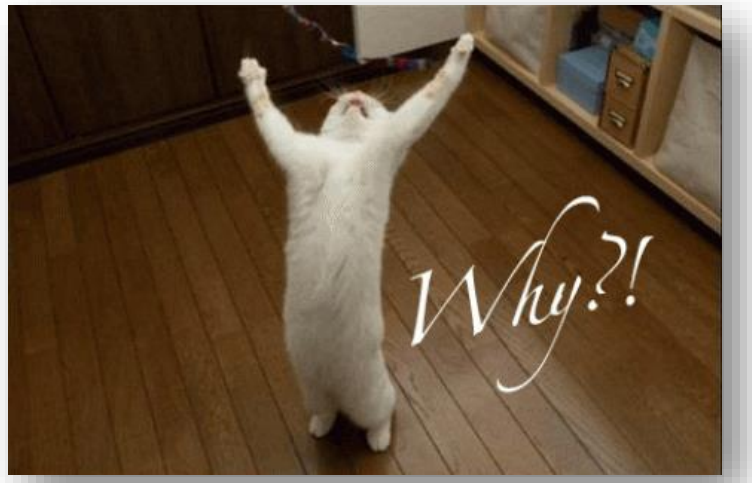
and yet, biological invasions are **little known** as a major problem

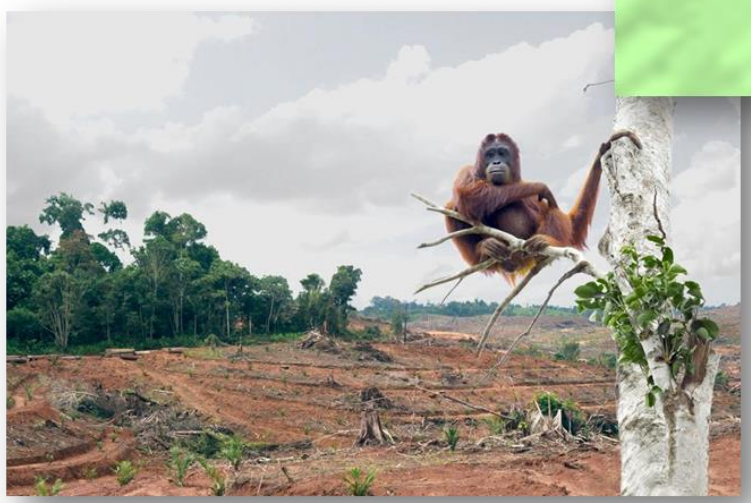


Paradox of biological invasions

Pollution

Overexploitation

Invasive species?



Habitat destruction

Climate change

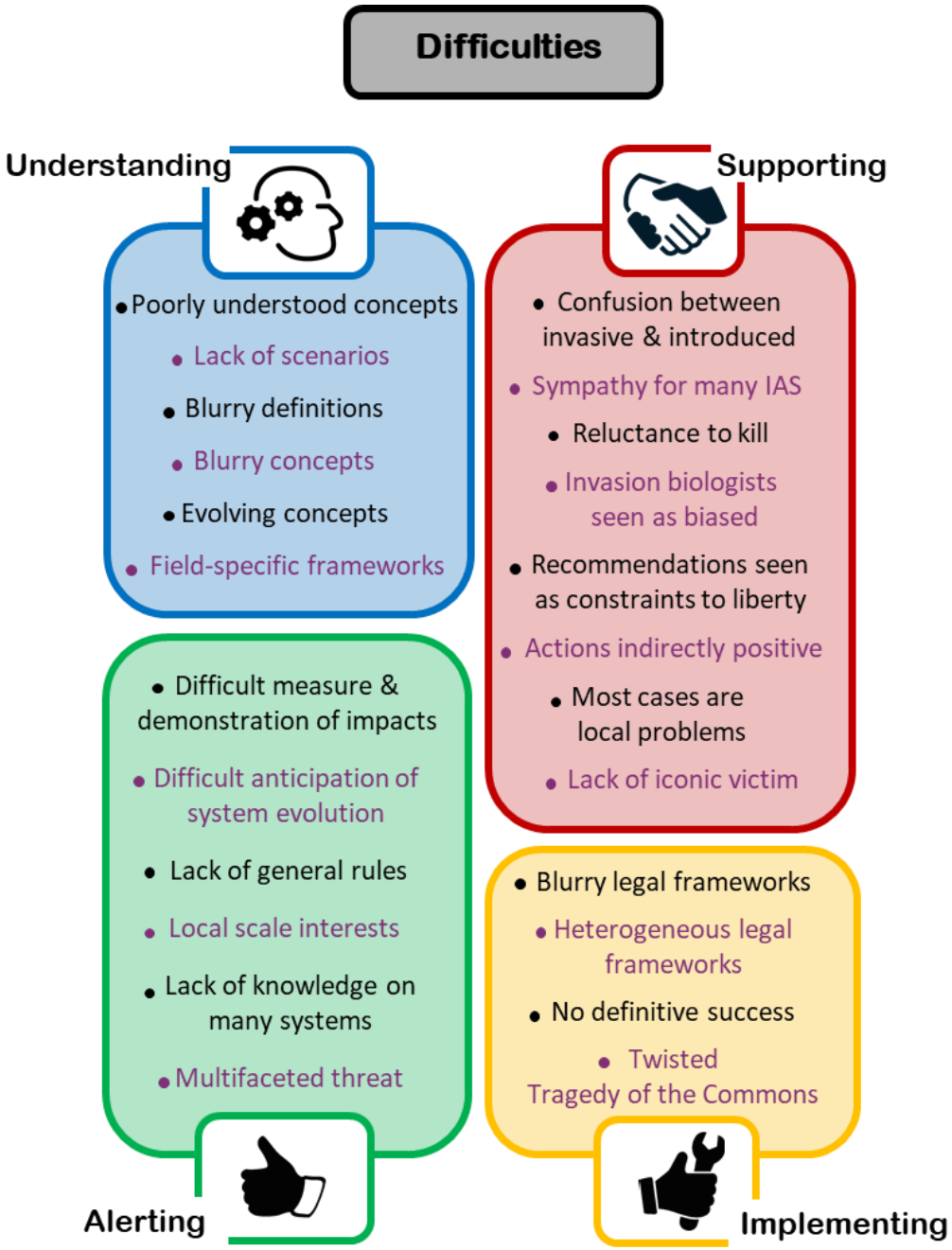
Trends in Ecology & Evolution

Opinion

Invasion Biology: Specific Problems and Possible Solutions

Franck Courchamp,[1,*] Alice Fournier,[1] Céline Bellard,[2] Cleo Bertelsmeier,[3] Elsa Bonnaud,[1] Jonathan M. Jeschke,[4,5,6] and James C. Russell[1,7]

24 specific issues that make it more difficult to



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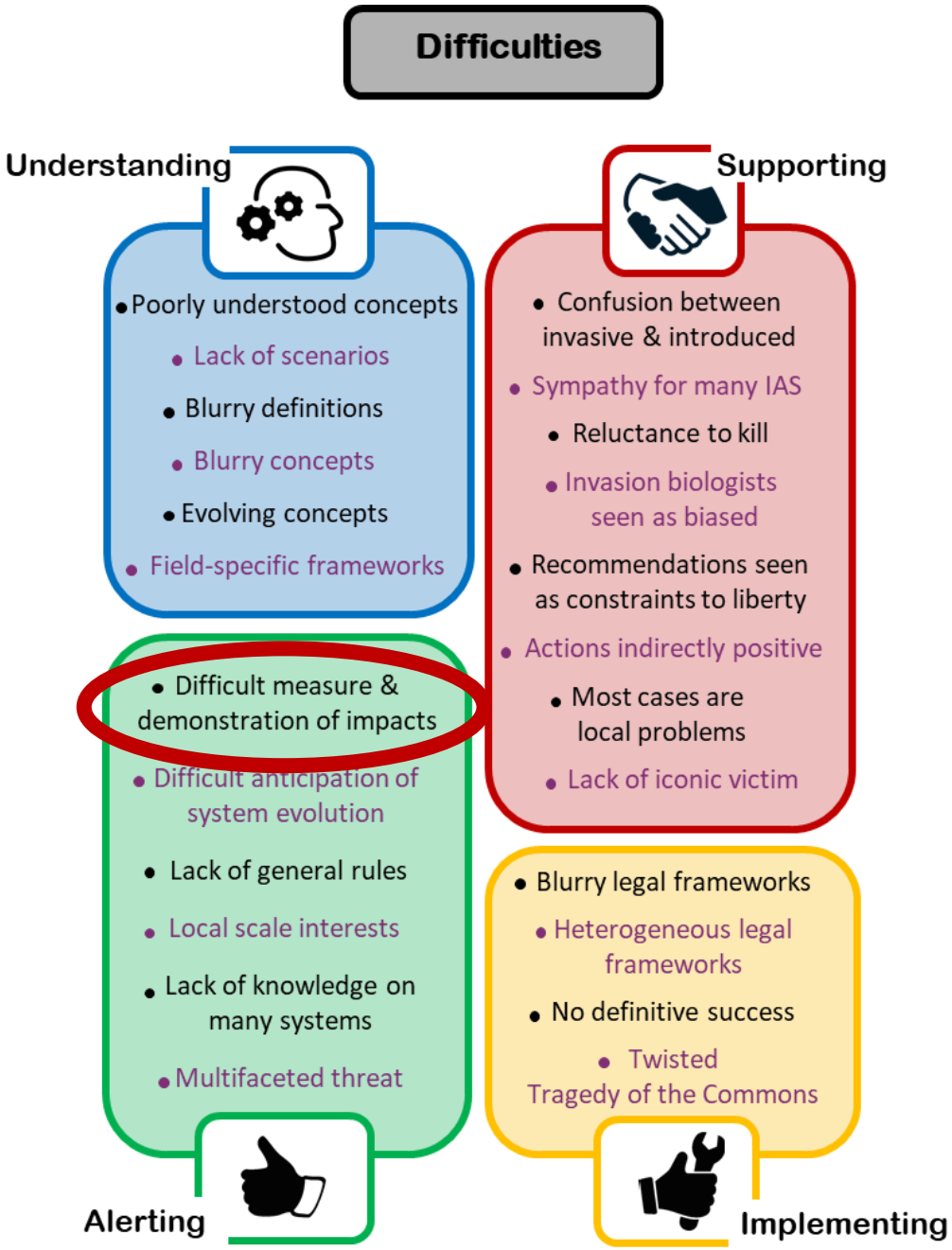

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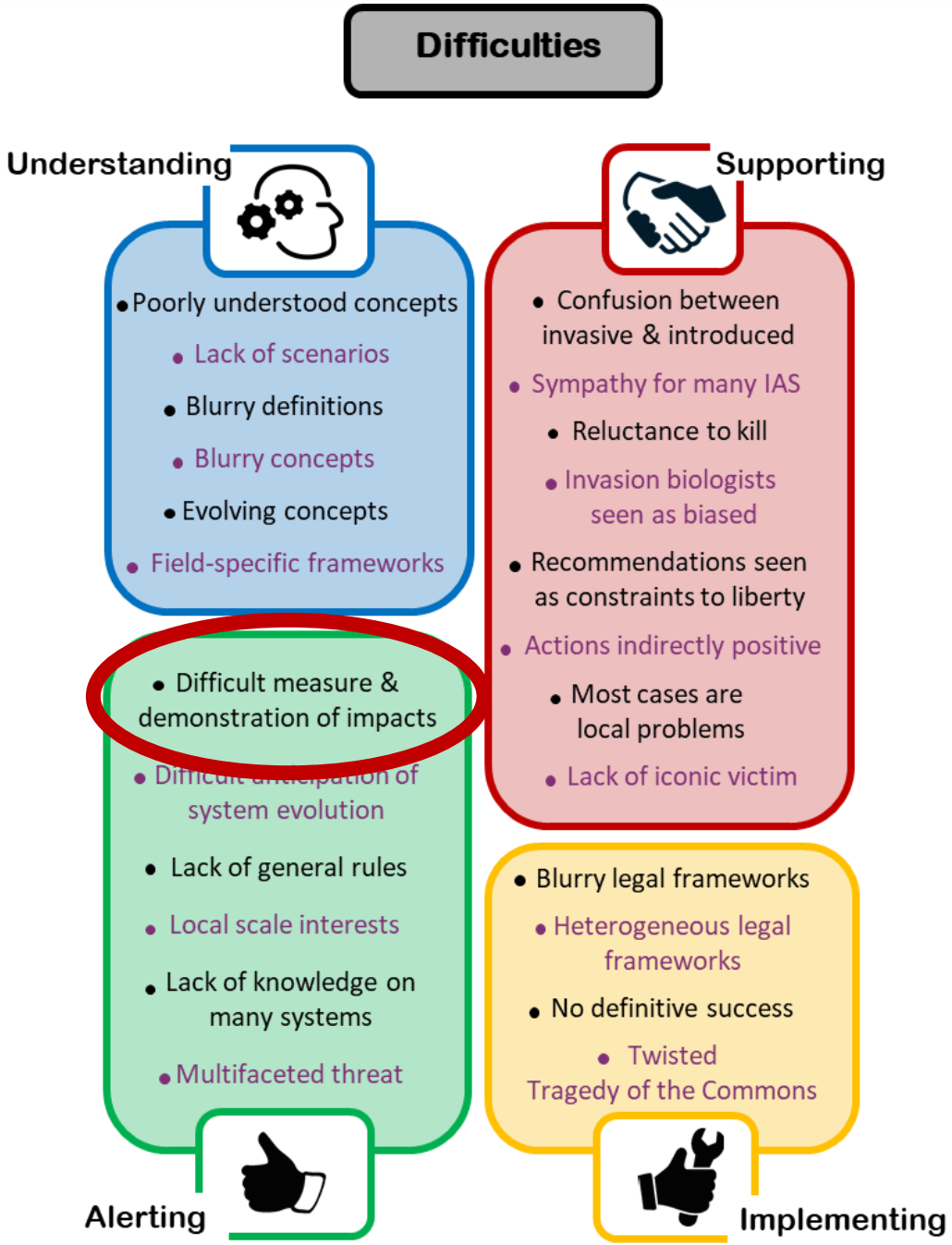
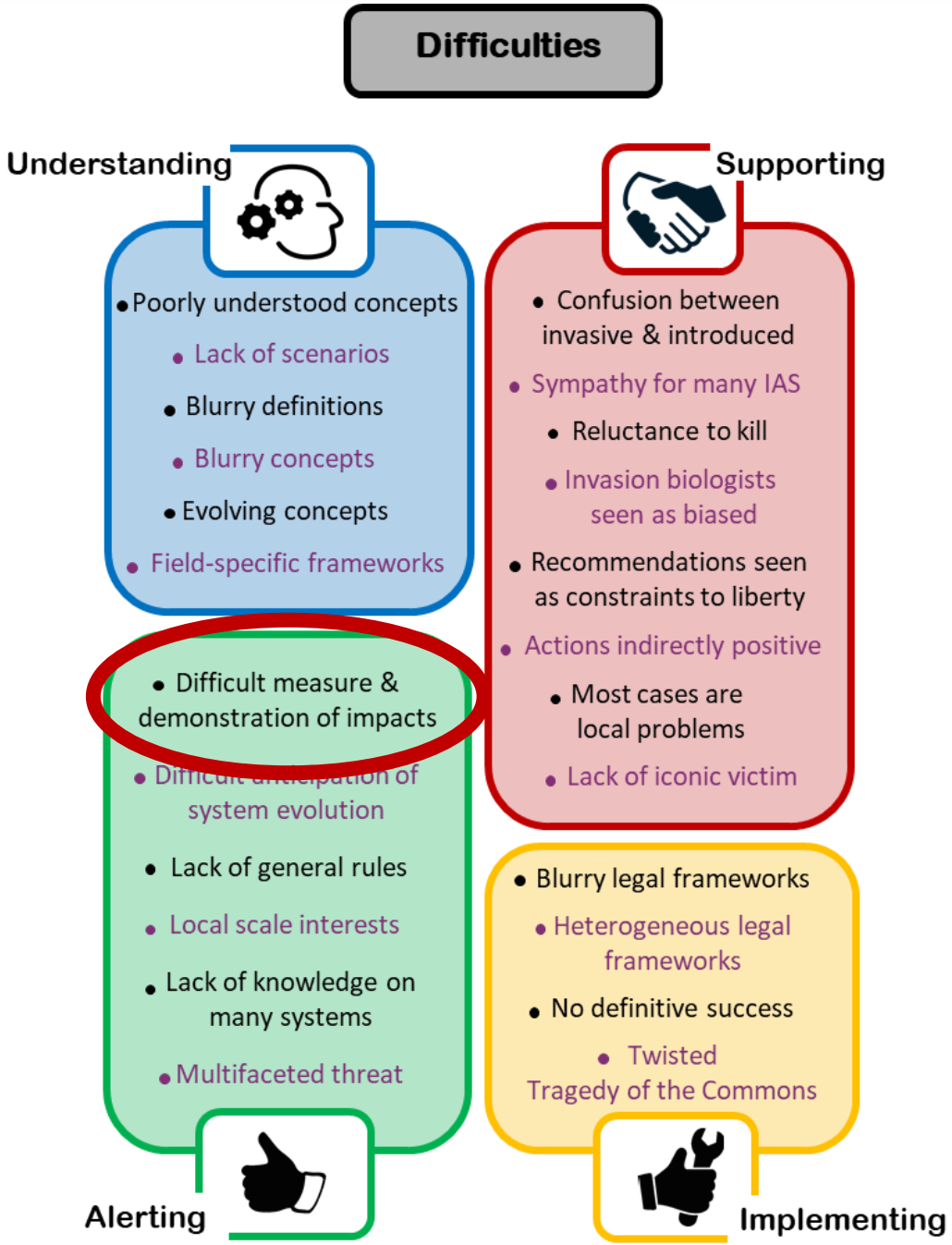
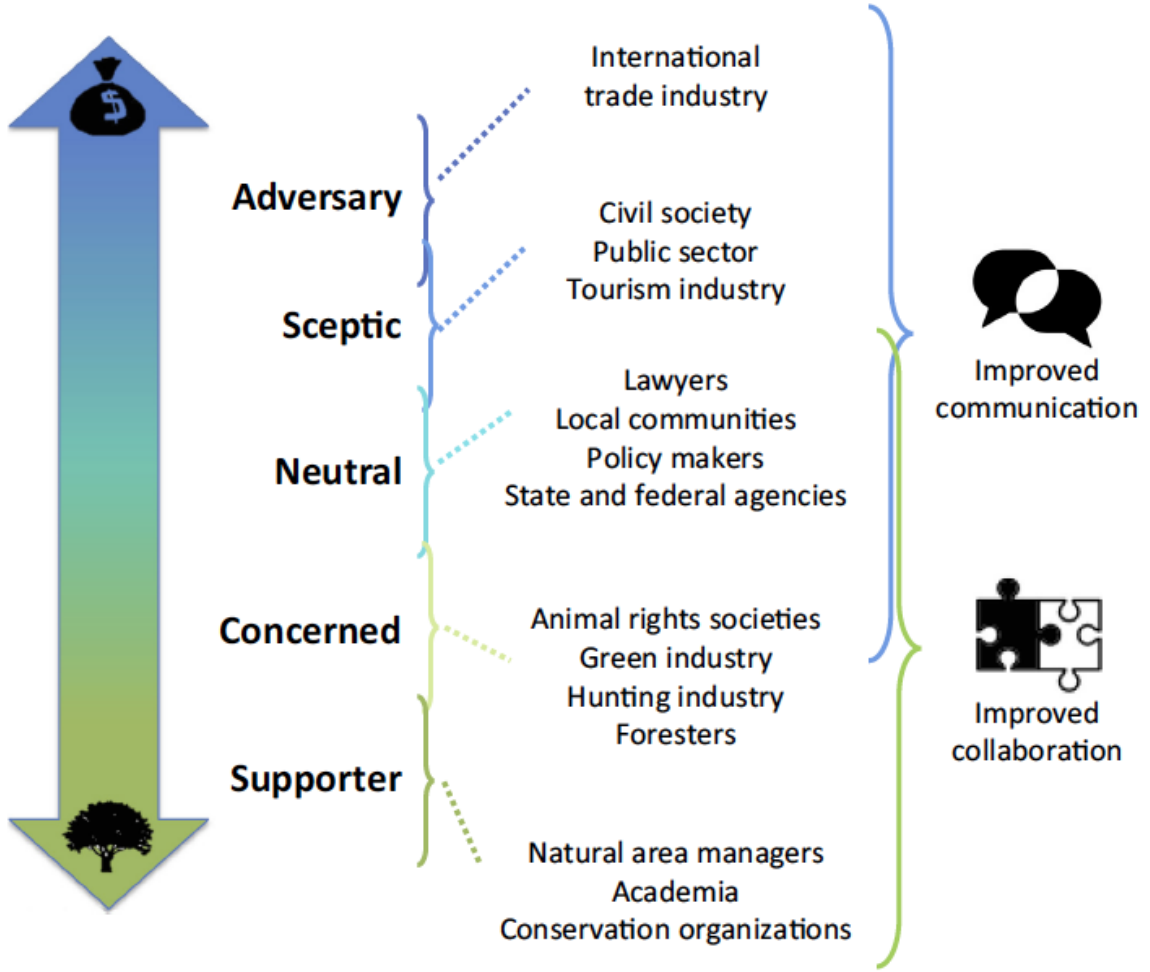


- Invasion debt (50 years!)
- How do you measure impact?
- Who cares about ecological impacts anyways?
- Changes are usually gradual, tending to pass unnoticed
- Difficult/impossible to quantify and demonstrate a change

Paradox of biological invasions

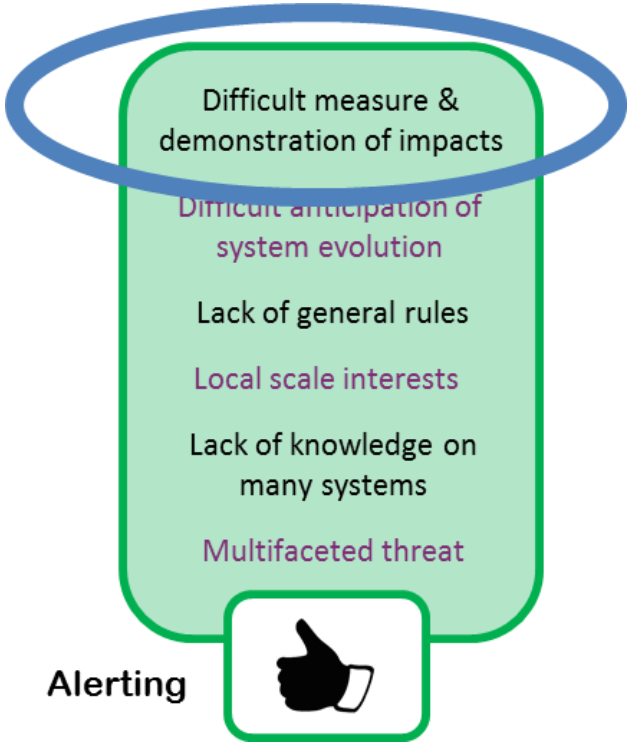




Trends in Ecology & Evolution

Figure 2. Different Types of Stakeholders with which Invasion Biologists Interact. Their position regarding biological invasions is not always in consensus and can be context-specific.

Biological invasions: why studying their economic costs?



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

Courchamp et al. 2017 *TREE*

Biological invasions: why studying their economic costs?

Difficult measure & demonstration of impacts

Difficult anticipation of system evolution

Lack of general rules

Local scale interests

Lack of knowledge on many systems

Multifaceted threat

Alerting

Currency: a common and understandable metrics

Economic costs

Damage and losses

Management expenditures

Bradshaw et al. 2016 *Sci Rep*
Courchamp et al. 2017 *TREE*

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Diagne et al. 2020 *NeoBiota*

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improve public **communication** and **compel** policymakers

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

increase prioritization in the **global** environmental **agenda**

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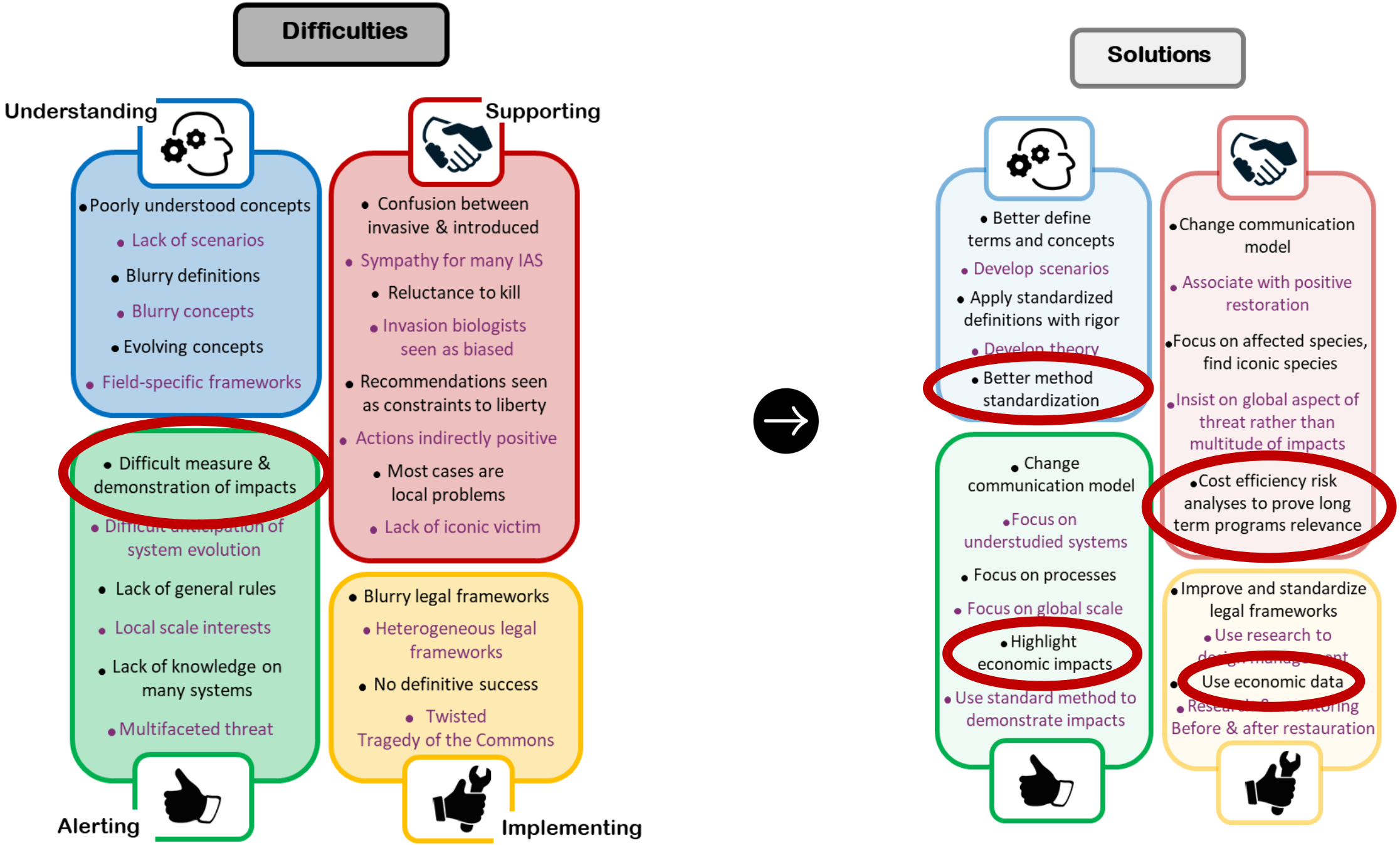
Paradox of biological invasions



Economic costs: need of a global overview

harmonize available information
& identify knowledge gaps

prioritize actions & coordinate
responses at relevant scales

Economic costs: need of a global overview

Dégats de la moule zébréee dans les grans lacs Canadiens sur les canalisations entre 1991 et 1997

Pertes agricoles et coûts de santé de l'Ambroisie en Europe de l'ouest de 2012 à 2017

Coûts de gestion des mammifères dans les îles Japonaises en 2005

100 000 hospitalisations par an due à la fourmi de feu aux USA

Budget de contrôle du moustique tigre en Amérique du Sud jusqu'en 2030

Coûts du serpent arboricole brun s'il envahissait l'Australie

Voies de navigations bouchées par la jussie dans 14 pays Africains depuis 1995

- different temporal and spatial scales,
- different areas, sectors or taxa,
- different types of costs (damage vs management),
- different methodologies, currencies,...

No possible **comparisons**
No general **trends/patterns**
No consistent **approach**

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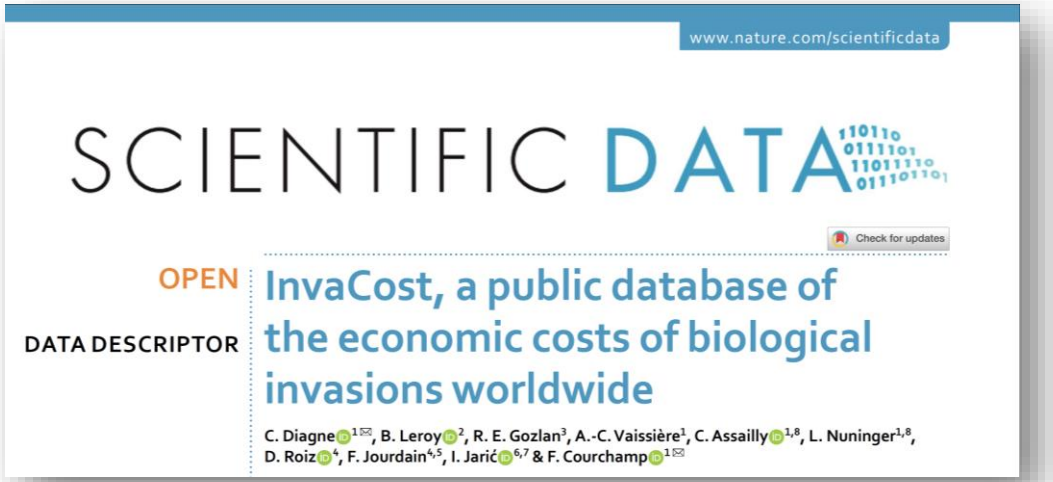

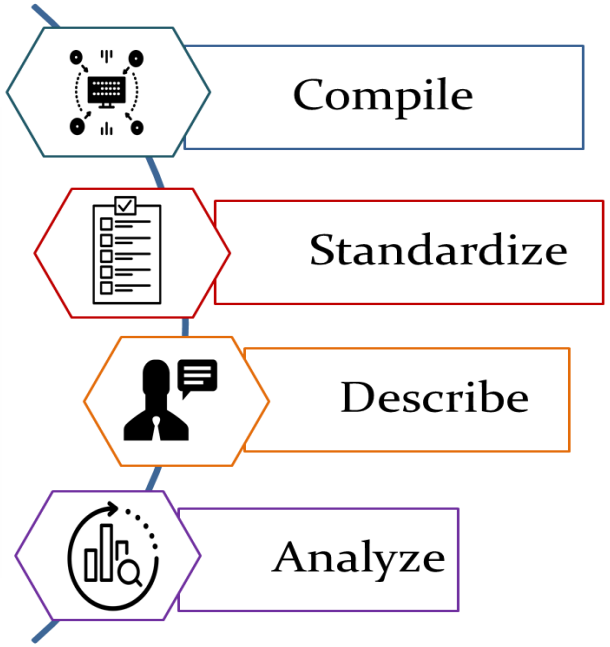

Economic costs: need of a global overview

More after the coffee break !!!

harmonize available information
& identify knowledge gaps

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www.nature.com/scientificdata
SCIENTIFIC DATA
Check for updates
OPEN
DATA DESCRIPTOR

InvaCost, a public database of the economic costs of biological invasions worldwide

C. Diagne[1✉], B. Leroy[2], R. E. Gozlan[3], A.-C. Vaissière[1], C. Assailly[1,8], L. Nuninger[1,8], D. Roiz[4], F. Jourdain[4,5], I. Jarić[6,7] & F. Courchamp[1✉]