Integrating Invasion Science and One Health:

A pathway to more effective and sustainable management of health and ecological challenges

Dr Sonia Vanderhoeven

Belgian Biodiversity Platform

BELGIAN ONE HEALTH

Ecosystems in the balance

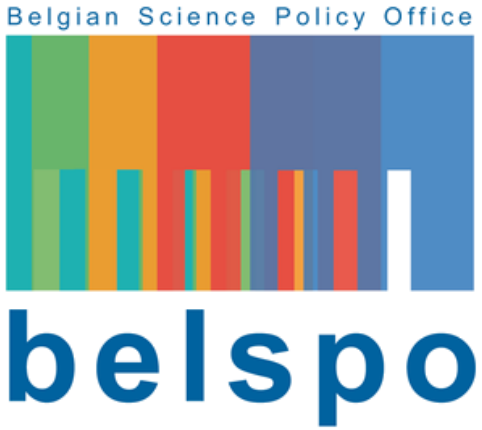
January 2024

Biodiversity.be

Belgian Biodiversity Platform

www.biodiversity.be

- National interface between science, policy and practice in the field of biodiversity
- Initiative of the Belgian Science Policy Office
- Since 2001 on the basis of cooperation agreements between federated entities



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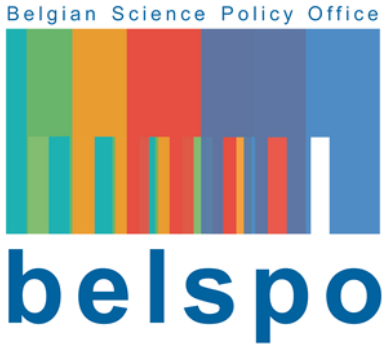
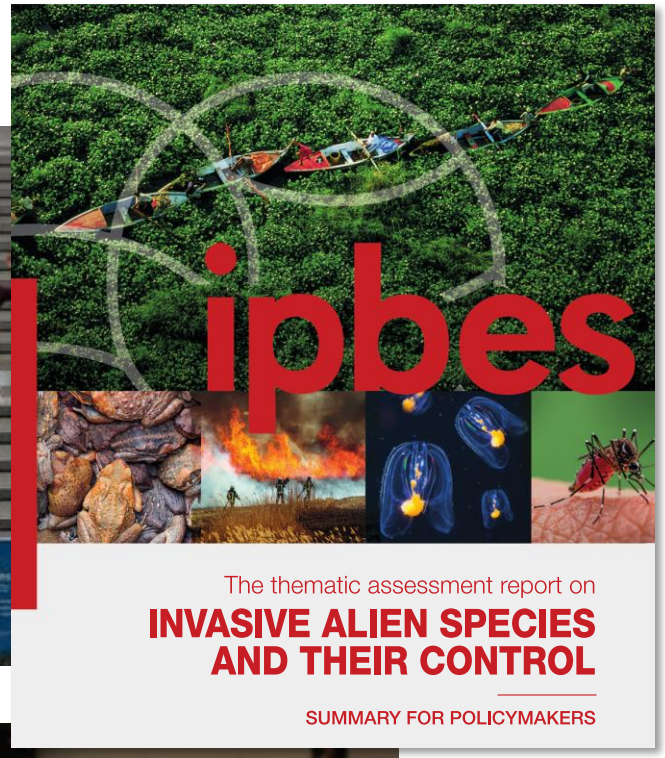


- Belgian Focal Point of the **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services**
- Analysis and synthesis of existing evidence for decision-making purposes
- Produces assessments that feed into the work of several international conventions, including the Convention on Biological Diversity (CBD)

Biological Invasions – the IPBES assessment

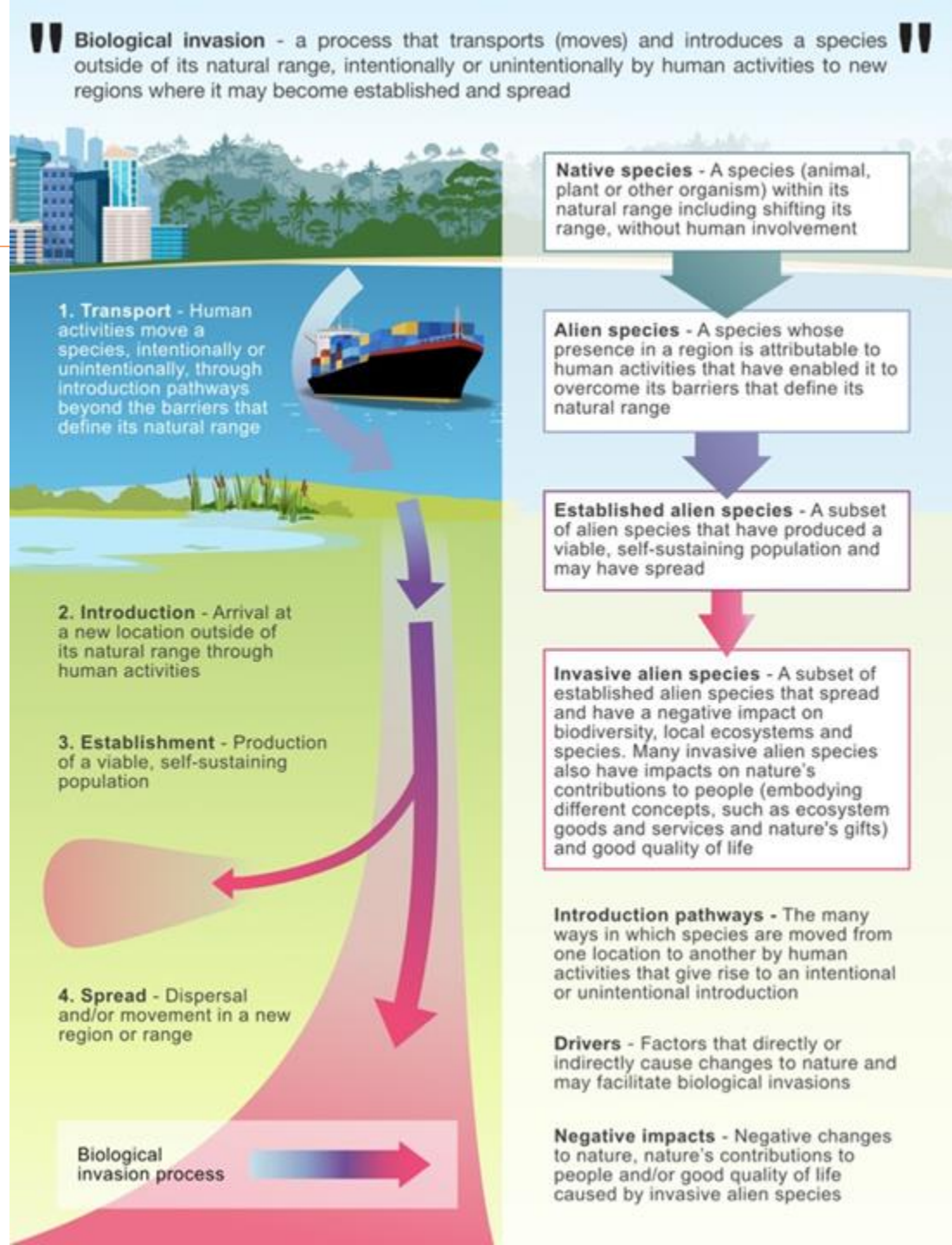


- Developed over 4 years
- Produced by a multidisciplinary team of 86 experts and >200 contributing authors
- Engagement with Indigenous People and Local Communities
- Approved by governments in December 2023

Biological Invasions

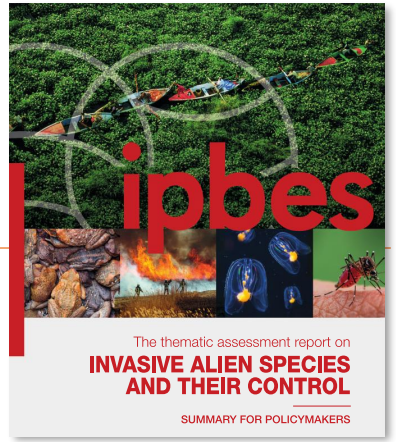
– a major driver of biodiversity loss

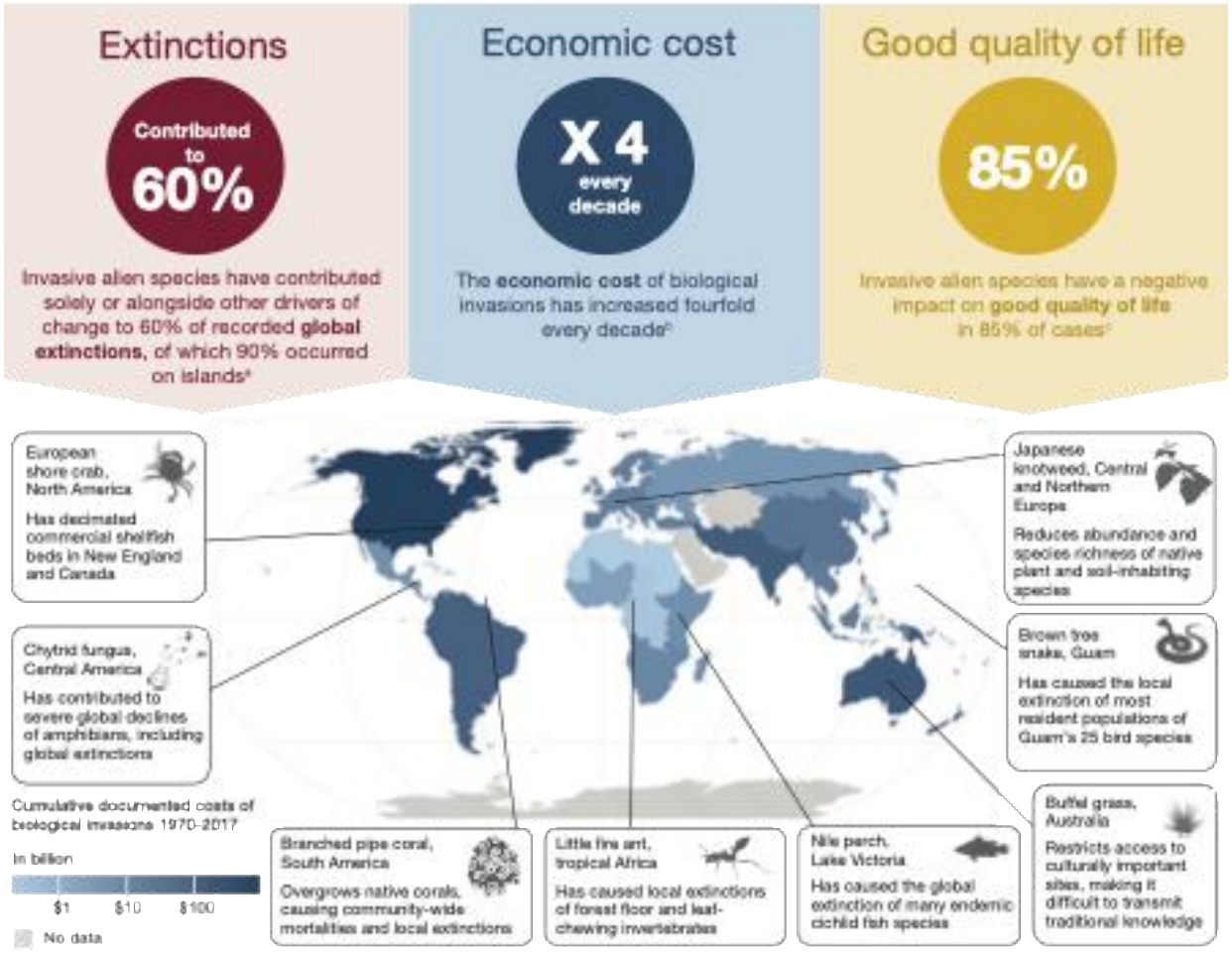
Biological invasion: Process involving the intentional or unintentional transport or movement of a species outside its natural range by human activities and its introduction to new regions, where it may become established and spread.

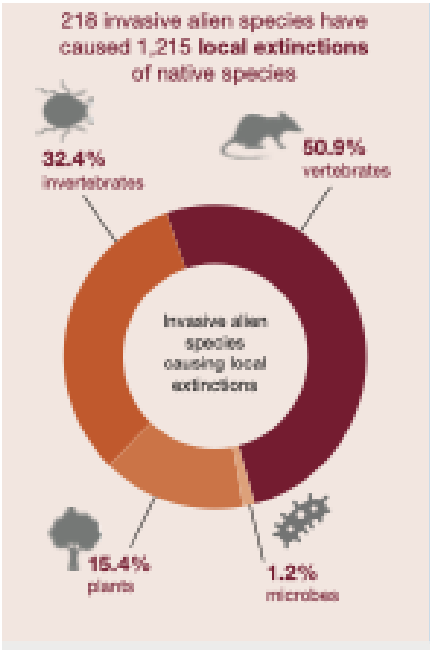


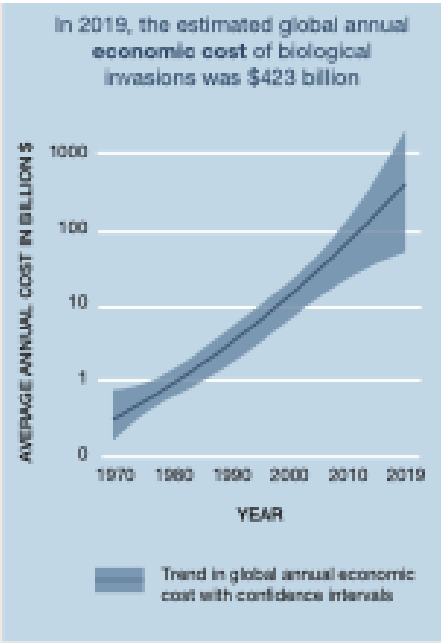
Biological Invasions

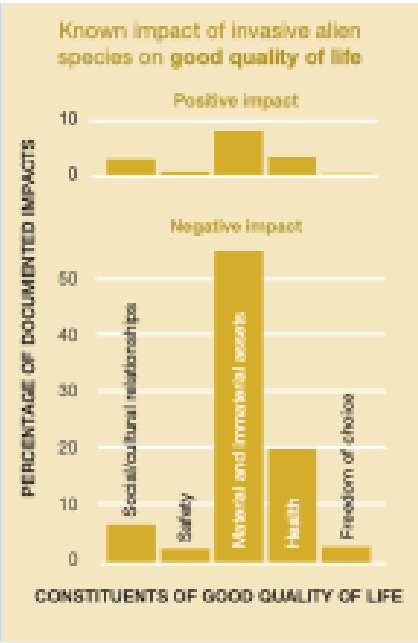
– a major driver of biodiversity loss











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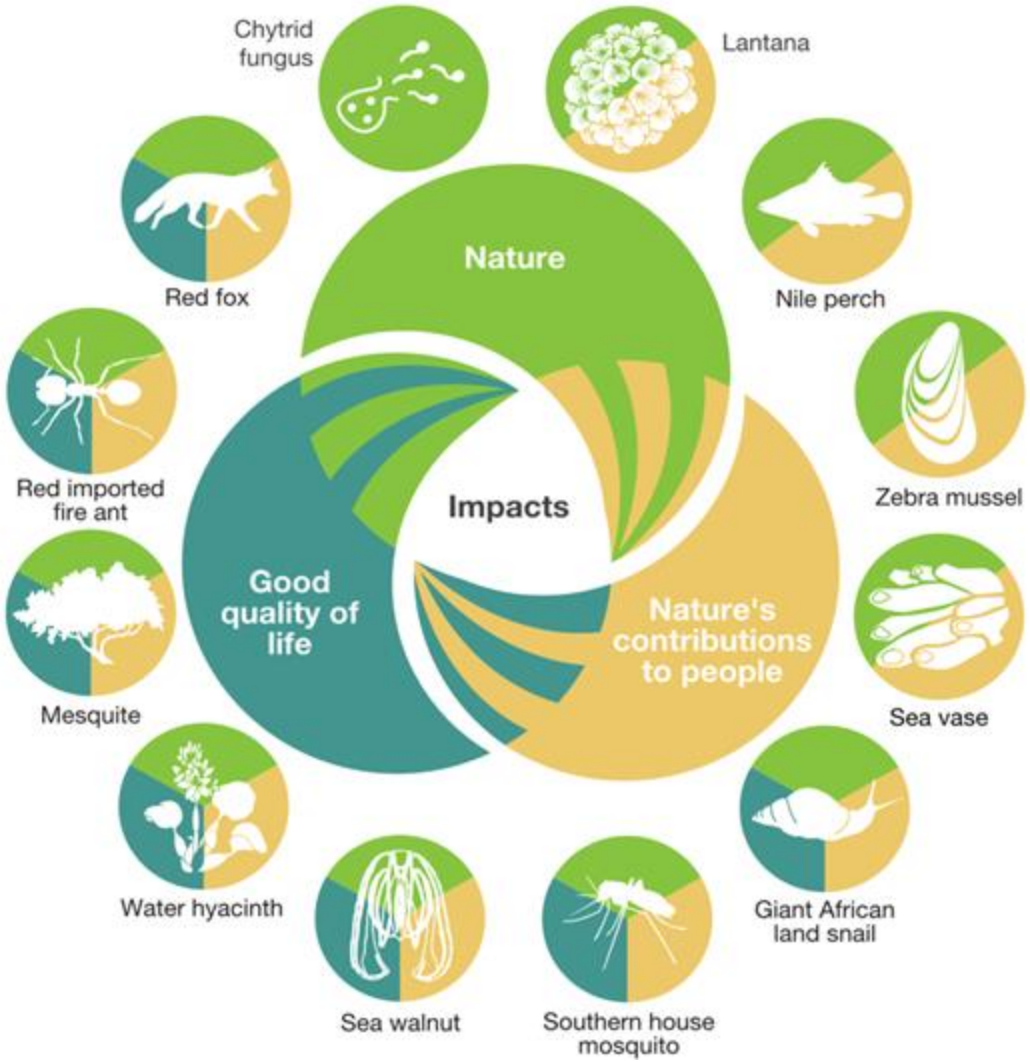
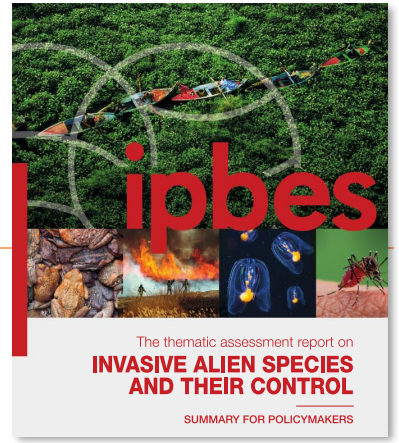


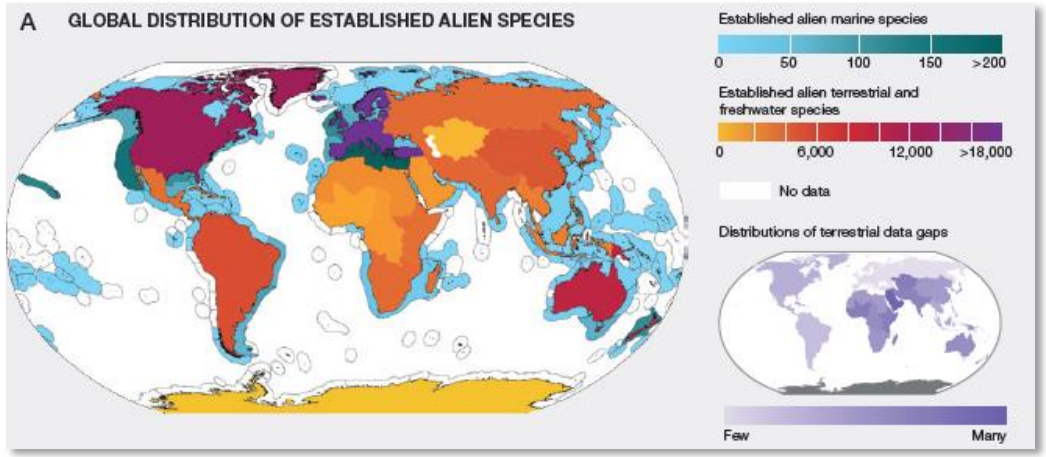


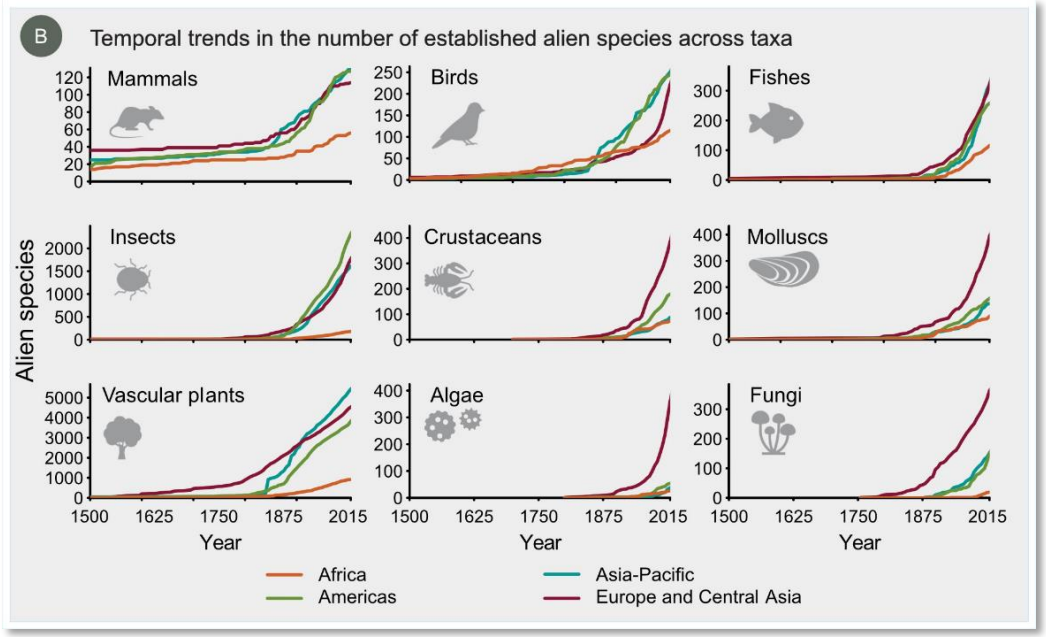
Negative impacts

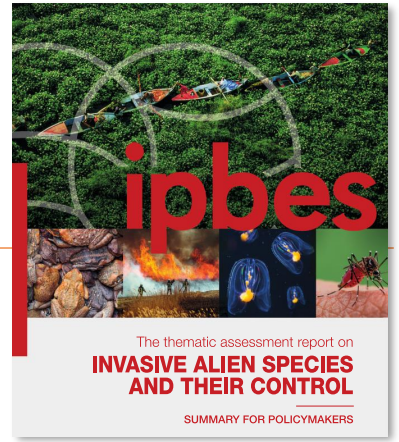
- 100% impacts on Nature
- 16% have impacts on nature's contributions to people
- 7% have impacts on good quality of life.

Biological Invasions

– a major driver of biodiversity loss







Status & trends

- Threats from invasive alien species are increasing significantly in every region

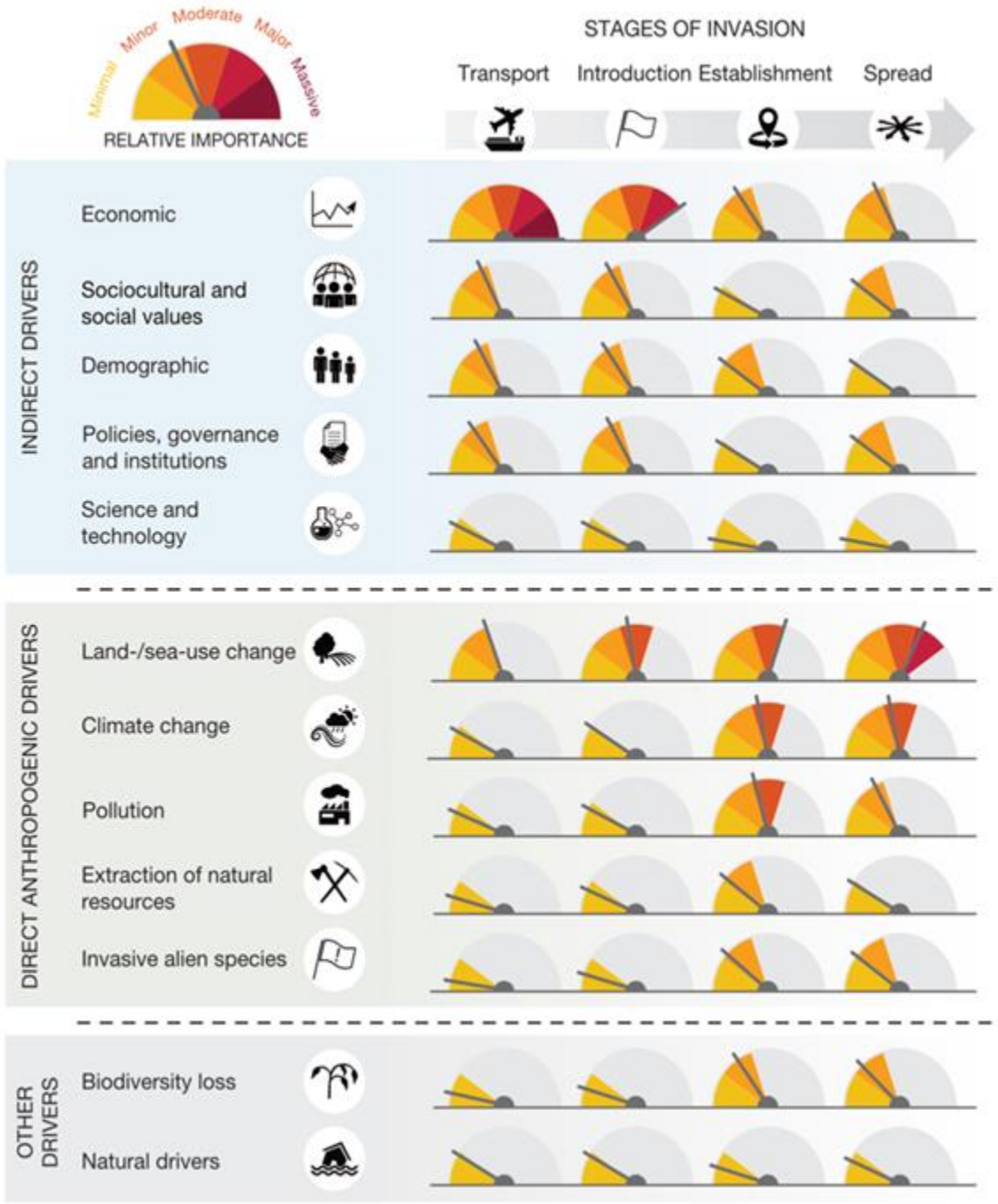
- If things remain unchanged, by 2050 the total number of alien species globally is expected to be about 1/3 higher than in 2005

Biological Invasions

– a major driver of biodiversity loss

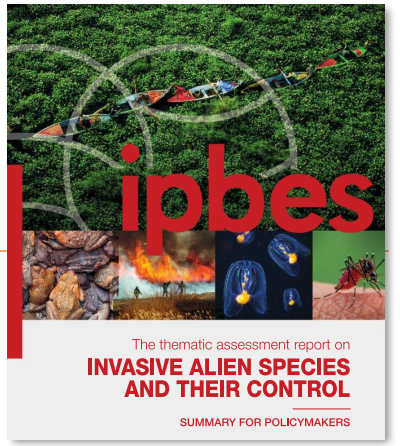
Drivers of biological invasions across all

biomes and biological invasion stages



Biological Invasions

– people at the heart of the solutions



Management

"direct or indirect actions taken to address the risks/threats and/or consequences/impacts of invasive alien species within a defined geographic area"

3 management options:

a) management of pathways of introduction and spread of invasive alien species
b) management of target invasive alien species at either local or landscape scales
c) site-based or ecosystem-based management.

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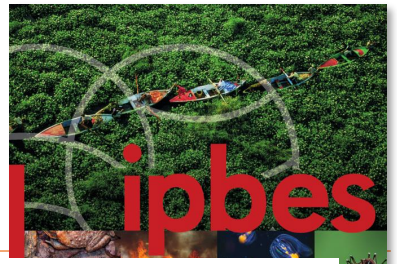
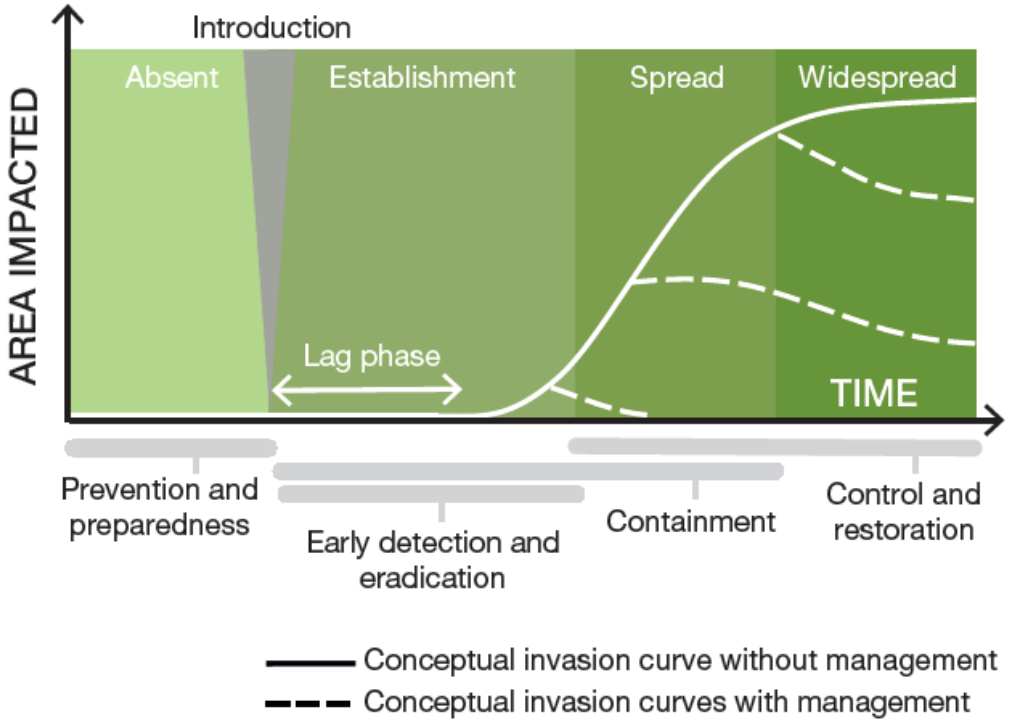
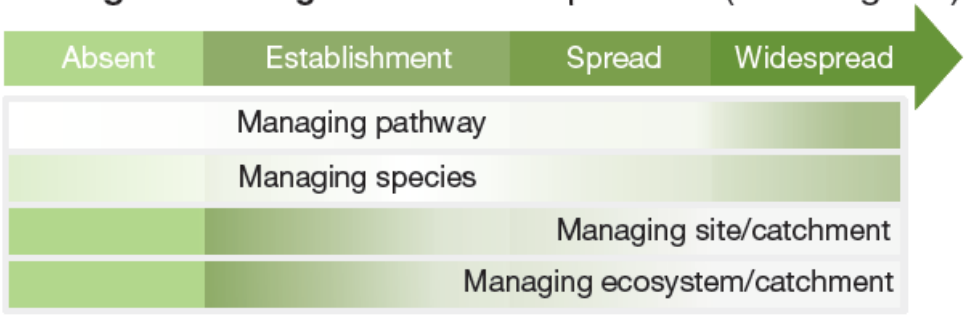


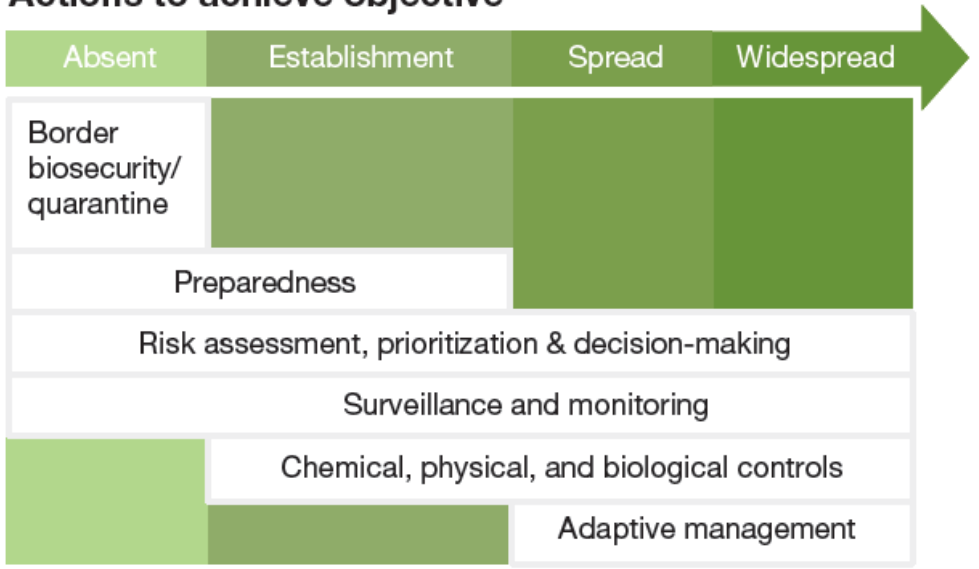
Management objectives



Management target - Relative importance (white highest)



Actions to achieve objective



A) Terrestrial and closed water systems

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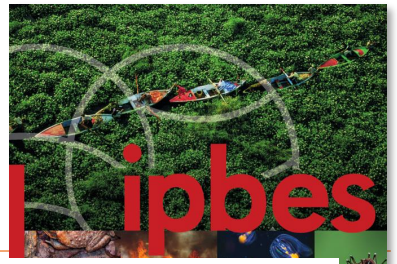

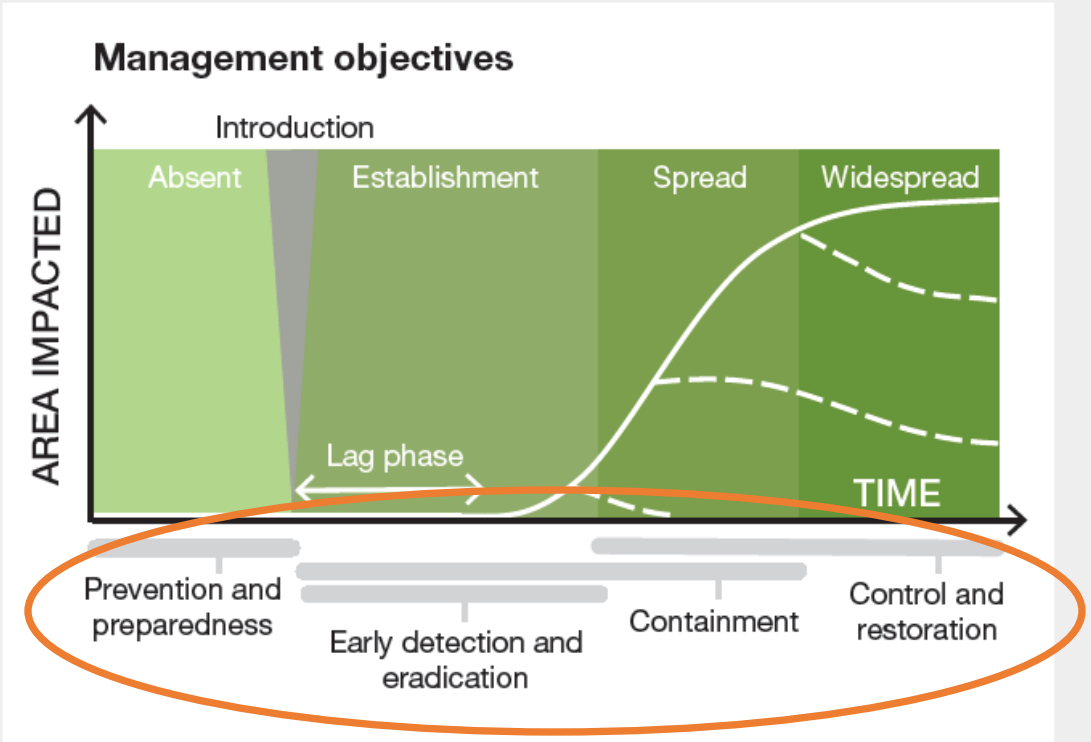

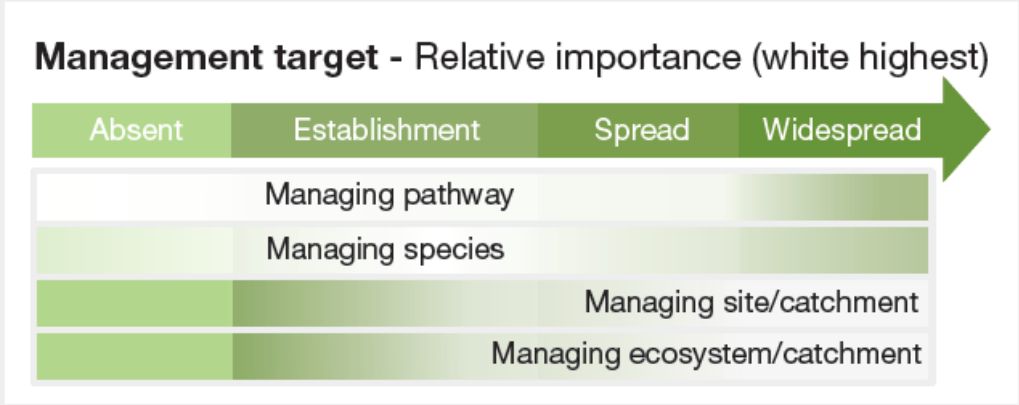

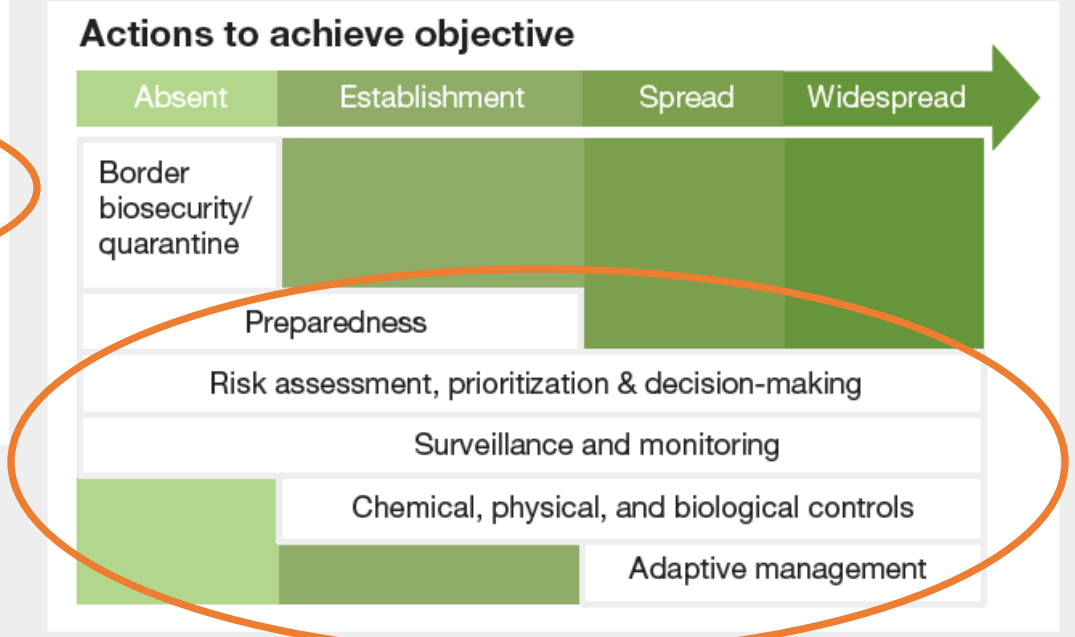

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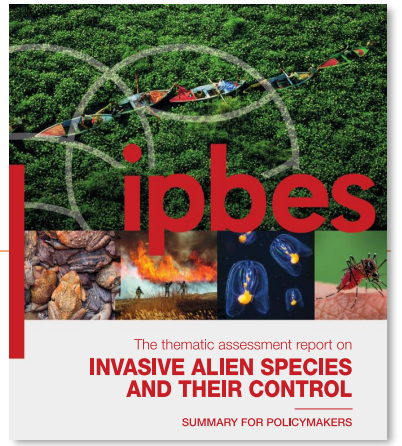
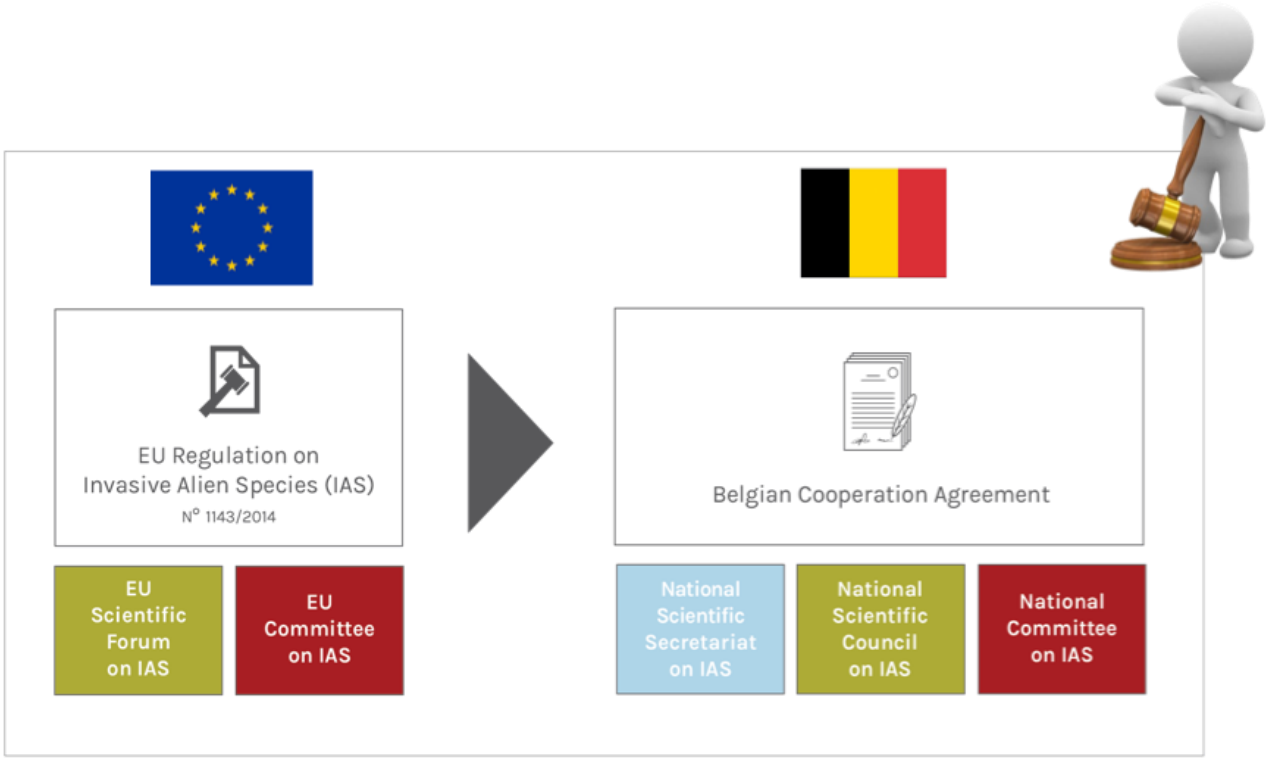


Decision-Support approaches, tools and methods

Evidence- & consultation- based, qualitative & quantitative decision support tools provide standards and frameworks that ensure decision transparency, accountability, adaptability & repeatability while documenting uncertainty



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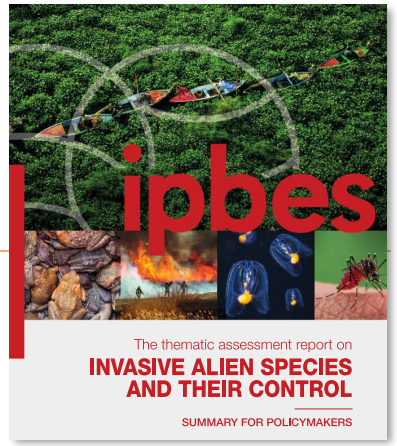


Decision-Support approaches, tools and methods

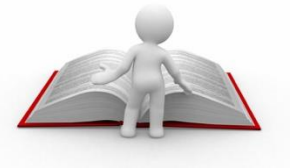
- Ban on import, sale and transport
- Obligation to notify, manage
- Setting up action plans for pathways of introduction and dispersal

Socio-economic issues

Formalising risk evaluation

Risk analyses

1. Risk assessment



2. Risk management

3. Risk communication

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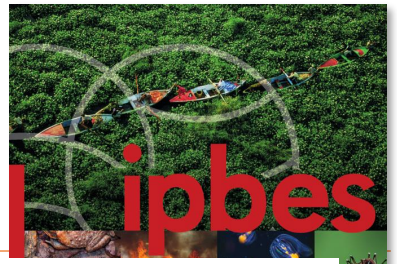

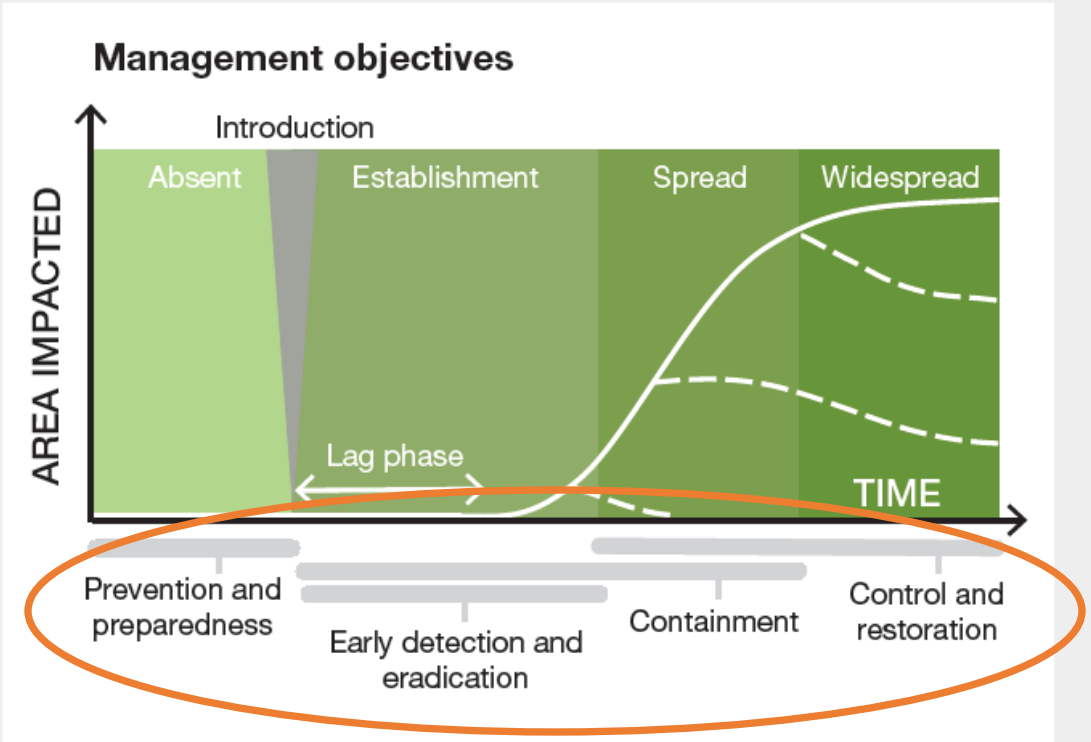

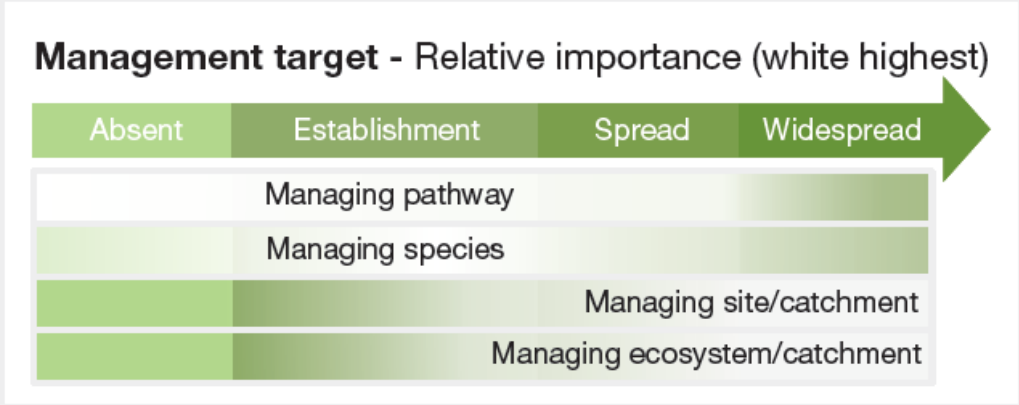

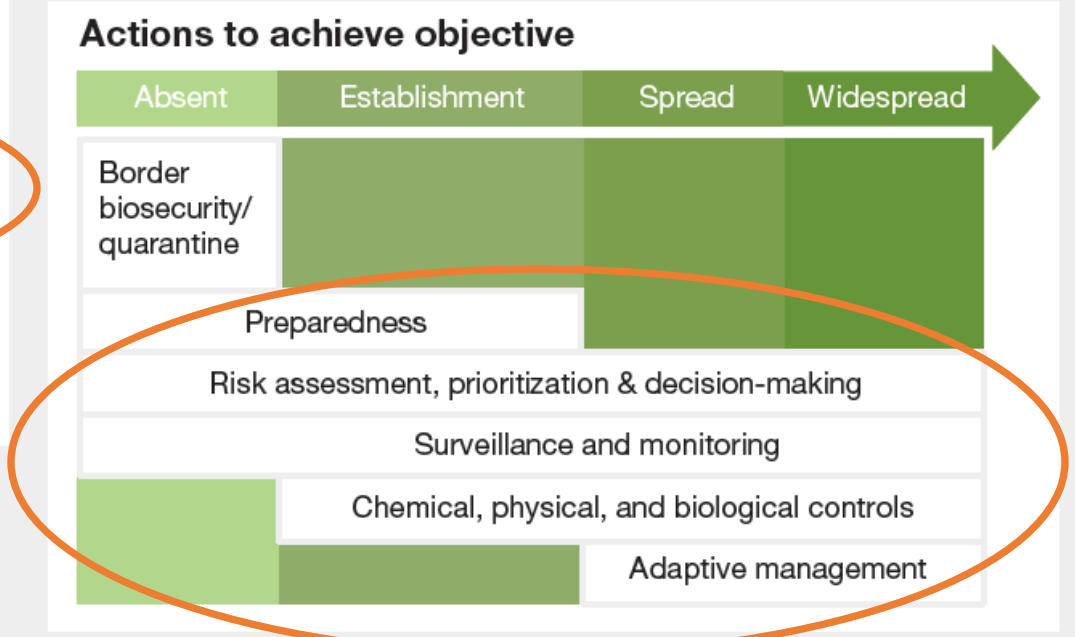

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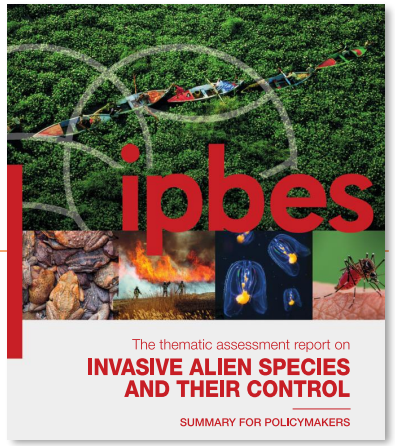
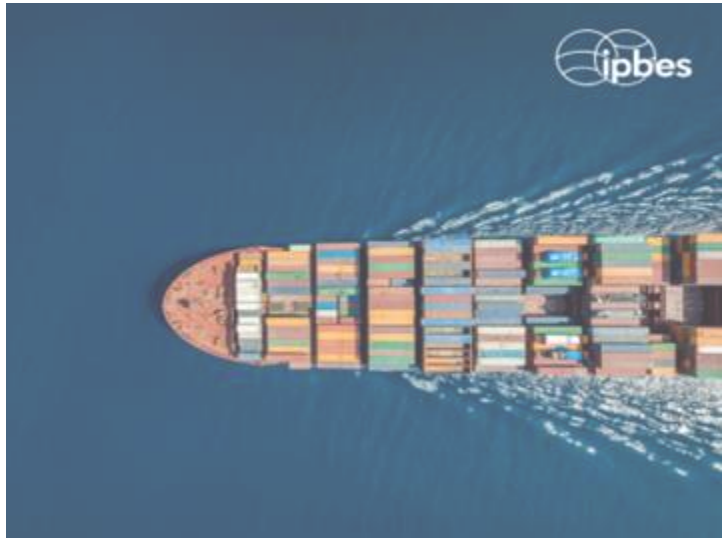


Prevention and preparedness are the most cost-effective options

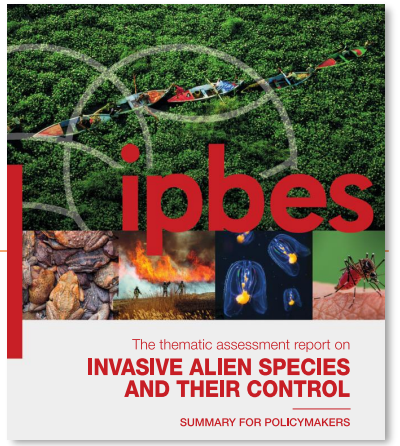


- Prevention results from effective pathway management:
  - import controls
  - pre-border, border and post-border biosecurity
  - rapid response protocols & agreements.

- Prevention is critical in marine and connected water systems where eradication has generally failed

Biological Invasions

– people at the heart of the solutions



Species-led management : eradication as objective?

- Most eradication programs fail but highly cost-effective on small islands or isolated habitats & for highly localized, slow spreading, easily delimited invasions.

- Success dependent on:
    - support and engagement of all relevant stakeholders
    - continuous science-based progress evaluation,
    - clear criteria for failure and long-term sustainability

Biological Invasions

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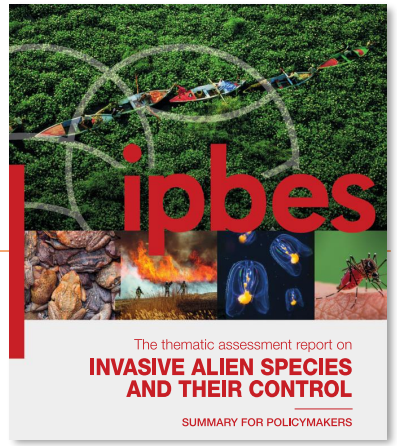

Species-led management : containment as objective ?

- Generally follows failed eradication
- Aims to slow spread in defined area
- Suppressing reproduction often used within the containment zone & a buffer zone to limit long-distance dispersal

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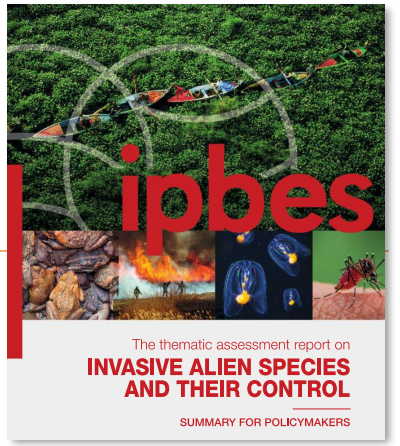
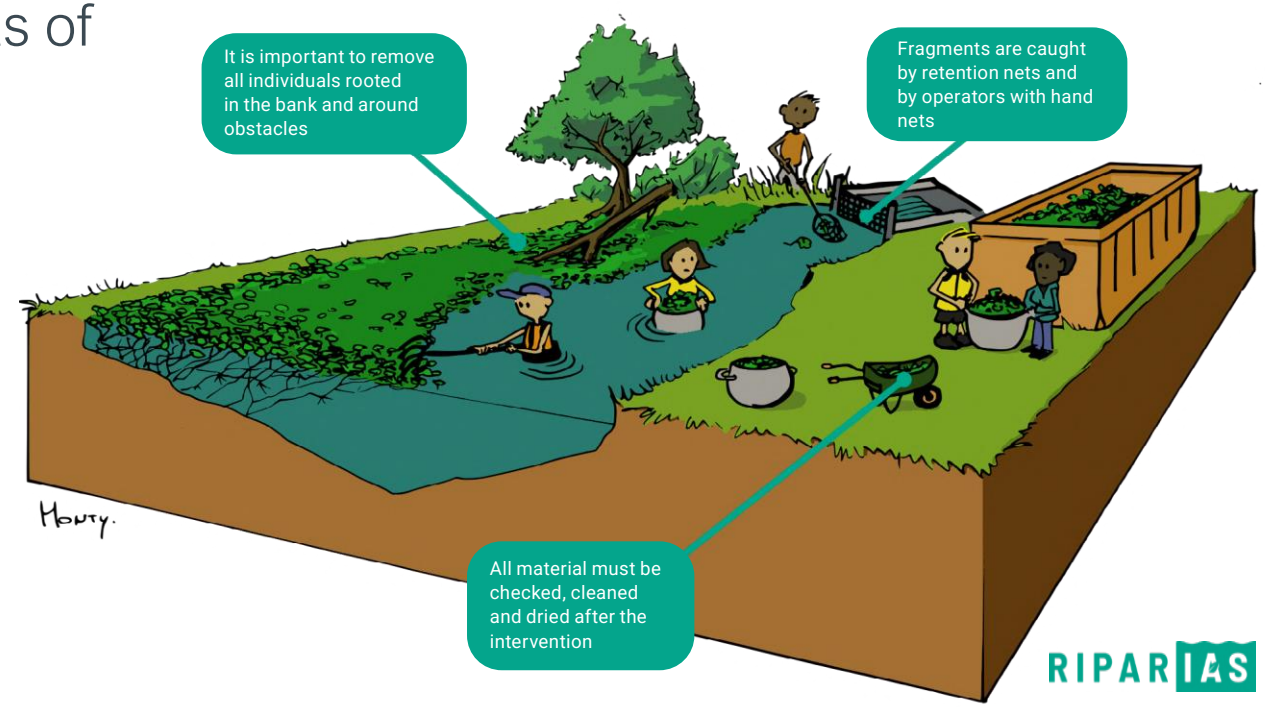


Species-led management : control as objective ?

- Direct actions taken to reduce or suppress the distribution, abundance, spread and impacts of species within an area
- Range of techniques :
  - Physical
  - Chemical
  - Biological



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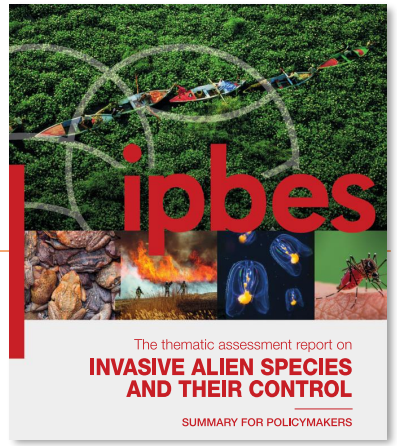


Precautionary principle & management

"*where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat*." (CBD 2002)

- Active capacity-building, priority and management settings should proceed despite knowledge, data, & management implementation gaps

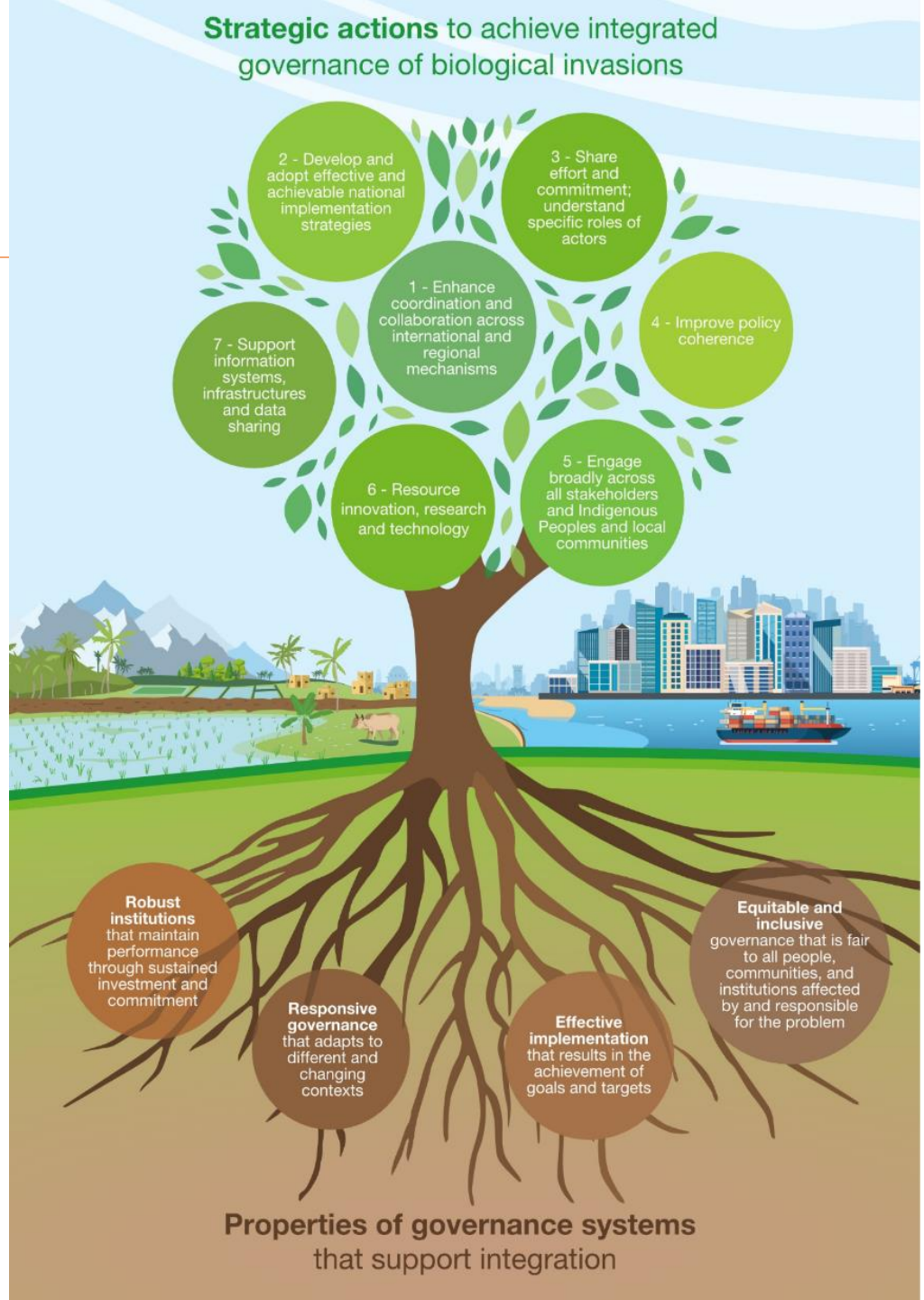
- Supported by
  - open-access data bases/sources & analytical tools
  - capturing, sharing, integrating, & analysing data to support decision-making
  - stakeholders & Indigenous & local knowledge
  - collective addressing of data/knowledge gaps & uncertainty (e.g., re global change impacts)

Biological Invasions

– people at the heart of the solutions

Towards Integrated Governance

Governing integrated planning & management, while recognising the **complexity** of biological invasions (drivers/impacts), the **social structure** and needs of diverse stakeholders & decision-makers though a **socio-ecological systems**-based approach



Integration of Biological Invasions within the One Health approach

Aquatic Invasions (2014) Volume 9, Issue 3: 383–390
doi: http://dx.doi.org/10.3391/ai.2014.9.3.12

REABIC

Open Access

Proceedings of the 18th International Conference on Aquatic Invasive Species (April 21–25, 2013, Niagara Falls, Canada)

Viewpoint

Aquatic invasive species and emerging infectious disease threats: A One Health perspective

David Bruce Conn[1,2]

2014

Conservation Letters
A journal of the Society for Conservation Biology
Open Access

2017

POLICY PERSPECTIVES

Alien Pathogens on the Horizon: Opportunities for Predicting their Threat to Wildlife

Helen E. Roy[1], Helen Hesketh[1], Bethan V. Purse[1], Jørgen Eilenberg[2], Alberto Santini[3], Riccardo Scalera[4], Grant D. Stentiford[5], Tim Adriaens[6], Karolina Bacela-Spychalska[7], David Bass[5,8], Katie M. Beckmann[9], Paul Bessell[10], Jamie Bojko[5,11], Olaf Booy[12,13], Ana Cristina Cardoso[14], Franz Essl[15,16], Quentin Groom[17], Colin Harrower[1], Regina Kleespies[18], Angeliki F. Martinou[19], Monique M. van Oers[20], Edmund J. Peeler[5], Jan Pergl[21], Wolfgang Rabitsch[15], Alain Roques[22], Francis Schaffner[23], Stefan Schindler[15,16], Benedikt R. Schmidt[24,25], Karsten Schönrogge[1], Jonathan Smith[26], Wojciech Solarz[27], Alan Stewart[28], Arjan Stroo[29], Elena Tricarico[30], Katharine M.A. Turvey[1], Andrea Vannini[31], Montserrat Vilà[32], Stephen Woodward[33], Anja Amtoft Wynns[2], & Alison M. Dunn[11]

Conservation Letters, July/August 2017, 10(4), 477–484

Science & Society

CellPress

Invasive species challenge the global response to emerging diseases

2014

Philip E. Hulme

The Bio-Protection Research Centre, Lincoln University, PO Box 84, Canterbury, New Zealand

Trends in Parasitology, June 2014, Vol. 30, No. 6

Bioinvasions, bioterrorism, and biosecurity

Laura A Meyerson[1,3] and Jamie K Reaser[2,3]

2003

Despite their high profile and potentially devastating consequences, bioterrorist acts are relatively unpredictable, rare, and thus far small-scale events. In contrast, biological invasions are occurring daily in the US and have significant impacts on human health, agriculture, infrastructure, and the environment, yet they receive far less attention and fewer resources. Scientists and the US government must work together to implement a comprehensive approach to biosecurity that addresses not only bioterrorism, but also the more common incursions of invasive alien species. This approach should also address the potential for the deliberate use of invasive alien species as agents of bioterrorism. To achieve these goals, it will be necessary for the relevant government institutions to acknowledge and include prevention, early detection, and rapid response to species incursions as central mission themes. In addition, the scientific community, industry, and the public must work together to ensure that the necessary technology and information systems are readily available.

Front Ecol Environ 2003; 1(6): 307–314

Despite the critical role invasive alien species can play as reservoirs and vectors of zoonotic diseases, the One Health approach has yet to systematically integrate the threat and impacts of biological invasions into its analyses

Integration of Biological Invasions within the One Health approach

Science & Society

2020

Invasion Science and the Global Spread of SARS-CoV-2

Martin A. Nuñez,[1,*]
Anibal Pauchard,[2,3]
and Anthony Ricciardi[4,5]

Emerging infectious diseases, such as coronavirus disease 2019 (COVID-19), are driven by ecological and socioeconomic factors, and their rapid spread and devastating impacts mirror those of invasive species. Collaborations between biomedical researchers and ecologists, heretofore rare, are vital to limiting future outbreaks. Enhancing the crossdisciplinary framework offered by invasion science could achieve this goal.

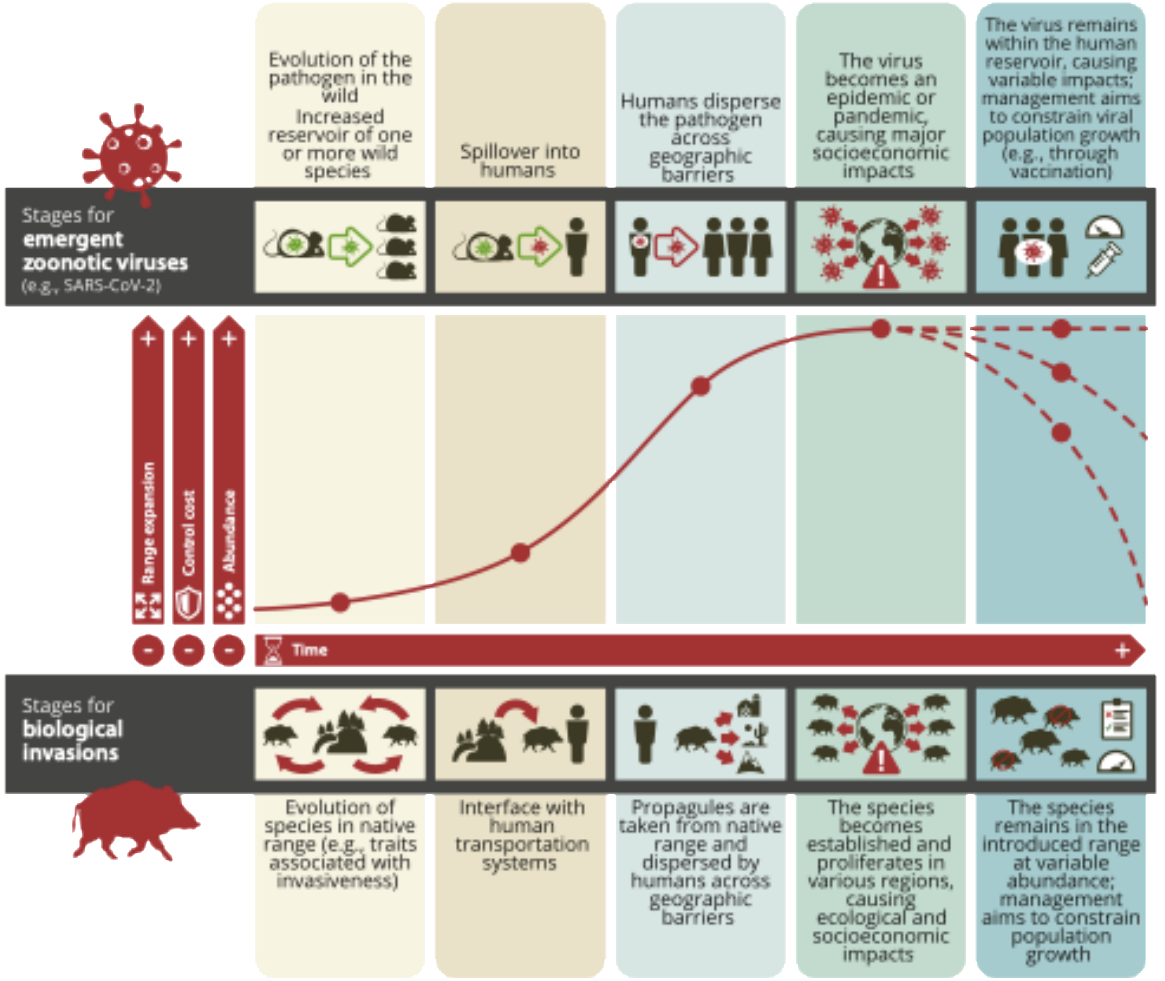
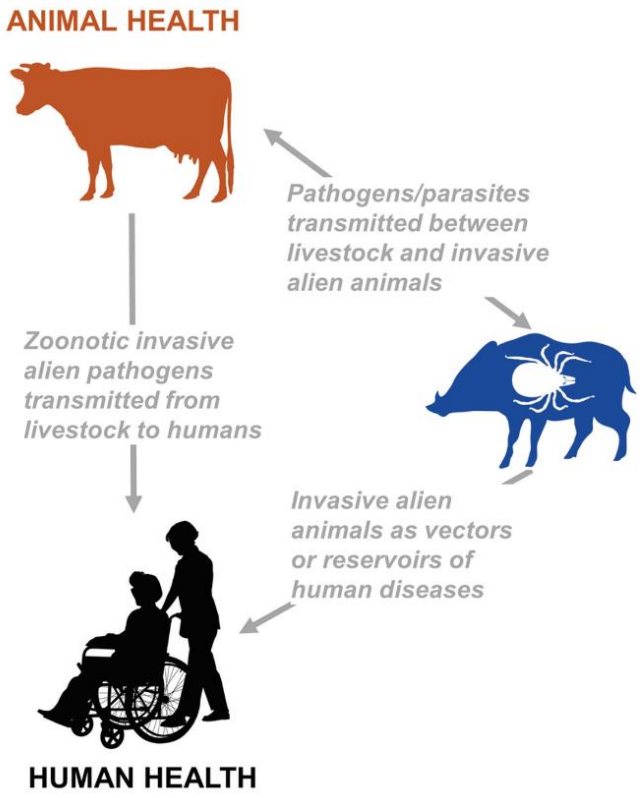


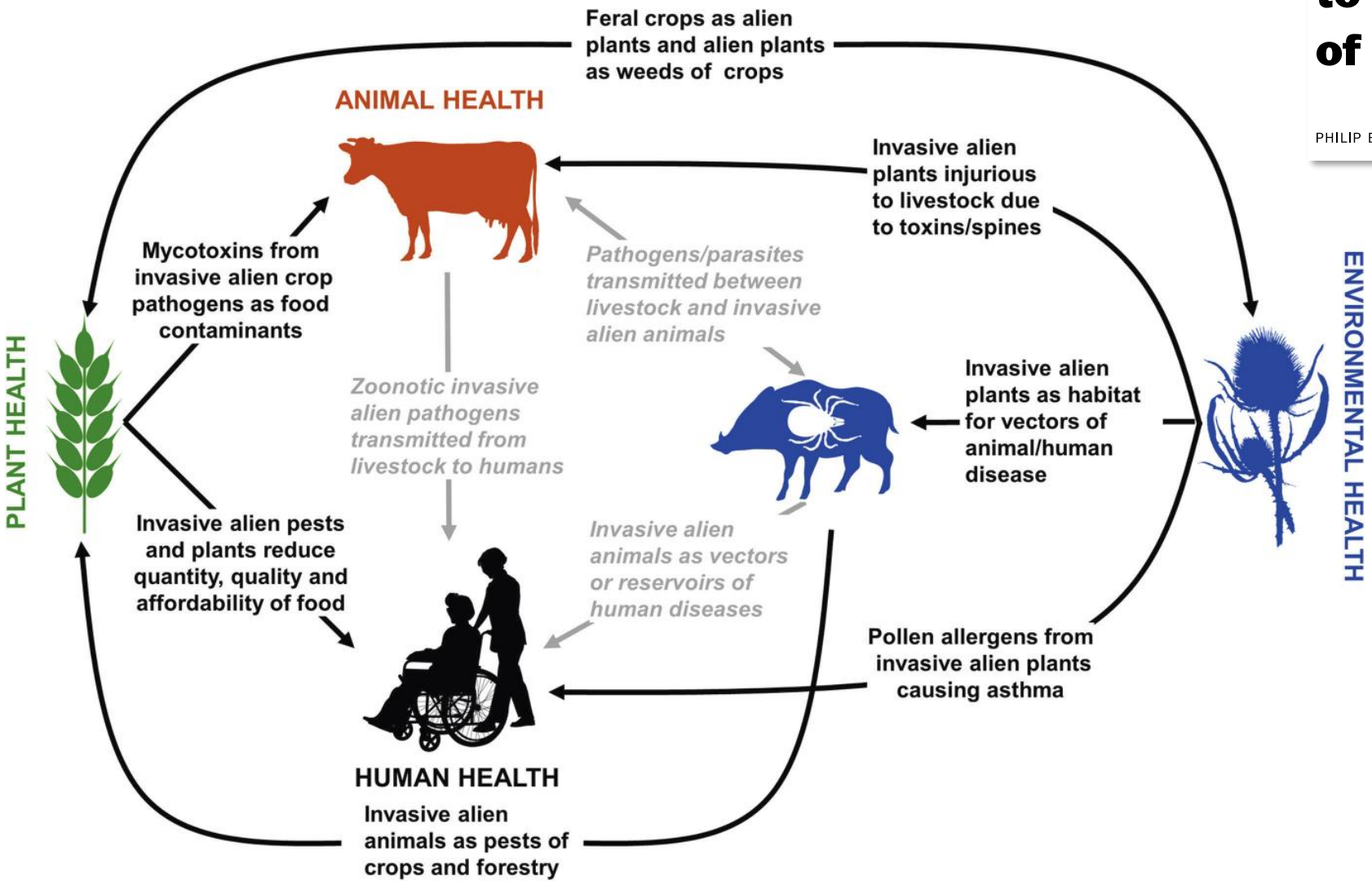
Figure 1. Stages of a Zoonotic Viral Epidemic Compared with those of a Biological Invasion. Similar stage-based processes affect the spread of infectious zoonotic pathogens (such as severe acute respiratory syndrome coronavirus 2; SARS-CoV-2) and nonpathogenic invasive organisms, demonstrating the need for a common set of international management actions (e.g. early detection, rapid response, eradication or containment, and mitigation) appropriate to each stage of the process.

Integration of Biological Invasions within the One Health approach



Main areas encompassed by the One Health concept

Integration of Biological Invasions within the One Health approach



Advancing One Biosecurity to Address the Pandemic Risks of Biological Invasions

PHILIP E. HULME

2021

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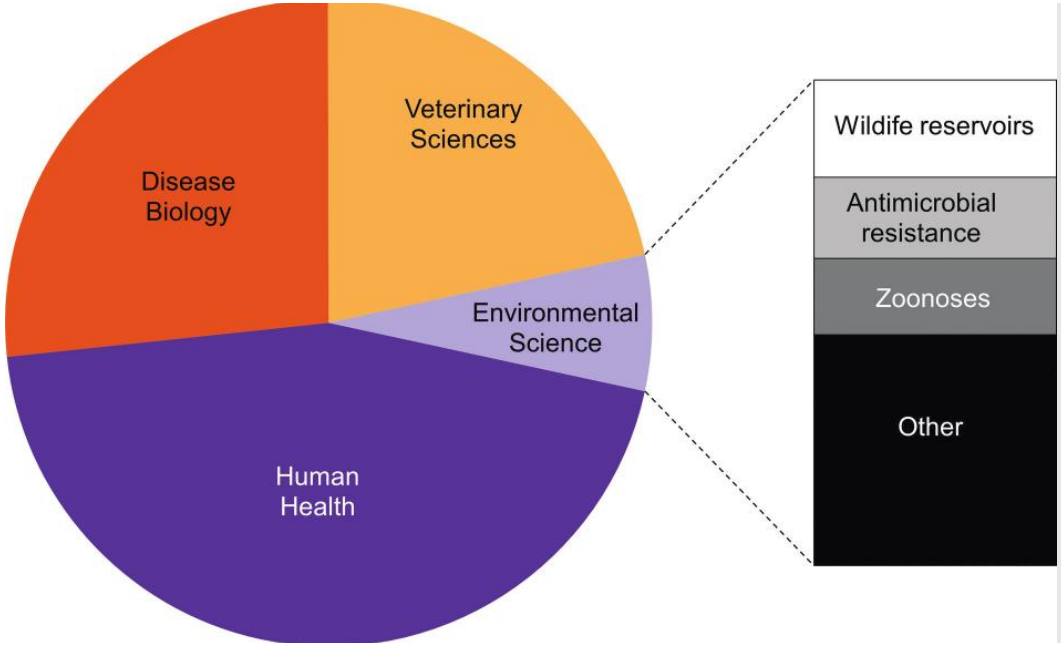
"One Biosecurity" would integrate the One Health framework with the practical necessities associated with the provision of biosecurity, including the prevention of all invasive alien species

Integration of Biological Invasions within the One Health approach



Disciplines covered in 3952 publications addressing the topic "One Health" published between 2007 and 2020 as catalogued in Web of Science.

Advancing One Biosecurity to Address the Pandemic Risks of Biological Invasions

PHILIP E. HULME

2021

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« Despite the significant role invasive alien species play in determining human and animal health outcomes, less than 0.5% (12 out of 3952 publications) of the literature addressing One Health examines biological invasions. »

Integration of Biological Invasions within the One Health approach

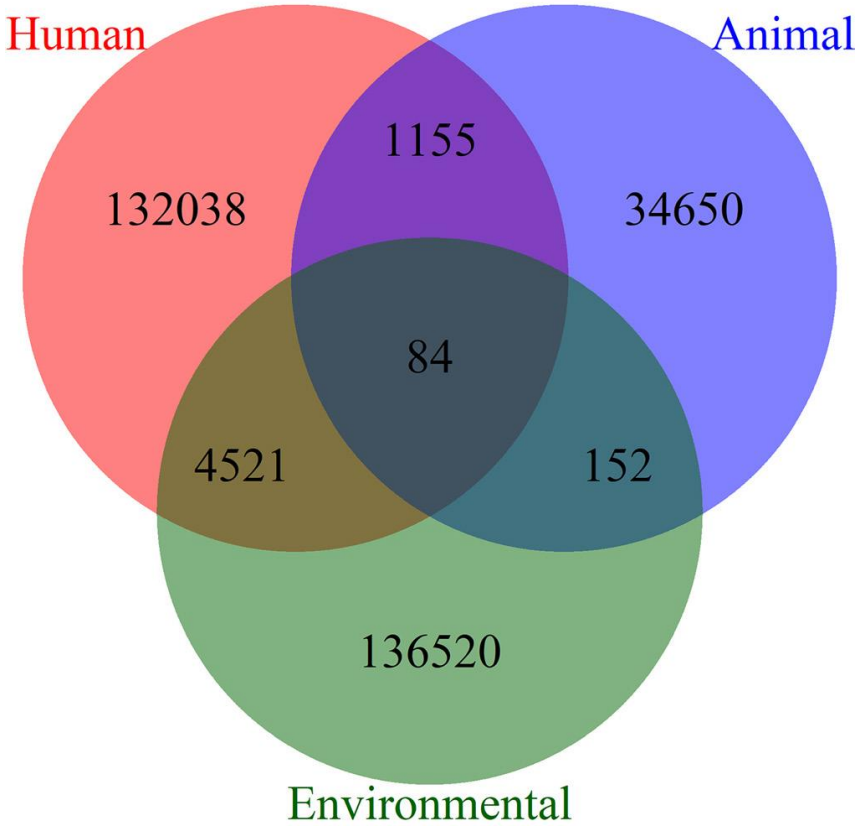

Fig. 1. Extracted from the Web of Science Core Collection, this diagram shows publication numbers using the terms "human health", "animal health", and "environmental health." Image credit: John L. Gittleman (University of Georgia, Athens, GA).

PNAS

OPINION

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"One Health" needs ecology

John L. Gittleman[a,b,1]

« I now see a growing, perilous skew emphasizing the animal–human side of the human–animal–environment triad. »

« It is impossible to separate human health from health of the natural world. Ecology is the unifying science that intergartes knowledge and understanding of the Earth, as well as the animal-human connections within it. »

Thank you!

Dr Sonia Vanderhoeven

Belgian Biodiversity Platform