



The €conomic co\$t of bio£ogica£ invasion\$



Christophe Diagne, Boris Leroy, Rodolphe Gozlan, Frédéric Jourdain, **David Roiz**, Anne-Charlotte Vaissière, Jean-Michel Salles, Ivan Jaric, Corey Bradshaw, Elena Angulo, Anna Turbelin, Liliana Ballesteros-Mejia & **Franck Courchamp**...

& the InvaCost consortium







collaborative



publicly accessible



'living'
(regularly updated)



(econom* OR cost OR monetary OR dollar OR euro OR "sterling pound") AND (invasi* OR alien OR non-indigenous OR nonindigenous OR nonnative OR non-native OR exotic OR introduced OR naturali* OR invader) NOT (cancer* OR cardio* OR surg* OR carcin* OR engineer* OR rotation OR ovar* OR polynom* OR purif* OR respirat* OR "invasive technique" OR carbon OR fuel OR therap* OR vehicle OR cell* OR drug OR fitness OR "operational research" OR banking OR liberalization)





65 descriptive fields

Data integration & <u>description</u>

Version 4.0: <u>https://invacost.fr/</u>

- **13,123** cost entries (US\$)
- **750+** taxa

- **90+** countries
- ~2200 sources

65 descriptive fields

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Reference title, authors, publication year, etc.



Column_name	Definition
Cost_ID	Unique identifier for the cost entry
Repository	Literature engine (Web of Science (WoS), Google Scholar (GS), Google search engine (Go)) or original source (Targeted collection (TC)) from
Reference_ID	Identifier for the reference where the cost entry is reported. As much as possible, this is the original source where the cost was first provid
Reference_title	Title of the reference where the cost entry is reported
Authors	Authors of the reference where the cost entry is reported
Abstract	If existing/accessible, the abstract of the reference where the cost entry is reported
Publication_year	Year of publication of the reference where the cost entry is reported
Language	Main language used in the original reference reporting the cost entry
Type_of_material	Type of reference analyzed (i.e. scientific peer-reviewed article or grey literature); for grey literature, the exact nature of the reference w
Previous_materials	If any, the list of successive materials checked before reaching the original reference providing the cost entry
Availability	The accessibility of the original reference as a searchable document (yes/no)



Kingdom	Taxonomic kingdom of the invasive species associated with the cost entry	
Phylum	Taxonomic phylum of the invasive species associated with the cost entry	
Class	Taxonomic class of the invasive species associated with the cost entry	
Order	Taxonomic order of the invasive species associated with the cost entry	
Family	Taxonomic family of the invasive species associated with the cost entry	
Genus	Taxonomic genus of the invasive species associated with the cost entry	
Species	Taxonomic species of the invasive species associated with the cost entry	
Sub-species	Taxonomic sub-species of the invasive species associated with the cost entry	
Common_name	Non-scientific (or vernacular) name(s) provided in the original reference, or by t	



Status of the cost estimate as potentially ongoing (if the cost can be expected to continue over time) or one-time (if the cost was deemed



Method reliability refined Explanation

Benefit_values

Details

Method_reliability_refined_Expert_Name

Assessment of the methodological approach used for cost estimation as of high or low reliability based on the evaluation of the estimation Detailed explanation why a particular methodological approach used for cost estimation was deemed as of high or low reliability based on Complete name and contact details of the expert had deemed the reliability of the cost entry Mention (if any) of the benefit value in the analyzed material (yes/no); the figure was not recorded or described as being out of the scope When necessary, narrative elements deemed important either to understand the cost estimate or to support choices made for completing

90+ countries

~2200 sources

NeoBiota 63: 25-37 (2020) doi: 10.3897/neobiota.63.55260 https://neobiota.pensoft.net

SHORT COMMUNICATION



What are the economic costs of biological invasions? A complex topic requiring international and interdisciplinary expertise

Christophe Diagne¹, Jane A. Catford^{2*}, Franz Essl^{3*}, Martin A. Nuñez^{4*}, Franck Courchamp¹



November 12-15, 2019 near Paris (France) 47 attendees from 23 countries



Today: 102 colleagues from 39 countries

InvaCost workshop: outcomes (example 1)



Contents lists available at ScienceDirect Science of the Total Environment



journal homepage: www.elsevier.com/locate/scitotenv

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



Elena Angulo^{a,*}, Christophe Diagne^a, Liliana Ballesteros-Mejia^a, Tasnime Adamjy^b, Danish A. Ahmed^c, Evgeny Akulov^d, Achyut K. Banerjee^e, César Capinha^f, Cheikh A.K.M. Dia^g, Gauthier Dobigny^b, Virginia G. Duboscq-Carra^h, Marina Golivetsⁱ, Phillip J. Haubrock^{j,k}, Gustavo Heringer¹, Natalia Kirichenko^{m,n}, Melina Kourantidou^{o,p,q}, Chunlong Liu^{r,s,t}, Martin A. Nuñez^h, David Renault^{u,v}, David Roiz^w, Ahmed Taheri^x, Laura N.H. Verbrugge^{y,z}, Yuya Watari^{aa}, Wen Xiong^{ab}, Franck Courchamp^a



- ~5300+ new cost entries
- ~250 additional species
- **15** newly reported countries

Twittear



Franck Courchamp @franckcourchamp

What language does #science speak? #English?

Not only. Also #French, #Spanish, #Chinese, #Arabic, #Russian, #Portuguese, #Japanese, #Hindi... Surprisingly, we miss much science by focusing only on English 🥳

doi.org/10.1016/j.scit..

@laboratoire_ese @INEE_CNRS @UnivParisSaclay



Non-English languages enrich scientific knowledge: The e... We contend that the exclusive focus on the English language in scientific research might hinder effective ... @ sciencedirect.com

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Q	t]	(2	<u>↑</u>

InvaCost workshop: outcomes (example 2)



'invacost' package (Leroy et al. 2020 BioRXiv – in revision in MEE)



https://borisleroy.com/invacost/invacost_livingfigure.html

InvaCost workshop: outcomes (example 3)



InvaCost workshop: outcomes (example 4)



UNIVERSITE PARIS-SACLAY

LES COÛTS ÉCONOMIQUES DES INVASIONS BIOLOGIQUES EN FRANC€





Avec l'appui de



InvaCost workshop: outcomes (example 4)



28 papers accepted/published



Article

High and rising economic costs of biological invasions worldwide

https://doi.org/10.1038/s41586-021-03405-6	Christophe Diagne ^{1⊠} , Boris Leroy², Anne-Charlotte Vaissière ¹ , Rodolphe E. Gozlan³, David Roiz⁴, Ivan Jarić ^{5,6} , Jean-Michel Salles ⁷ , Corey J. A. Bradshaw ⁸ & Franck Courchamp ^{1⊠}		
Received: 8 April 2020			
Accepted: 28 February 2021			
Published online: 31 March 2021 Check for updates	Biological invasions are responsible for substantial biodiversity declines as well as high economic losses to society and monetary expenditures associated with the management of these invasions ^{1,2} . The InvaCost database has enabled the generation		

- based on InvaCost v1.0 (original database: 2,419 cost entries)
- only the **most robust subset** (~55%) considered
- using the *invacost* R package (Leroy et al. 2020)



A minimum of ~US\$ 1,288 billion between 1970 and 2017

In 2017, costs are estimated to reach US\$ 162.7 billion, more than...



... the **gross domestic product** of **50 out of 54** African countries



... 20 times higher than the total funds available in 2016–2017

- Consistent three-fold increase each decade
- Higher **increase** for **damage costs** compared with **management expenditures**





→ Invasions increase (no sign of saturation)

- → Global trade increase (more introductions)
- → Climate change increase (more establishments)
- \rightarrow Cost reporting, awareness and knowledge increase

Insight 3: costs are unevenly distributed



Management is very costly, but still worth, as losses are even more important



Type of cost

Damage-loss costs Management costs Mixed costs

(based on InvaCost v4.0)

Insight 3: costs are unevenly distributed



(based on InvaCost v4.o)





These costs are only the tip of the iceberg









on their origins







Intensify research efforts towards under-reported regions and taxa

→ incentivizing prevention and control efforts at multiple scales



→ fostering partnerships for coordinated, adapted and sustainable management



Evaluate cost-efficiency of past and current management strategies

➔ promoting biosecurity measures and refining local control strategies

- Costs are tremendous, increasing, uneven... and largely underestimated
- Springboard for more standardized, concerted and intersectoral efforts
- Costs as an (additional) alert item towards the broader impacts of invaders

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It's not all about **money**...





...(non-monetizable) biodiversity and sanitary issues are the greatest concerns

Acknowledgements



<u>Collaborative projects & funders</u>







Franck Courchamp (CNRS Orsay, France)

My amazing colleagues

Leroy B. (MNHN Paris) Gozlan R. (IRD Montpellier) Roiz D. (IRD Montpellier)

Jourdain F. (IRD Montpellier) Jaric I. (HBU Prague) Salles J-M. (CEE Montpellier) Vaissière A-C. (CNRS Orsay) Bradshaw C. (CSE Adelaide) Assailly C. (Univ. Paris-Saclay) Nuninger L. (Univ. Paris-Saclay) Angulo E. (Univ. Paris-Saclay)

and the wonderful **InvaCost consortium**!

Thank you!