

IPBES IAS assessment, data management report for Chapter 4. Impact Evidence Database

Version: 1

DOI: 10.5281/zenodo.5766070

Project leader and contributors:

- Project Leaders: Sven Bacher, Bella Galil, Martin Nuñez, Michael Ansong; Phillip Cassey; Katharina Dehnen-Schmutz, Georgi Fayvush, Ankila Hiremath, Makihiko Ikegami, Angeliki Martinou, Shana McDermott, Cristina Preda, Montse Vilà, Olaf Weyl, Romina Fernandez, Ellen Ryan-Colton

- Contributors

Vidyadhar Atkore, Pilar Castro-Diez, Steven Chown, Mario Coiro, Franck Courchamp, Christophe Diagne, Virginia Duboscq, Emilie Ens, Tom Evans, Paul Fofonoff, Rachel Leihy, N. A. Aravind Madhyastha, John Measey, Baptiste Michel, Alessia Prepori, Shaina Russell, Gregory Ruiz, Ned Ryan-Schofield, Alberto Santini, Alejandro Trillo, Lara Volery, Julissa Rojas-Sandoval, Paola Flores-Males, Gonzalo Rivas-Torres, Diego Cisneros-Heredia, Pieter van't Hof, Clinton Carbutt, Julie Coetzee, Vanessa Céspedes, James Dickey, Belinda Gallardo, Jonathan Jeschke, Bram Koese, Chunlong Liu, Agata Mrugała, Camille Musseau, Elena Tricarico, Laura Zinnert, Georgia Roberts, Ioanna Angelidou, Katerina Athanasiou, Aikaterini Christopoulou, Jakovos Demetriou, Imogen Cavadino, Lori Lach, Douglas H Boyes, Maarten de Groot, Bjorn Beckmann, Katharina Lapin, Lara Carisio, Simon Lioy, Sara Straffon

Data curator(s):

- Sven Bacher (sven.bacher@unifr.ch)
- Phill Cassey
- Mario Coiro

Description

Data were gathered on direct observations of impacts from published literature, including grey literature, in order to form a database on the evidence to which invasive alien species impact, negatively and positively, nature, nature's contributions to people and good quality of life for chapter 4 of IPBES thematic assessment of invasive alien species and their control. The criteria for inclusion were a published direct evidence of an impact on native species, a change in ecosystem properties, nature's contributions to people and the extent to which humans were affected through changes in their constituents of well-being.

Process overview

The search was done separately for different terrestrial regions and the marine realm and for different taxonomic groups. Generally, first a list of species with alien populations for a certain region was established. Records for impacts of each species were gathered with standardised search strings from scientific literature databases (GoogleScholar, WoS, ..). Only sources containing direct observations of impacts were selected.

Protocol

Detailed description of the data gathering

The search was done separately for different terrestrial regions and the marine realm and for different taxonomic groups. Generally, first a list of species with alien populations for a certain region was established. Records for impacts of each species were gathered with standardised search strings from scientific literature databases (GoogleScholar, WoS, ..). Only sources containing direct observations of impacts were selected.

For each record, we collected data on the following items (if applicable):

assessor; reference; year of reference; year of impact (if different); Language; Type of source; IPBES region; Country; Island (yes,no); Protected areas (yes,no); Methodology; Realm; IPBES Unit of analysis; spatial scale; IAS Species Name; IAS Taxon; IAS Functional Group; text excerpt describing the impact; Affected native species ; Affected ecosystem property; investigated level of organization; EICAT mechanism; impact direction (Nature); impact magnitude (Nature); impacted nature's contributions to people; impact direction (NCP); impact magnitude (NCP); relevant for ILK; affected constituent of well-being (SEICAT); impact direction (SEICAT); impact magnitude (SEICAT); native range of IAS

For each region/taxon combination, the following search protocol was carried out:

Forest pathogens/Europe and Central Asia

- Assessor(s) – Alberto Santini, Alessia Pepori
- Search language(s) – English
- Search terms – TITLE-ABS-KEY ("species name" AND impact AND (portugal OR spain OR france OR "Great Britain" OR ireland OR italy OR germany OR switzerland OR poland OR "Czech Republic" OR slovakia OR slovenia OR croatia OR serbia OR ukraine OR russia OR georgia OR turkey OR azerbaijan OR armenia OR belgium OR Iran OR "The Netherlands" OR Luxembourg OR Belarus))
- Search engine – WoS
- Date – March 2020
- Overview of the search results – 190 records of impacts were obtained
- Files – *EU IFP impact evidence base 20200513_MC20210505.csv*

Ungulates/global

- Assessor(s) – Lara Volery, Sven Bacher, Mario Coiro
- Search language(s) – English
- Search terms – ('introduced' OR 'invasive' OR 'alien' OR 'non-native' OR 'non-indigenous' OR 'feral' OR 'exotic' AND '[common name]' OR '[latin name]')
- Search engine – GoogleScholar, WoS, UCL Explore (<https://www.ucl.ac.uk/library/electronic-resources/about-explore>), the CABI's Invasive Species Compendium (ISC; <https://www.cabi.org/ISC>) and Google (<https://www.google.ch>)
- Date – May 2020
- Results were published in Volery et al. 2021
- Overview of the search results – 334 records of impacts were obtained
- Files – included in *IPBES_EUROPE_VERT.csv*

Volery, L., Jatavallabhula, D., Scillitani, L., Bertolino, S., & Bacher, S. (2021). Ranking alien species based on their risks of causing environmental impacts: A global assessment of alien ungulates. *Global Change Biology*, 27(5), 1003-1016.

All taxa/China

- Assessor(s) – Cang Hui, Xiaozhuo Han
- Search language(s) – Chinese
- Search terms – 外来种 危害, 入侵植物 危害, 外来种 多样性, 外来种 化感作用, 入侵种 化感 (translation: Alien species, Invasive plant impact, Exotic species diversity, Allelopathy, Invasive species allelopathy)
- Search engine –CNKI (www.cnki.net)
- Date – April 2021
- Overview of the search results – 59 records of impacts were obtained
- Files – *Copy of Chapter4_China_Hui2_SB.xlsx*

Birds/global

- Assessor(s) – Tom Evans, Mario Coiro, Sven Bacher
- We included all original references from the global reviews on environmental and socio-economic impacts of birds from Evans et al. 2016, 2020.
- Overview of the search results – 399 records of impacts were obtained
- Files – included in *IPBES_EUROPE_VERT.csv*

Evans, T., Kumschick, S., & Blackburn, T. M. (2016). Application of the Environmental Impact Classification for Alien Taxa (EICAT) to a global assessment of alien bird impacts. *Diversity and Distributions*, 22(9), 919-931.

Evans, T., Blackburn, T. M., Jeschke, J. M., Probert, A. F., & Bacher, S. (2020). Application of the Socio-Economic Impact Classification for Alien Taxa (SEICAT) to a global assessment of alien bird impacts. *NeoBiota*, 62, 123.

Amphibians/global

- Assessor(s) – John Measey, Mario Coiro, Sven Bacher
- Search language(s) – English, French, Spanish
- We included all original references from the global reviews on environmental and socio-economic impacts of amphibians from Measey et al. 2016
- Overview of the search results – 356 records of impacts were obtained
- Files – included in *IPBES_EUROPE_VERT.csv*

Measey, G. J., Vimercati, G., De Villiers, F. A., Mokhatla, M., Davies, S. J., Thorp, C. J., ... & Kumschick, S. (2016). A global assessment of alien amphibian impacts in a formal framework. *Diversity and Distributions*, 22(9), 970-981.

Rodents/global

- Assessor(s) – Lisanna Schmidt, Johann Cheseaux, Maddie Harris, Mario Coiro, Sven Bacher
- Search language(s) – English, French, Spanish, German
- Search terms – ('introduced' OR 'invasive' OR 'alien' OR 'non-native' OR 'non-indigenous' OR 'feral' OR 'exotic' AND '[common name]' OR '[latin name]')
- Search engine – GoogleScholar, WoS, and Google (<https://www.google.ch>)
- Date – May 2020-May 2021
- Overview of the search results – 289 records of impacts were obtained
- Files – included in *IPBES_EUROPE_VERT.csv*

Reptiles/Europe and Central Asia

- Assessor(s) – Riccardo Scalera
- Search language(s) – English
- Search terms – used the database by Capinha et al 2017 as a starting point <https://onlinelibrary.wiley.com/doi/full/10.1111/ddi.12617> then checking own folders where I collect any new literature, and eventually integrating with a simple Google search species by species + relevant country/area
- Search engine – GoogleScholar and Google
- Date – December 2020- January 2021
- Overview of the search results – 14 records of impacts were obtained
- Files – included in *IPBES_EUROPE_VERT.csv*

Fish (freshwater)/Europe and Central Asia

- Assessor(s) – Baptiste Michel, Sven Bacher, Mario Coiro
- Search language(s) – English
- Search terms – species list from EASIN (accessed 2019), search terms ('introduced' OR 'invasive' OR 'alien' OR 'non-native' OR 'non-indigenous' OR 'exotic' AND '[common name]' OR '[latin name]')
- Search engine – GoogleScholar and Google
- Date – December 2019 - January 2021
- Overview of the search results – 289 records of impacts were obtained
- Files – included in *IPBES_EUROPE_VERT.csv*

Plant and microbes/South America

- Assessor(s) – Romina Fernandez
- Search language(s) – English, Spanish and Portuguese
- Search terms:
- Plants: (Invasive plant OR exotic plant OR alien plant OR no-native plant OR invasive plants) AND (impact OR effect OR increase OR decrease) AND (diversity OR abundance OR cover OR ecosystem process OR well-being OR economic OR production OR biosecurity) AND (Argentina OR Chile OR Uruguay OR Brazil OR Bolivia OR Peru OR Colombia OR Venezuela OR Paraguay OR Ecuador OR Guyana OR Surinam).
- Microbes: (Invasive bacteria OR invasive fungi OR invasive microbes) AND (impact OR effect OR increase OR decrease) AND (diversity OR abundance OR cover OR ecosystem process OR well-being OR economic OR production OR biosecurity) AND (Argentina OR Chile OR Uruguay OR Brazil OR Bolivia OR Peru OR Colombia OR Venezuela OR Paraguay OR Ecuador OR Guyana OR Surinam).
- I also searched the references contained in the sources I obtained from the literature search
- Search engine – Google Scholar, Scopus, WoS
- Date – September 2019- April 2021
- Overview of the search results – 820 records of impacts were obtained Files – Impact evidence base for plants and microbes South America_MC_RF_12-04-2021 and NEW Impact database for plant and microbes South America-12-04-2021_MC20210427

Plant Galapagos:

- Assessor(s): Flores-Males, Paola; Rivas-Torres, Gonzalo; van 't Hof, Pieter
- Search language(s): English and Spanish
- Search terms: - galapagos AND non native species, galapagos AND non native species OR alien taxa OR introduced OR introduction OR invasor, galapagos AND non native species OR alien taxa OR introduced OR introduction OR invasor AND plants OR flora AND impact, galapagos AND non native

species OR alien taxa OR introduced OR introduction OR invasor AND plants OR flora AND impact AND Fabaceae, galapagos AND non native species AND invasor* OR impact* , galapagos AND non native species AND invas* OR impact* AND flora OR plant* , “Bauhinia variegata” AND galapagos AND impact, “Abrus precatorius” AND galapagos AND impact, “Arachis hypogaea” AND galapagos AND impact, “Arachis pintoi” AND galapagos AND impact, “Cajanus cajan” AND galapagos AND impact, “Canavalia dictyota” AND galapagos AND impact, “Canavalia ensiformis” AND galapagos AND impact, “Canavalia rosea” AND galapagos AND impact, “Centrolobium paraense” AND galapagos AND impact, “Clitoria ternatea” AND galapagos AND impact, “Crotalaria retusa” AND galapagos AND impact, “Desmodium glabrum” AND galapagos AND impact, “Desmodium incanum” AND galapagos AND impact, “Desmodium intortum” AND galapagos AND impact, “Desmodium limense” AND galapagos AND impact, “Dioclea reflexa” AND galapagos AND impact, “Dioclea virgata” AND galapagos AND impact, “Erythrina corallodendron” AND galapagos AND impact, “Erythrina edulis” AND galapagos AND impact, “Erythrina fusca” AND galapagos AND impact, “Erythrina poeppigiana” AND galapagos AND impact, “Erythrina smithiana” AND galapagos AND impact, “Galactia tenuiflora” AND galapagos AND impact, “Geoffroea spinosa” AND galapagos AND impact, “Gliricidia sepium” AND galapagos AND impact, “Glycine max” AND galapagos AND impact, “Indigofera suffruticosa” AND galapagos AND impact, “Labiab purpureus” AND galapagos AND impact, “Lens culinaris” AND galapagos AND impact, “Macroptilium lathyroides” AND galapagos AND impact, “Medicago sativa” AND galapagos AND impact, “Mucuna rostrata” AND galapagos AND impact, “Phaseolus coccineus” AND galapagos AND impact, “Phaseolus lunatus” AND galapagos AND impact, “Phaseolus vulgaris” AND galapagos AND impact, “Pisum sativum” AND galapagos AND impact, “Pueraria phaseoloides” AND galapagos AND impact, “Spartium junceum” AND galapagos AND impact, “Vicia faba” AND galapagos AND impact, “Vigna unguiculata” AND galapagos AND impact, “Zornia curvata” AND galapagos AND impact, “Zornia piurensis” AND galapagos AND impact, “Bauhinia monandra” AND galapagos AND impact, “Caesalpinia bonduc” AND galapagos AND impact, “Caesalpinia gilliesii” AND galapagos AND impact, “Caesalpinia pulcherrima” AND galapagos AND impact, “Cassia fistula” AND galapagos AND impact, “Cassia grandis” AND galapagos AND impact, “Delonix regia” AND galapagos AND impact, “Schizolobium parahyba” AND galapagos AND impact, “Senna alata” AND galapagos AND impact, “Senna bicapsularis” AND galapagos AND impact, “Senna hirsuta” AND galapagos AND impact, “Senna obtusifolia” AND galapagos AND impact, “Senna septemtrionalis” AND galapagos AND impact, “Senna siamea” AND galapagos AND impact, “Tamarindus indica” AND galapagos AND impact, “Albizia guachapele” AND galapagos AND impact, “Acacia caven” AND galapagos AND impact, “Acacia nilotica” AND galapagos AND impact, “Calliandra calothyrsus” AND galapagos AND impact, “Inga edulis” AND galapagos AND impact, “Inga insignis” AND galapagos AND impact, “Inga sapindoides” AND galapagos AND impact, “Inga spectabilis” AND galapagos AND impact, “Inga striata” AND galapagos AND impact, “Inga vera” AND galapagos AND impact, “Leucaena leucocephala” AND galapagos AND impact, “Leucaena trichodes” AND galapagos AND impact, “Mimosa pudica” AND galapagos AND impact, “Ochroma pyramidale” AND galapagos AND impact, “Cleome viscosa” AND galapagos AND impact, “Cucumis dipsaceus” AND galapagos AND impact, “Ricinus communis” AND galapagos AND impact, “Brachiaria mutica” AND galapagos AND impact, “Digitaria eriantha” AND galapagos AND impact, “Citrus x aurantiifolia” AND galapagos AND impact, Citrus x limon AND galapagos AND impact, “Citrus

medica" AND Galapagos AND impact, "Datura stramonium" AND galapagos AND impact, "Solanum lycopersicum" AND Galapagos AND impact, "Trema micrantha" AND galapagos AND impact, "Furcraea hexapetala" and Galapagos, "Cordia alliodora" AND Galapagos, "Tradescantia fluminensis" AND Galapagos, "Bryophyllum pinnatum invasive" AND Galapagos, "Persea americana invasive" AND Galapagos, "Cedrela odorata invasive" AND Galapagos, "Psidium guajava invasive" AND Galapagos, Syzygium jambos invasive" AND Galapagos, "Passiflora edulis invasive" AND Galapagos, "Melinis minutiflora" AND Galapagos, "Panicum maximum" AND Galapagos, "Pennisetum purpureum" AND Galapagos, "Rubus niveus" and Galapagos, "Cinchona pubescens" AND Galapagos, "Cestrum auriculatum" AND Galapagos, "Lantana camara" AND Galapagos

- Search engine: -Google Scholar; BioOne; COBUEC; CABI; EBSCO; ScienceDirect; ProQuest; Scopus; Scielo. We also searched the references contained in the sources we obtained from the literature search.

Marine/all regions

- Assessor(s) – Bella Galil
- Search language(s) – English, Spanish, Portuguese
- Search terms – "alien" "invasive" "introduced" "non-native" "non-indigenous" AND impact AND (sea (e.g. Baltic, Mediterranean), country, or "species scientific name" AND impact AND (sea (e.g. Baltic, Mediterranean), country. References cited within resulting articles were examined, and where appropriate, were accessed and assessed. ORIGINAL PUBLICATIONS of direct experiments/observations of impacts ONLY, no secondary sources (i.e., compilations, reviews), mostly peer-reviewed, some "grey".
- Search engine – GoogleScholar
- Date – 2019 – June 2021
- Overview of the search results – about 2100 records of impacts

Plants /Europe and Central Asia

- Assessor(s) – Montserrat Vilà, Pilar Castro, Alejandro Trillo
- Search language(s) – All
- Search terms: ISI Web of Knowledge (plant invader OR exotic plant OR alien plant OR plant invasion*) AND (impact* OR effect*) AND (community structure* OR diversity* OR ecosystem process* OR competition*)
- Date – December 2019
- ((plant invader OR exotic plant OR alien plant OR plant invasion*) AND (impact* OR effect*) AND (community structure* OR diversity* OR ecosystem process* OR competition*)) AND (Russian Federation OR Russia OR Slovakia OR Belarus OR Moldova OR Ukraine OR Albania OR Bosnia and Herzegovina OR Croatia OR Serbia OR Montenegro OR Yugoslavia OR Armenia OR Azerbaijan OR Georgia)
- ((plant invader OR exotic plant OR alien plant OR non-native plant OR plant invasion*) AND (impact* OR effect*) AND (nature contribution to people OR good quality of life OR human well-being)
- (plant invader OR exotic plant OR alien plant OR plant invasion*) AND (impact* OR effect*) AND (community structure* OR diversity* OR ecosystem process* OR competition*) AND (Kazakhstan OR Kyrgyzstan OR Tajikistan OR Turkmenistan OR Uzbekistan)
- Search engine: ISI Web
- Date – November 2020

We also searched for tree impacts on NCP by references listed in Castro - Díez, P. *et al.* 2019. Global effects of non - native tree species on multiple ecosystem services, *Biological Reviews* 94: 1477-1501. p. brv.12511. doi: 10.1111/brv.12511. Paying attention not to retrieve duplicates from previous mentioned searchers

- Overview of the search results – 3283 records of impacts were obtained

Plants (Aquatic plants)/Europe and Central Asia

- Assessor(s) – Montserrat Vilà
- Search language(s) – All
- Search terms: (invas* OR alien OR non-native OR exotic) AND (lake OR river OR estuary OR wetland OR reservoir) AND (impact OR effect) AND (macrophyte OR algae OR primary producer)
- Search engine – Scopus
- Date – November 2020
- We also screened all references listed in

Brundu, G. 2015. Plant invaders in European and Mediterranean inland waters: profiles, distribution, and threats. *Hydrobiologia*, 746(1), 61-79.

Hussner et al. 2017. Management and control methods of invasive alien freshwater aquatic plants: a review. *Aquatic Botany*, 136, 112-137.

Pieterse et al. 2009. Proceedings of the 12th European Weed Research Society Symposium August 24–28 2009, Jyväskylä, Finland

- Overview of the search results – 107 records of impacts were obtained

Plants (impacts on hybridization)/Europe and Central Asia

- Assessor(s) – Montserrat Vilà, Alejandro Trillo
- Search language(s) – All
- Search terms -
(plant invader OR invasive plant OR exotic plant OR non-native plant OR alien plant OR plant invasion*) AND (plant hybrid*) AND (impact on native OR effect on native OR harmful on native OR detriment*)
(plant invader OR invasive plant OR exotic plant OR non-native plant OR alien plant OR plant invasion*) AND (hybrid* OR introgres*) AND conservation
- Search engine – ISI Web
- Date – February 2020
- Overview of the search results – 52 records of impacts were obtained

Plants (impacts on NCP and GQL)/Europe and Central Asia

- Assessor(s) – Montserrat Vilà, Alejandro Trillo
- Search language(s) – All
- Search terms:
(invasive plant OR alien plant OR non-native plant OR exotic plant) AND (impact OR effect) AND people safety
(invasive plant OR alien plant OR non-native plant OR exotic plant) AND (impact OR effect) AND Freedom
(invasive plant OR alien plant OR non-native plant OR exotic plant) AND (impact OR effect)
(invasive plant OR alien plant OR non-native plant OR exotic plant) AND (impact OR effect) AND (employment OR income OR poverty OR job OR wealth OR standard of living)
(invasive plant OR alien plant OR non-native plant OR exotic plant) AND (impact OR effect) AND heritage

- We also searched for references in:
- Shackelton et al 2019: The role of invasive alien species in shaping local livelihoods and human well-being: A review. *J Env Man* 229: 145-157.
- Vaz et al. 2017. Integrating ecosystem services and disservices: insights from plant invasions. *Ecosyst. Serv.* 23, 94–107.
- Celesti-Grapow, L., & Ricotta, C. (2020). Plant invasion as an emerging challenge for the conservation of heritage sites: the spread of ornamental trees on ancient monuments in Rome, Italy. *Biological Invasions*, 1-16.
- Kueffer, C., & Kull, C. A. (2017). Non-native species and the aesthetics of nature. In *Impact of biological invasions on ecosystem services* (pp. 311-324). Springer, Heidelberg
- Howard PL 2019. Human adaptation to invasive species: A conceptual framework based on a case study: metasyntesis. *Ambio* 2019, 48:1401–1430. <https://doi.org/10.1007/s13280-019-01297-5>
- Nentwig W, Mebs D & Vilà M. 2017. Impacts of Non-Native Animals and Plants to Human Health. In: Vilà M & Hulme PE (eds) *Impact of biological invasions on ecosystem services*. Springer, Heidelberg
- Kapitza, K., Zimmermann, H., Martín-López, B., & von Wehrden, H. (2019). Research on the social perception of invasive species: a systematic literature review. *NeoBiota*, 43, 47.
- Milanović M, Knapp S, Pyšek P, Kühn I (2020) Linking traits of invasive plants with ecosystem services and disservices. *Ecosystem Services* 42: 101072. doi: 10.1016/j.ecoser.2020.101072.
- Search engine – Web of Science
- Date – February 2021
- Overview of the search results – 152 records of impacts were obtained

All taxa/Russian Federation (Siberia, Far East, Caucasus), Central Asia, South Caucasus

- Assessor(s) – Georgi Fayvush
- Search language(s) – Russian, English
- Search terms – инвазивные виды, инвазионные виды (invasive species), Siberia, Far East, Kazakhstan, Caucasus, Uzbekistan, Tadjikistan, Kyrgyzstan, Turkmenistan, вредители леса и сельского хозяйства (forest's and agriculture's pests)
- Search engine – GoogleScholar, WoS, e-library, Researchgate, CABInternational
- Date – February-April 2021
- we also searched the references contained in the sources we obtained from the literature search
- Overview of the search results– 1700 records of invasive alien species were found, but only 36 had impact assessment, they were included in the database/
- Files – Examples NCP GQL George15.04.xlsx

Freshwater invertebrates/Europe and Central Asia

- Assessor(s) – Cristina Preda, Vanessa Céspedes, James Dickey, Belinda Gallardo, Jonathan Jeschke, Bram Koese, Chunlong Liu, Agata Mrugala, Camille Musseau, Elena Tricarico, Laura Zinnert
- Search language(s) – English, Spanish, German
- Search terms – 1st stage query: invasive, freshwater, Europe, impact; 2nd stage refined query: [invasive alien species name] AND (Introduce* OR inva* OR alien OR nonnative OR non-native OR exotic OR naturaliz* OR non-indigenous OR nonindigenous) AND (impact* OR effect* OR change*) AND country
- Search engine – GoogleScholar, Google, WoS, Scopus, CABI's Invasive Species Compendium
- Date – April 2021
- we also searched the references contained in the sources we obtained from the literature search
- Overview of the search results – 471 records of impacts were obtained

- Files – EU freshwater invert impact db may 2021 cleaned_MC20210614

Terrestrial invertebrates/Europe and Central Asia

- Assessor(s) – Angeliki F. or Kelly Martinou, Ioanna Angelidou, Katerina Athanasiou, -Aikaterini Christopoulou, Jakovos Demetriou, Imogen Cavadino, Lori Lach, Douglas H Boyes, Maarten de Groot, Bjorn Beckmann, Katharina Lapin, Lara Carisio, Simon Liroy, Sara Straffon
- Search language(s) – English, French, German, Russian, Greek, Italian, Spanish, Finnish
- Search terms – [invasive alien species name] (invas* OR alien OR non-native OR exotic) AND (impact OR Europe OR Asia)
- Search engine – Google Search, Scopus
- Date – up to January 2021
- Overview of the search results – 2387 records of impacts were obtained
- Files – [IPBES FILES EU TERR INVERTS_CLEAN] (name to be confirmed currently is being cleaned)

Plants /Africa

- Assessor(s) – Katharina Dehnen-Schmutz, Clinton Carbutt
 - Search language(s) – English
- Search terms: ((TITLE ("introduced species" OR "invasive species" OR "invasive alien species" OR "IAS" OR "alien" OR "non-native" OR "non-indigenous" OR "invasive plant" OR "pest" OR "exotic") AND TITLE-ABS-KEY ("Africa" AND "impact")))
- Date – April 2020 and January 2021
 - Search engine: Scopus, Google Scholar
 - we also searched the references contained in the sources we obtained from the literature search
 - Overview of the search results – 841 records of impacts were obtained
- Files : Africa_plants_2_May_21, Africa plants_updated_MC20210428

Aquatic plants/Africa

- Assessor: Julie Coetzee
 - Search language: English
- Search terms: invasive aquatic plant impact + each African country, also the scientific and common names of invasive plants
- Water hyacinth – Eichhornia crassipes
Water lettuce – Pistia stratiotes
Parrots feather – Myriophyllum aquaticum
Kariba weed/giant salvinia – Salvinia molesta
Red water fern – Azolla filiculoides
- NO other species came up with results.
- Overview of the search results – all records of impacts were integrated in the Africa plants data files

Vertebrate/Invertebrate and North America/Mesoamerica/Caribbean

- Assessor(s) – Shana McDermott and Georgia Roberts
- Search language(s) – English
- Search terms –
- General search: (invasive OR alien AND species) AND (freshwater OR marine OR ocean OR lake OR forest OR terrestrial OR aquatic) AND (vertebrate OR invertebrate OR animal) AND (North America

OR United States OR Canada OR Mexico OR Caribbean OR Florida) AND (summary OR meta-analysis OR meta OR analysis) AND (effects OR impacts)

- Some species were also included in the search terms above: (species scientific name OR emerald ash borer OR EAB OR feral hog OR starlings OR spiny waterflea OR gypsy moth OR spotted winged drosphelia OR lionfish OR northern snakehead OR monkey)
- Specific impacts were also included on occasion: (health OR economic OR nature OR indigenous)
- Search engine – GoogleScholar
- Date – October 2019 – June 2021
- We also searched the references contained in the sources we obtained from the literature search
- In addition, we included all original references from the United States/Global reviews on economic impacts of invasive alien species (see references included below)
- We included papers recommended during the zero/first order draft internal/external review comments.
- Overview of the search results – 2,541 records of impacts were obtained
- Files –
 1. Impact evidence base template NA vert_&_invter (mcdermott) 5-13-20_MC_MC20210510
 2. North America Carribean animals edit

References:

Diagne, Christophe, et al. "High and rising economic costs of biological invasions worldwide." *Nature* 592.7855 (2021): 571-576.

Duenas, Manuel-Angel, et al. "The role played by invasive species in interactions with endangered and threatened species in the United States: a systematic review." *Biodiversity and Conservation* 27.12 (2018): 3171-3183.

Gallardo, Belinda, et al. "Global ecological impacts of invasive species in aquatic ecosystems." *Global change biology* 22.1 (2016): 151-163.

Gutiérrez, Jorge L., Clive G. Jones, and Ronaldo Sousa. "Toward an integrated ecosystem perspective of invasive species impacts." *Act*

Hanley, Nicholas, and Michaela Roberts. "The economic benefits of invasive species management." *People and Nature* 1.2 (2019): 124-137.

Howard, Patricia L. "Human adaptation to invasive species: A conceptual framework based on a case study metasythesis." *Ambio* 48.12 (2019): 1401-1430.

Kapitza, Katharina, et al. "Research on the social perception of invasive species: a systematic literature review." *NeoBiota* 43 (2019): 47.

Olson, Lars J. "The economics of terrestrial invasive species: a review of the literature." *Agricultural and Resource Economics Review* 35.1 (2006): 178-194.

Pimentel, David, Rodolfo Zuniga, and Doug Morrison. "Update on the environmental and economic costs associated with alien-invasive species in the United States." *Ecological economics* 52.3 (2005): 273-288.

Sanderson, L. A., J. A. McLaughlin, and P. M. Antunes. "The last great forest: a review of the status of invasive species in the North American boreal forest." *Forestry* 85.3 (2012): 329-340.

Shackleton, Ross T., Charlie M. Shackleton, and Christian A. Kull. "The role of invasive alien species in shaping local livelihoods and human well-being: A review." *Journal of environmental management* 229 (2019): 145-157.

All/East-South East Asia

- Assessor(s) – Maki IKEGAMI
- Search language(s) – English
- Search terms – ("alien" or "non-native" or "non-indigenous" or "invasive" or "invasion*") and ("impact" or "influence" or "effect") and ("Cambodia" or "East Asia" or "Far East" or "Indonesia" or "Japan" or "Korea" or "Laos" or "Malaysia" or "Myanmar" or "Papua New Guinea" or "Philippine" or "Singapore" or "Taiwan" or "Vietnam") NOT ("medical" or "cancer" or "drug" or "education")
- Search engine –web of science
- Date – April 2021
- Overview of the search results – 1,293 results, then examined the abstract for the DB.
- Files – East_SEAsia_MakiIKEGAMI_20210516.xlsx

All/East Asia

- Assessor(s) – Maki IKEGAMI
- Search language(s) – Japanese
- Search terms – “外来種” and “影響” with “jstage”, “alien species impact Japan” or “non-native species impact Japan” for google scholar
- Search engine – <https://www.jstage.jst.go.jp/> <https://scholar.google.co.jp/> In addition, I used some review papers and books (both in Japanese and English)
- Date –20190927
- Overview of the search results – 2,230 results were obtained from jstage, 69,300 and 35,000 results from google scholar (with “alien” and “non-native” respectively). For jstage, most relevant first 560th papers, and for google first 400th most relevant papers have been examined, after 100 no relevant papers have been continued. In addition, I used references from following review paper and book: Yan et al (2001) for China and JWRC(2008,2019) for Japan.
- Files – East Asia All_Maki20210426.xlsx
- Search engine –

Yan, Xie, et al. "Invasive species in China—an overview." *Biodiversity & Conservation* 10.8 (2001): 1317-1341.
JWRC (ed) (2008, 2019) A Photographic Guide to the Invasive Alien Species in Japan. Heibonsha, Tokyo (in Japanese)

All taxa / West Asia

- Assessor(s) – Mohd Asgar Khan
- Search language(s) – English
- Search terms –
- (“invasive” OR “alien” OR “exotic” OR “introduced”) AND (“insects” OR “pathogen” OR “pests” OR “parasites” OR “birds” OR “plants” OR “animals” OR “weeds” OR “reptiles” OR “amphibians”) AND (“livelihood” OR “human well-being” OR “ecosystem service” OR “diversity” OR “ecosystem

function”) AND (“impacts” OR “benefits” OR “costs” OR “negative impacts” OR “positive impacts”) AND (“country name”)

- Search engine – Google Scholar
- Date – 20 March 2021 to 22 April 2020
- [NOTE on “country name”: Countries in West Asia = Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen (Arabian peninsula); Iraq, Jordan, Lebanon, State of Palestine and Syrian Arab Republic (Mashreq)]
- Criteria used to select articles to review was based on relevance of title and abstract. I also used papers that were cited in literature reviews.
- Overview of the search results –
- File: IBPES WEST ASIA DATA_MAK_20210422_ajh_MC20210503

Molluscs/South Asia

- Assessor(s) – N A Aravind Madhyastha
- Search language(s) – English
- Search terms –
 - Introduced molluscs + India or South Asia
 - Invasive molluscs + India or South Asia
 - “species” + India or South Asia [species = individual species name which are introduced to India or South Asia]
 - Introduced Molluscs + India/south Asia + marine
- Search engine – Google Scholar
- Date – April 2020
- Apart from these, we also back referenced the article to get more information if any.
- Overview of the search results -
- File: IPBES South Asia Molluscs_MC_NAM_20210405_MC20210505

Plants/Iran

- Assessor(s): Sima Sohrabi
- Search language(s): English, Persian
- Search terms – (1) using the species’ scientific name combined with keywords indicating its alien/invasive status and impact categories as defined in EICAT in Web of Science; (2) databases of invasive species with impacts recorded, namely CABI, GISD, USDA, and BioNET-EAFRINET.
- Search engine – Web of Science (Clarivate Analytics); CABI (Invasive Species Compendium, www.cabi.org), GISD, USDA, BioNET-EAFRINET
- Date – March 2021
- Apart from these, bibliographic sources of information, including regional and national case studies and books (Sohrabi et al.2017; Zand et al.2017) were used. The most important criteria that I used to decide which papers are suitable to review was having some reports and direct studies on alien plants in Iran. In addition I considered the experts' observations.
- Overview of the search results -
- File: SouthAsia_Iran_Plants_SimaSohrabi_20210415_MC20210428

Fish/South Asia

- Assessor(s) – Vidyadhar Atkore
- Search language(s) – English
- Search terms – “invasive fish”, 'exotic fish', 'introduced fish species’, “invasive alien fish species” AND “impacts”, "costs" AND “country”
- [For country: “India”, “Nepal”, “Bhutan”, “Pakistan”, “Bangladesh”, "Sri Lanka", “Maldives”, “Iran”, “Afghanistan”]
- Search Engine – Google Scholar
- Date - 07.04.2020 to 10.05.2020
- I skimmed through the content briefly to see if it had adequate information on names of one or few or more invasive fish species, their impact, distribution, etc. I reviewed almost all the papers that I got using these criteria (some countries had more and some countries had very few). For main research papers - I read the title, looked for the invasive species of interests, region (country) it covered, its impacts etc. I rejected 1-2 papers that had genetic /molecular information, which was not meeting our criteria. Once I got acquainted with the author’s work, then I also searched selected authors’ bibliographies by visiting his/her website or Google Scholar page. In addition I also looked at relevant literature given in the ‘reference cited’ section in each of the papers and tried accessing if it was available online.
- Overview of the search results -
- File – Impact evidence base_FISH_VA_10.05.2020_STANDARDIZED
DATA_MC_VA_04.04.2021_MC20210510

Multiple taxa/South Asia

- Assessor(s) – Ankila Hiremath
- Search language(s) – English
- I. Preliminary search:
 - Search terms – (invasive + alien + species + India) + (impact OR cost OR benefit)
 - Search engine – Google Scholar
 - Date – September 2019
- II. Birds:
 - Search terms – (“introduced” OR “invasive” OR “alien” OR “IAS” OR “non-native” OR “non-indigenous” OR “pest” OR “exotic”) AND “bird” AND (“impacts” OR “costs”) AND “Country”
 - [NOTE: “Country” = India; Nepal; Bhutan; Bangladesh; Sri Lanka; Maldives; Pakistan; Afghanistan; Iran]
 - Search engine – Google Scholar
 - Date – April 2020
- III. Animals/mammals:
 - Search terms – (“introduced” OR “invasive” OR “alien” OR “IAS” OR “non-native” OR “non-indigenous” OR “pest” OR “exotic”) AND (“animal” OR “mammal”) AND (“impacts” OR “costs”) AND “Country”
 - [NOTE: “Country” = India; Nepal; Bhutan; Bangladesh; Sri Lanka; Maldives; Pakistan; Afghanistan; Iran]
 - Search engine – Google Scholar
 - Date – 8 April 2020
- IV. Reptiles, Amphibians:

- Search terms – ("introduced" OR "invasive" OR "alien" OR "IAS" OR "non-native" OR "non-indigenous" OR "pest" OR "exotic") AND ("reptile" OR "amphibian" OR "anuran") AND ("impacts" OR "costs") AND "Country"
- [NOTE: "Country" = India; Nepal; Bhutan; Bangladesh; Sri Lanka; Maldives; Pakistan; Afghanistan; Iran]
- Search engine – Google Scholar
- Date – April 2020

V. Pests, insects, parasites, pathogens:

- Search terms – ("introduced" OR "invasive" OR "alien" OR "IAS" OR "non-native" OR "non-indigenous" OR "exotic") AND ("pest" OR "parasite" OR "pathogen" OR "insect") AND ("impacts" OR "costs") AND "India"
- [NOTE: "Country" = India; Nepal; Bhutan; Bangladesh; Sri Lanka; Maldives; Pakistan; Afghanistan; Iran]
- Search engine – Google Scholar
- Date – April 2020

VI. Plants:

- Search terms – ("introduced" OR "invasive" OR "alien" OR "IAS" OR "non-native" OR "non-indigenous" OR "exotic") AND ("plant" OR "weed") AND ("impacts" OR "costs") AND "[country]"
- [NOTE: "Country" = India; Nepal; Bhutan; Bangladesh; Sri Lanka; Maldives; Pakistan; Afghanistan. Iran was not included, as a CA was conducting a search on Plants/Iran.]
- Search engine – Google Scholar
- Date – January to March 2021
- Article titles, abstracts were checked to make sure that articles included impacts of invasive species. Articles reporting on invasive species distributions, or just comprising an inventory of invasive species were omitted. Articles cited in review papers were also searched and reviewed.
- Overview of the search results -
- Files:

(1) Impact evidence

base_SouthAsia_MultipleTaxa_AJH_17May20_StandardisedData_Clarifications_MC_AJH_20210402_MC20210510

(2) SouthAsia_MultipleTaxa_AJH_20210406_MC20210428

Data cleaning and Analysis

- Step by step analysis (methodology, categories, etc.)