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

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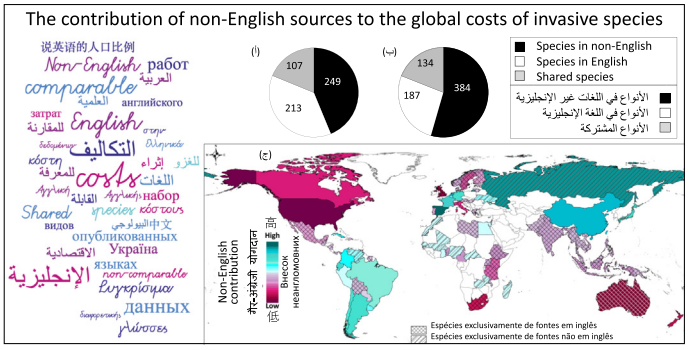
HIGHLIGHTS

- We compiled global economic cost data of invasive species from non-English sources.
- A large number of costs was added for new invasive species and new countries.
- As a result, global cost estimates of invasions increased by 16.6% (US$ 214 billion).
- Multi-language collaborations are necessary to enrich scientific knowledge.
- The use of non-English sources enhances data completeness and reduces knowledge gaps.

GRAPHICAL ABSTRACT



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ABSTRACT

We contend that the exclusive focus on the English language in scientific research might hinder effective communication between scientists and practitioners or policy makers whose mother tongue is non-English. This barrier in scientific knowledge and data transfer likely leads to significant knowledge gaps and may create biases when providing global patterns in many fields of science. To demonstrate this, we compiled data on the global economic costs of invasive alien species reported in 15 non-English languages. We compared it with equivalent data from English documents (i.e., the InvaCost database, the most up-to-date repository of invasion costs globally). The comparison of both databases (~7500 entries in total) revealed that non-English sources: (i) capture a greater amount of data than English sources alone (2500 vs. 2396 cost entries respectively); (ii) add 249 invasive species and 15 countries to those reported by English literature, and (iii) increase the global cost estimate of invasions by 16.6% (i.e., US$ 214 billion added to 1.288 trillion estimated from the English database). Additionally, 2712 cost entries — not directly comparable to the English database — were directly obtained from practitioners, revealing the value of communication between scientists and practitioners. Moreover, we demonstrated how gaps caused by overlooking non-English data resulted in significant biases in the distribution of costs across space, taxonomic groups, types of cost, and impacted sectors. Specifically, costs from Europe, at the local scale, and particularly pertaining to management, were largely under-represented in the English database. Thus, combining scientific data from English and non-English sources proves fundamental and enhances data completeness. Considering non-English sources helps alleviate biases in understanding invasion costs at a global scale. Finally, it also holds strong potential for improving management performance, coordination among experts (scientists and practitioners), and collaborative actions across countries. Note: non-English versions of the abstract and figures are provided in Appendix S5 in 12 languages.

1. Introduction

English is the language that dominates scientific publications in peer-reviewed journals in all research fields (O'Neil, 2018). However, in recent years there has been an increasing recognition of the importance of non-English literature for filling knowledge gaps, expanding the scientific knowledge base and successfully complete global pictures in multiple facets of science (Salager-Meyer, 2008; Amano et al., 2016; Hartling et al., 2017). Despite its importance, non-English literature remains largely underutilized by most researchers due to the language barrier that impedes understanding of the published materials, in addition to the lower accessibility to these sources (Ito and Wiesel, 2006; Lazarev and Nazarovets, 2018; Tao et al., 2018).

Knowledge gaps due to neglecting non-English literature are particularly severe for studies covering topics in ecology and biodiversity. Indeed, many geographic regions still remain highly underrepresented in the English ecological literature, simply because they lie in areas where mother tongues are not English (Di Marco et al., 2017; Hickisch et al., 2019; Nuñez et al., 2019). For example, it is known that directionality in transboundary research is extremely unbalanced, with English-speaking countries (e.g., USA, UK, Australia) dominating over non-English speaking regions, such as francophone Africa or Latin America (Verde Arregoitia and González-Suárez, 2019). Additionally, non-English knowledge from countries where English is not an official language is largely under-utilized, since it is not always accessible to the international scientific community, which undervalues the relevance of local expertise (Fazey et al., 2005; Zenni et al., 2017). Thus, researchers are geographically biased, which limits our understanding of global ecological patterns (Amano et al., 2016; Bellard and Jeschke, 2016). Researchers that are non-native English speakers might prefer to publish part of their work in their native language or in local journals (Verde Arregoitia and González-Suárez, 2019; but see Nuñez and Pauchard, 2010). While this maximizes local or national impact, it restricts the scope of their results to the scientific community and popular press globally, and thereby decreases opportunities for sharing experiences, novel ideas, observations or methodological advances (Nuñez et al., 2019). The value of accounting for data and results beyond just those made available in English has also been recently recognized for global meta-analyses (Konno et al., 2020).

In applied sciences, such as conservation biology or applied ecology, language is an essential factor for the transfer of knowledge and practices at different spatial scales, from global to local and vice versa. Language barriers are among the top obstacles to the use of science in policy, also negatively affecting the interaction between scientists and

practitioners (Rose et al., 2018). On the one hand, scientific information is not always correctly transferred to practitioners, local managers, and policy makers, and this may be exacerbated if the relevant English publications cannot be accessed or if their formats are unusable (Rose et al., 2018). As an example, the prevalence of English as a primary publication language limited the use of scientific information by directors of protected areas in Spain (Amano et al., 2016). On the other hand, knowledge produced locally, beyond academic institutions, is not fully transferred to the international scientific community. For example, Verde Arregoitia and González-Suárez (2019) showed that one quarter of presenters from non-academic institutions (i.e., government entities, private foundations, NGOs, or civilian groups) at the 25th International Congress of Conservation Biology, published their work slower and less often than presenters from academia. Even if in that case presenters interacted in English, the knowledge produced outside academia adds to the language gap. This observation is reinforced by the low priority of non-academic stakeholders in having their findings published in the scientific literature. While English literature is characterized by a higher number of citations (Di Bitetti and Ferreras, 2017), a significant amount of data is compiled in reports that are not further published. For instance, local authorities may collect and report biodiversity related information in order to meet their environment and biodiversity management targets. As the information is intended for local stakeholders, most often non-researchers, the country's language is often used in these reports. These issues highlight the need to find ways that foster increased communication and collaboration among stakeholders and across regions, in order to favor the extrapolation of applied management strategies from one region to others (Nuñez et al., 2019).

In invasion biology, a global synthesis in the field has acknowledged the gaps of using only English literature (Lowry et al., 2013). Moreover, it is well-known that there is a strong geographical bias, partially caused by omitting non-English literature (Nuñez and Pauchard, 2010; Bellard and Jeschke, 2016). There is a misleading view of how non-English speaking countries are currently dealing with invasions: Zenni et al., (2017) showed how non-English literature reporting world leading efforts was internationally largely ignored, most likely due to well established expert scientific communities of biological invasions pertaining to English speaking countries. Hence, our objective here was to assess the potential gaps and biases in data compiled exclusively from sources written in English. To this end, we used InvaCost, a recently published database that synthesizes the reported economic costs of biological invasions worldwide ($N = 2419$ cost entries; Diagne et al., 2020a). Diagne et al. (in press) explored the distribution of these costs across space, taxa, and types of expenditure over time, and found that invasions cost a minimum of US$1.288 trillion (2017 US dollars) from 1970 to 2017 globally. Beyond these results, the authors also found large geographical data gaps, with few data outside North America, Europe, and Australia/New Zealand, and the majority of source documents being scientific peer-reviewed articles. In this sense, InvaCost (hereafter English database) for now consists of English sources exclusively. It is very likely that the studies on economic costs are not as rare as usually admitted, and that this preconception comes from a focus on English sources. In addition, not considering non-English sources can bias economic assessments, and hinder analyses that inform prioritization and expenditure on the management of invasive species.

We performed a data search in non-English languages, to compare it with the English database. We focused mainly on the most widely spoken languages, or the ones where we assumed that reports of economic costs of biological invasions could be found, such as Bengali, Chinese, French, or Spanish. By comparing the non-English and English data, we aimed: (i) to show how much more cost data we were able to capture when considering non-English languages (i.e., the gaps of considering only English documents), and (ii) to detect the magnitude and type of costs that were missing from the English literature (i.e., the bias produced when only considering English documents).

2. Methods

2.1. Data searching methods

We searched costs associated with biological invasions in 15 non-English languages by native speakers (Table 1). Following the methodology used to compile the English database (Diagne et al., 2020a), we used two complementary approaches for collating cost information. First, we performed a standardized literature search using three online bibliographic sources successively: ISI Web of Science platform (WoS hereafter; https://webofknowledge.com/), Google Scholar database (https://scholar.google.com/) and the Google search engine (https://www.google.com/). In the WoS, we used the same search string as those used for the English database, and used the "language" option to retrieve results for each non-English language (Appendix S1). This standardized search method was the only one that was exactly comparable to the methodology used in the English database (Diagne et al., 2020a). Search strings used in Google and Google Scholar were unavoidably slightly different in each language, which was due to inherent linguistic differences and methodological constraints in Google engines (Haddaway et al., 2015; Appendix S1). Second, similar to the English database, albeit more targeted, an opportunistic search was carried out in each language (Appendix S1). This included (i) searching web pages of national institutions, NGOs, and other organizations, (ii) seeking specific literature databases of the countries/languages considered, and (iii) contacting official national managers or researchers that could provide cost data.

Data were retrieved until May 2020 (Angulo et al., 2020; doi:https://doi.org/10.6084/m9.figshare.12928136). All data were compiled using the same structure as the English database (Diagne et al., 2020a; Appendix S2). Briefly, the database consisted of about 40 columns with four types of information: raw and standardized cost estimates; characteristics of data source documents (e.g., type of document, authorship, title, year); taxonomic classification of the invasive alien species for which costs were given; and cost characteristics (e.g., impacted sector, type of cost, spatial and temporal coverage, type of environment in which the cost occurred). We followed the procedures described in Diagne et al. (2020a) to screen for duplicates within the non-English database entries and against the English entries, as costs reported in non-English could have been the source of costs reported in English; in which case, exact cost entries were removed. Whenever possible and to ensure validity, each document was checked independently by two co-authors (i.e., all languages except Ukrainian and Greek). Cost standardization to 2017 US Dollars ($) also followed Diagne et al. (2020a).

2.2. The non-English database and comparability to the English database

Given that the non-English search was performed more recently than the English one (data for the English database - original version

Table 1
Number of cost entries (Entries) and documents (Docs) for each language in the non-English database. The four Indian languages are Hindi, Tamil, Telugu and Bengali.

Languages	Entries	Docs
Arabic	0	0
Chinese	117	33
French	1148	55
German	47	5
Greek	10	6
Indian languages (4)	0	0
Japanese	328	22
Portuguese	34	21
Russian	89	4
Spanish	3289	97
Dutch	50	15
Ukrainian	100	98
Total	5212	356

of the InvaCost database; Diagne et al., 2020a - was retrieved up until December 2017) and the search methods were slightly different, we consider that the two databases could not be fully compared. Thus, we divided the non-English database into two datasets (Fig. 1): one containing exclusively costs gathered from documents published before 2018, which could be quantitatively compared with the English database (hereafter called "comparable dataset"); and another one containing data from documents published after 2017 as well as unpublished data obtained from expert requests (i.e., that was not quantitatively comparable to the English database; hereafter called "non-comparable dataset").

Although most documents from the English database were published before 2018, we also extracted an "English comparable dataset" in which the few cost entries from unpublished documents or materials published after 2017 were removed (Fig. 1).

2.3. The effect of the proportion of English speakers on the number of costs

We analyzed the correlation between the numbers of cost entries of each non-English language per country and the proportion of English speakers per country. To do so, we used the complete non-English database. The number of entries was log10 transformed. We obtained data for the proportion of English speakers for 26 countries from Amano and Sutherland (2013) and Eberhard et al. (2020). Amano and Sutherland (2013) obtained the total number of speakers of English as the first or second language from four different sources - including a previous version of Eberhard et al. (2020) -, related it to the national population, and used the maximum value obtained for each country. When no data was available in Amano and Sutherland (2013), we referred to Eberhard et al. (2020). We related the number of entries (log transformed) to the proportion of English speakers in each country.

2.4. Differences between non-English and English data in cost descriptors

Using only the comparable datasets of both non-English and English databases, we evaluated the differences between them in three ways. First, we tested whether the number of entries was different for each of the following cost descriptors: geographic region and type of environment where the cost occurred, spatial scale and impacted sector of the cost, as well as the type of cost. The original categories of the "Spatial_scale" column of the English database (Appendix S2) were re-assigned to three categories as follows: 'supranational' costs (regrouping the original categories of *global*, *intercontinental*, *continental*, and *regional*, i.e., costs estimated for more than one country), 'country-level' costs (estimated for a whole country) and 'local-level' costs (regrouping the original categories of *site* and *unit*, i.e., costs estimated within a country). The original categories of the type of cost of the English database were re-grouped in three categories: cost related to 'damage or loss', cost related to 'management', and 'mixed' costs when both costs categories are reported together or when the type of cost was unspecified meaning that it could not be easily classified under one or the other category (Appendix S3). For the type of economic sector, we used the categories: 'authorities/stakeholders', 'agriculture', 'health', 'environment', 'forestry', 'public and social welfare', 'fishery'; and we merged mixed categories with 'diverse/unspecified'. To assess differences in the taxonomic composition of invasive species between English and non-English entries, we only used the most represented, broad categories: the kingdom Plantae for plants and the phyla Arthropoda, Chordata, and Mollusca for animals. For the purposes of this analysis, we excluded data assigned to more than one of these categories.

To perform all of these comparisons, we fitted generalized linear mixed models with a binomial distribution and a logit link (SAS Institute Inc., 2018). For this purpose, we added dummy variables for each category within each of the above cost descriptors, with '0' (when the cost entry was not assigned to a specific category) or '1' (when the cost entry was assigned to a specific category). We considered each dummy variable as the dependent variable, and whether they come from the non-English or the English datasets as the independent variable. Because there could be more than one cost estimate within a given document (e.g., reporting five cost estimates for a given species in different years, or reporting costs for the control of five different aquatic species), entries coming from the same document were not statistically independent. Thus, we included the "Reference_ID" (the identification code for each document) as a random effect to explicitly model the covariance structure due to cost entries extracted from the same document ("repeated_subject" in Proc Genmod).

We also calculated, for each category of the cost descriptors, the percentage that the monetary costs of the comparable non-English dataset represented to the total costs obtained once combining the English and non-English (comparable datasets) (in 2017 US dollars).

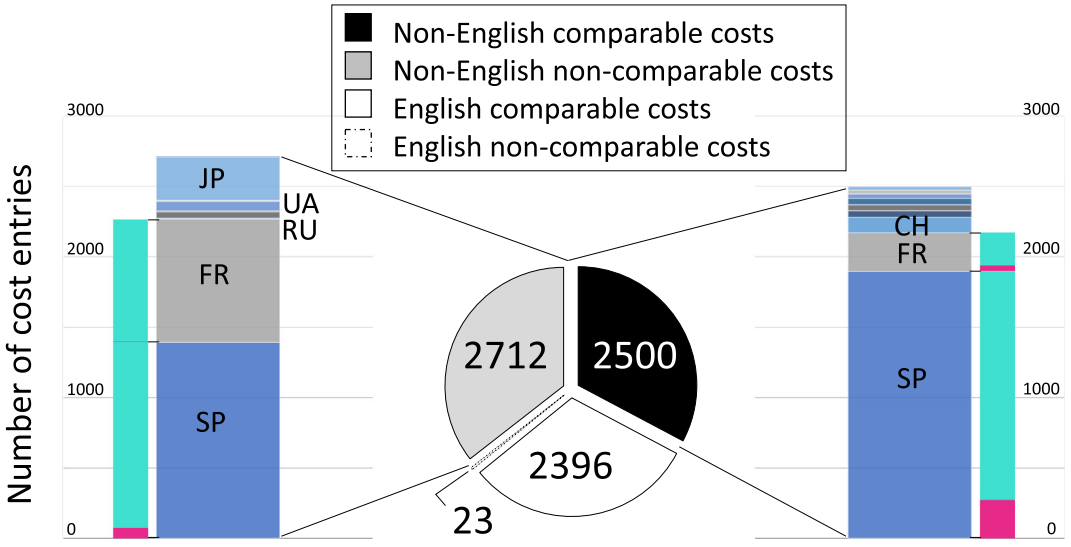

Fig. 1. Number of cost entries of invasive species in non-English languages and in English (InvaCost database), distinguishing comparable and non-comparable datasets. For each of the non-English datasets, the number of cost entries by language are represented in the bar diagrams. Languages shown: SP, Spanish; FR, French; JP, Japanese; UA, Ukranian; RU, Russian; CH, Chinese. For SP and FR, turquoise and magenta bars distinguish entries from Spain and France (turquoise) and entries from Spanish-speaking South American countries and francophone African countries (magenta). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

2.5. Differences in invasive species recorded in both databases

First, we compared invasive species reported in the non-English and English databases, using both the comparable and the complete datasets. Specifically, we examined whether species with costs in the non-English datasets were already included in the English dataset (shared species), or whether they were only included in the non-English datasets; and similarly for species with costs in the English dataset. Since some cost entries were assigned to multiple species simultaneously, we obtained the complete list of species having reported costs, as follows: we expanded all species contained in these cost entries (in the column "Species"), so that each species was individually considered. In order to avoid over-estimations, we also removed subspecies or genus when the corresponding species was present in the same dataset (e.g., we removed *Canis lupus dingo* when *C. lupus* was already present; we removed *Ludwigia* sp. if any *Ludwigia* species, such as L. *grandiflora*, was present). When comparing both species lists (non-English and English), if a genus was present in a list (but the species name was missing) while in the other list there were one or more than one species, we considered that only one species was shared between the two databases (e.g., *Rubus* sp. appears in the English dataset, while both *Rubus glaucus* and *R. constrictus* do in the non-English dataset; so only one shared species was counted).

Second, we quantified the contribution of costs reported from species in the non-English relative to the English dataset, and graphically mapped the results. Using only the comparable datasets, we developed an index that reflects the difference between the number of species by country in the non-English and English datasets (that is, for each country, we subtracted the number of species in the English dataset from the number of species in the non-English dataset). This index is positive when the number of species in the non-English dataset is higher than those in the English dataset for that particular country; or negative otherwise. In this analysis, species costs reported for Great Britain, England and Scotland were considered as belonging to a single country: the United Kingdom. Additionally, overseas territories are represented in their main country territory (e.g., Martinique or French Guiana are represented in France).

3. Results

3.1. The relevance of non-English documents reporting costs

The non-English database includes 5212 cost entries from 356 documents, which covered 10 out of the 15 non-English languages examined in this study (Fig. 1, doi:https://doi.org/10.6084/m9.figshare.12928136). Despite our extensive search efforts, we could not find cost reports in five of the languages we considered. These languages are Arabic and four languages used in India: Hindi, Telugu, Tamil, and Bengali. Some documents obtained directly from Spanish official managers were written in two co-official languages: Catalan and Galician. From the 356 documents collected, 30 were unpublished materials ($N = 1635$ cost entries), and 149 documents were published after 2017 ($N = 1850$). This resulted in a total of 2500 entries that were comparable to the English entries (i.e., the comparable non-English dataset) and 2712 entries were not comparable (Fig. 1). In general, Spanish and French dominated over the other languages, and mostly Spanish from Spain (>85%) rather than from Latin American countries, and French from France (>80%) rather than from francophone African countries.

From the English database, the non-comparable dataset consisted of 15 cost entries from six unpublished documents (i.e., "Type_of_material" column: "Unpublished material") and eight entries from five documents published in 2018. The English comparable dataset had therefore 2396 entries from 838 documents.

In relation to the total economic cost, the non-English comparable dataset resulted in US$ 214 billion (sum of the annual estimated costs), and when including the non-comparable dataset, the contribution from the non-English database resulted in US$ 234 billion. In comparison, a refined version of the English database led to about US $ 1.288 trillion, considering either the comparable English dataset or both comparable and non-comparable English datasets. Thus, considering non-English data increased the English-based global cost estimates of invasions by 16.6% (only the comparable dataset) or by 18.1% (the full non-English database).

3.2. Relationship between the number of cost entries and the proportion of English speakers

We found a negative relationship between the number of cost entries (log transformed) and the proportion of English speakers per country (correlation coefficient $r = -0.216$, $N = 26$; Fig. 2), suggesting that countries with a low proportion of English speakers published more in their native languages. This pattern is highly driven by the Spanish and French-speaking countries, from where many of our cost entries originated. European countries followed this trend, with countries with a higher proportion of English speakers, such as the Netherlands (68.3%), Germany (44.1%), and Belgium (48.6%) having fewer documents published in their own language compared with countries with a lower proportion of English speakers, such as France (24.3%) or Spain (20.7%). The rest of the countries were grouped as follows: African countries with a variable range of English speakers, but very few non-English cost entries, South American countries with an average number of cost entries and low proportion of English speakers (<10%), and Asian countries (i.e., China and Japan) with a high number of entries and a low proportion of English speakers (<0.05%) (Fig. 2).

3.3. Differences in cost descriptors

Compared to the English dataset, the number of entries in the non-English dataset was significantly higher for European countries, and significantly lower for countries from Africa, North and Central America, and Oceania and Pacific Islands (Fig. 3a, Appendix S4). The number of entries in the non-English dataset was significantly higher at the local scale, but significantly lower at the country and global scales compared to the English dataset (Fig. 3b, Appendix S4). With respect to the environment where the cost occurred, the number of cost entries was not significantly different between the non-English and English datasets (Fig. 3c, Appendix S4). The number of entries in the non-English dataset was significantly higher for the authorities and stakeholders, but significantly lower for agriculture, forestry, and public and social welfare sectors than in the English dataset (Fig. 3d, Appendix S4). The number of entries in the non-English dataset was significantly higher for management costs, but significantly lower for damage costs than in the English dataset (Fig. 3e, Appendix S4). Finally, we obtained a significantly higher number of entries for invasive alien plants in the non-English dataset while significantly lower entries for Chordata and Arthropoda, and no difference for Mollusca (Fig. 3f, Appendix S4).

Regarding the differences in the spatial scale of cost entries between non-English and English comparable datasets, we observed that only African countries had entries (in French) at the supranational scale (Fig. S1a). Those costs had a higher proportion than those in the English database (12% vs. 5.3% respectively). In the English database, the proportion of cost entries at the local scale or at the country level were very similar (48.5 and 46.2% respectively) (Fig. S1b). Besides African countries, there were many countries with most entries at the local scale (e.g., 100% for Spain, Ecuador, and Cuba; >90% for Ukraine, France, and Belgium); while few countries had costs mostly at the country level (e.g., >85% for Russia, the Netherlands, and Colombia), or with a proportion of costs more equally distributed between the country and the local scale (e.g., Chile: 60 vs. 40%; Argentina: 72 vs. 28%; or Germany: 76 vs. 23% respectively) (Fig. S1a).

Concerning the cost figures, we observed that non-English economic costs were very important at the geographic level for South America,

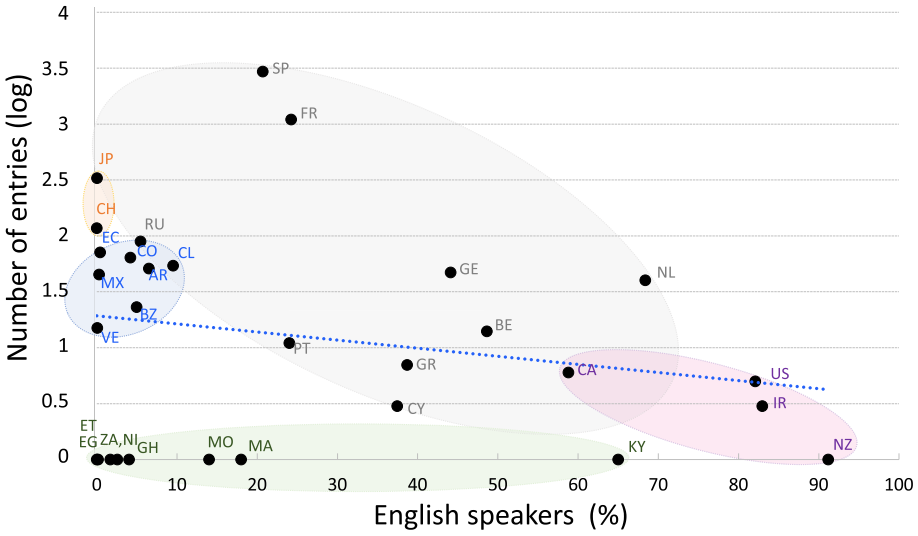

Fig. 2. Relationship between the number of entries of economic costs of invasive species in non-English languages and the percentage of English speakers in each country. Regression line is marked in blue. Countries are grouped according to their occupied convex hull area and encompassed with standard ellipses (considering confidence intervals = 95% of their respective data); European countries in grey, African countries in green, South American countries in blue, Asian countries in yellow, and English speaking countries in pink. Country abbreviations: AR, Argentina; BE, Belgium; BZ, Brazil; CA, Canada; CL, Chile; CH, China; CO, Colombia; CY, Cyprus; EC, Ecuador; EG, Egypt; ET, Ethiopia; FR, France; GE, Germany; GH, Ghana; GR, Greece; IR, Ireland; JP, Japan; KY, Kenya; MA, Madagascar; MX, Mexico; MO, Morocco; NL, Netherlands; NI, Nigeria; NZ, New Zealand; PT, Portugal; RU, Russia; SP, Spain; US, United States; VE, Venezuela; ZA, Zambia. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

and at the taxonomic level for invasive alien plants (Fig. 3). Costs for South America constituted 53.7% of the total non-English cost and 56% when comparable non-English and English costs were combined (Fig. 3g). Non-English costs were also relatively higher at the local scale (US$ 24 billion, Fig. 3h), for Chordata (US$ 28 billion, Fig. 3l), when occurring in semi-aquatic environments (US$ 1.5 billion, Fig. 3i), and when spent by authorities and stakeholders (US$ 11 billion, Fig. 3j). Costs for invasive plants in non-English amounted to US$ 120 billion, which constituted 67.2% of the total non-English costs, and 31% when non-English and English costs were combined (Fig. 3l).

3.4. Differences in invasive alien species recorded in both databases

The comparable and non-comparable datasets of the English database had the same species lists. In the non-English database, the non-comparable dataset had a higher number of species than the comparable dataset, resulting overall in more species being listed in the non-English than in the English database. The species lists of the two comparable (English and non-English) datasets shared only 19% of species, and species brought up by the search in non-English languages represented 44% of the total (249 out of 569 species; Fig. 4a). When considering the full non-English database (comparable and non-comparable datasets), the percentage of shared species remained 19%, but amounted to 54% for species reporting cost only in non-English languages (384 out of 705 species; Fig. 4b).

The difference in species per country between non-English and English datasets varied from −102 to 132 species. Positive values represent more species in the non-English dataset, which was found in 18 countries, with the highest value in Spain (Fig. 4c). Negative values represent more species in the English dataset, which was found in 5 countries, with the highest (negative) value in the USA (Fig. 4c). Additionally, for countries with species in one dataset only, positive values were found in 15 countries (i.e., reporting costs for species only in non-English languages) and negative values occurred in 59 countries (i.e., reporting costs for species only in English). In both cases, the extreme values were lower: a total of 43 species was the maximum number of species with reported costs only in the non-English dataset, and was found from Russia; and − 56 species was the minimum number of species with reported costs only in English and was found from Australia (Fig. 4c).

4. Discussion

The relevance of considering non-English languages was substantiated as non-English data: (i) increased the content of the published English database by more than 100% (2500 non-English vs. 2396 English entries), (ii) increased the global cost estimate of invasions by 16% (by ~US$ 214 billion), and (iii) provided costs for 249 new species and 15 new countries. In addition, 135 other species were found by considering 2712 cost entries from non-published sources, directly obtained from practitioners or managers and/or from documents produced after 2017. Moreover, these gaps resulted in an underrepresentation of cost entries (i) associated with European countries, (ii) measured at the local scale, (iii) impacting primarily authorities and stakeholders, (iv) corresponding to management, and/or (v) reported for plants. In summary, relying on data exclusively published in English has some important implications, particularly when the concerned discipline has a strong applied component, for e.g., through informing policy on invasions.

4.1. Knowledge gaps when considering only English in the costs of invasive species

The large number of costs of invasive species reported exclusively in non-English languages highlights the importance of increasing efforts to capture all available literature beyond English only. This is in agreement with previous findings that provide evidence for gaps in global assessment and ecological patterns, e.g., the assessments of IUCN population status of endangered taxa (Amano et al., 2016) or the use of interviews in conservation biology (Young et al., 2018). Here, we also demonstrated that relying on only English sources results in a distorted picture of lower invasion costs. For example, management expenses were under-represented in English versus non-English datasets. This could be explained by the fact that a third of the cost entries in the non-English database were obtained from local managers and/or practitioners. Also, it could depend on how local funds are distributed, with priority on management rather than on damage evaluation, which would require additional resources and scientific skills (and would likely be reported in English). The gaps reported are in line with those of Zenni et al. (2017), whose work supports the notion that invasion biologists should work more intensively with managers and practitioners,

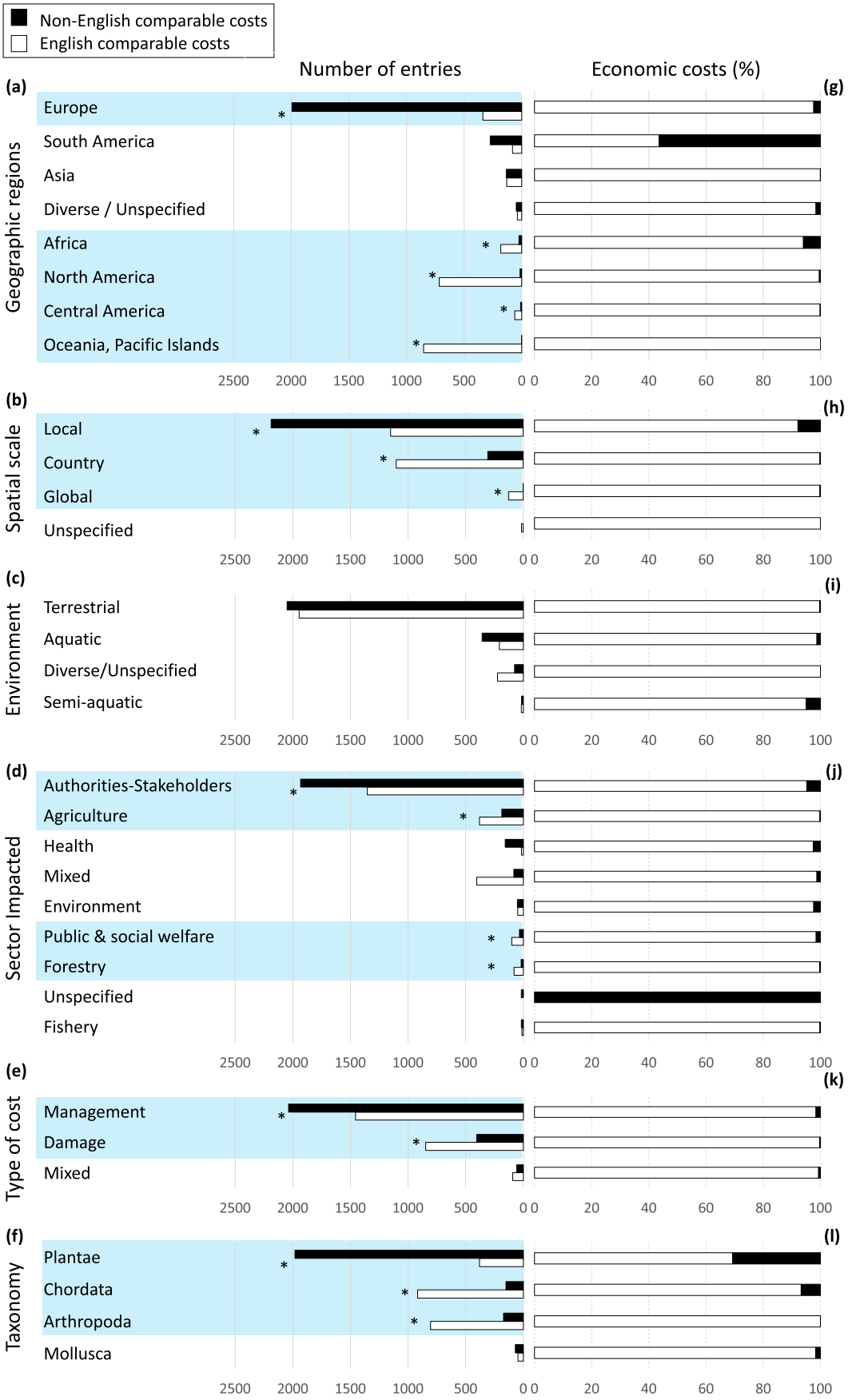

Fig. 3. Number of entries (a, b, c, d, e, f) and relative amount (g, h, i, j, k, l) of economic costs of invasive alien species in non-English languages and in English (from InvaCost database), by (a, g) geographic regions where the cost occurred, (b, h) spatial scale of the cost, (c, i) environment where the cost occurred, (d, j) impacted sector of the cost, (e, k) type of cost, and (f, l) main taxonomic groups. Significant differences in the number of entries between non-English and English are marked with asterisks and highlighted in blue. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

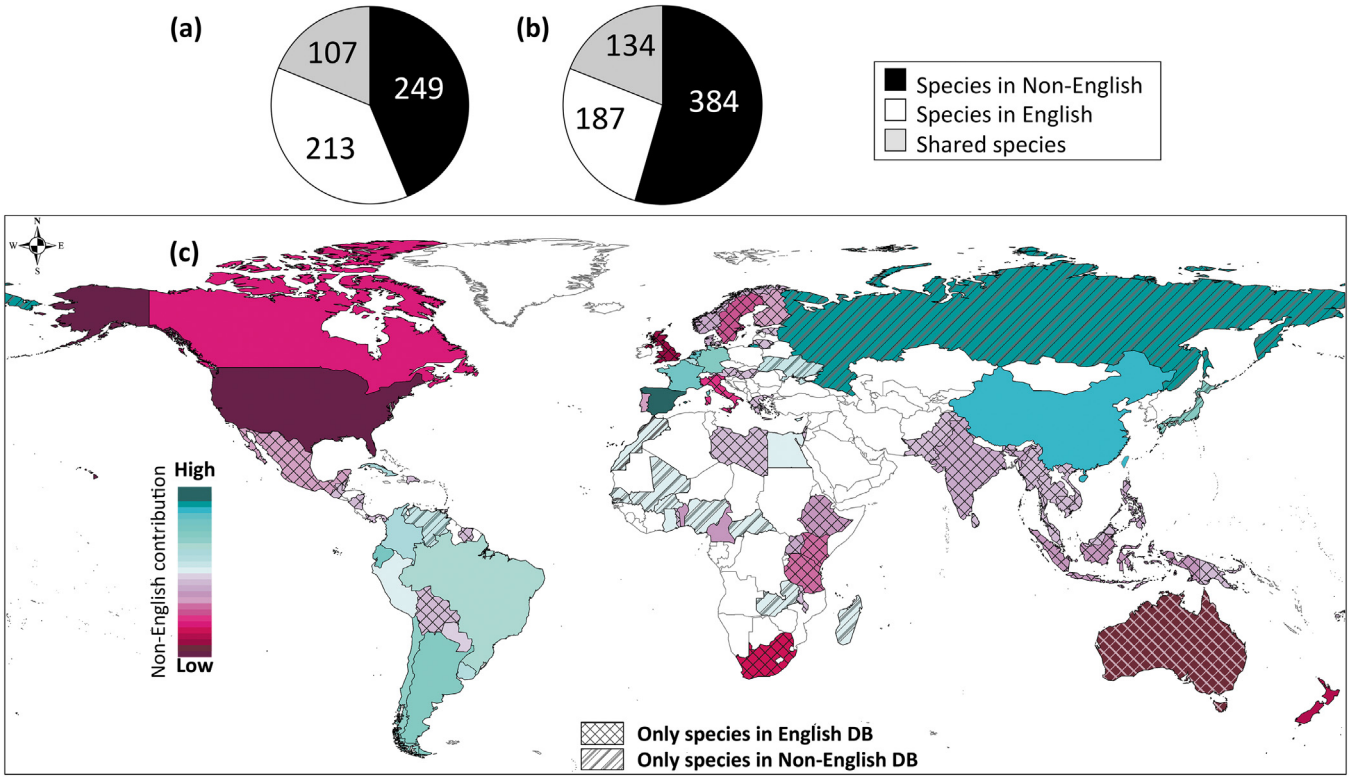

Fig. 4. Number of shared and unshared species between the non-English database and the English database (InvaCost), considering (a) only comparable data ($N = 569$ species) and (b) all data in non-English languages ($N = 705$ species). (c) The map shows the number of species that the non-English comparable dataset contributed minus the total number of species of the English comparable dataset by country (turquoise-magenta scale). Countries having only species in the non-English comparable dataset are marked with stripes and countries having only species in the English comparable dataset are marked with a grid. The borders illustrated in the map may not represent the current political reality. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

and more broadly, with society as a whole. Similar gaps were also found in other applied ecological global databases, such as the Forest Global Earth Observatory (ForestGEO: https://forestgeo.si.edu/) and the Nutrient Network (Nutnet: http://www.nutnet.umn.edu/) (Nuñez et al., 2019).

We also found marked differences in the number of cost entries among languages. This uneven geographic distribution is similar to what Amano et al. (2016) reported in the context of biodiversity and conservation, when comparing 16 major languages. These researchers found that 64.4% of the documents were published in English, followed by 12.6% in Spanish, 10.3% in Portuguese, 6% in Chinese, and 3% in French. In our case, and considering together the English and non-English databases, we obtained 43% of cost entries in Spanish, 31.7% in English, 15% in French, 4.3% in Japanese, and 1.5% in Chinese. We observed that Spanish and French represented a large proportion of the cost entries that were not reported in English. Not surprisingly, countries with a high proportion of English speakers were more represented in the English database compared to the non-English database. In multilingual countries, several of them located in Africa or Asia, publishing in the native tongue(s) may not be the most practical or efficient. Indeed, there may be several native tongues within a single country, making it complicated to opt for consensual non-English language(s) to report information. For example, while Kenya and the Netherlands have a similar proportion of English speakers, the non-English speakers in Kenya are linguistically more diverse, where about 70 languages are spoken, whereas for the Netherlands the remaining almost entirely speak Dutch (Eberhard et al., 2020). In addition, other implications, such as political or historical ones, may explain low reported costs in some languages/countries. For example, the long colonial history and a large middle class that is fluent in English in India could explain the predominant use of this language in publications (Fazey et al., 2005).

Some languages have been targeted to attempt increasing the visibility of papers written in that language. For example, Tao et al. (2018) claimed that 79 million papers have been published in Chinese since 1979, some of them describing important advances that remain unseen by Western researchers. Acknowledging these omissions, along with the fact that 1.39 billion people speak some dialects of Chinese, the journal *Conservation Biology* announced that their papers will include abstracts in Chinese from 2017 onwards (Conservation Biology, 2017). Other journals in the field are following suit, such as *Biological Invasions*, or the *Journal of Applied Ecology* which translated the 'Guide to Getting Published' in Chinese and is promoting abstracts in local languages (Nuñez et al., 2019).

4.2. Ignoring non-English data biases cost patterns for invasive species

We identified the biases from considering exclusively English sources when reporting global trends in costs. First, we identified a geographic bias, both in the number of entries and in the magnitude of costs, in agreement with a previous hypothesis (Zenni et al., 2017). The non-English search provided substantially more entries for Europe, especially Spain and France. Concerning the amount of money they represented, costs reported in non-English from South America and, to a lesser extent, from Africa, were highly relevant. This could be the result of the increasing development of national strategies and research budgets for the control of invasive alien species (Zenni et al., 2017). In fact, the recent release of InvaCost_3.0 (Diagne et al., 2020b), which included English as well as non-English data, permitted to show that for some continents and countries economic assessments of invasive species mostly rely on non-English data. For instance, in Central and South America over 40% of cost estimates have been published in non-English languages (Heringer et al., in press); among those, in

Ecuador 51% of all costs have been published in Spanish (Ballesteros-Mejia et al., in press). A similar situation is observed in Asia (reviewed in Liu et al., in press), where all cost estimates from Japan have been reported in Japanese (Watari et al., in press), and cost entries from Russia have predominantly originated from Russian-language documents (Kirichenko et al., in press).

Costs reported at larger spatial scales were more frequent in the English database, whilst the non-English search added significantly more cost entries at the local scale (~8% of the total money spent on combining English and non-English databases). This is likely due to local researchers and practitioners being more informed on a local level, but maybe not speaking English, or not being encouraged to publish their data in traditional scientific outlets (Nuñez et al., 2019). Some journals have launched specific spaces for practitioners to publish their opinions and examples of best practice (Hulme, 2011). Improved connections with other scientists or practitioners can help promote good practices between localities with similar applied problems (Nuñez et al., 2019). In fact, we detected costs for similar concepts in different regions or sites, showing that although local discoveries of efficient control interventions for invasive species can be relevant for successful control elsewhere, the language barrier may have applied consequences. It is apparent that a stronger link is required between researchers and stakeholders to increase the international visibility of local knowledge (Sutherland et al., 2019). For example, BiodivERsA attempts to facilitate this by forming a network of funding organizations to support biodiversity research (Durham et al., 2014). The non-English database can constitute an essential tool for practitioners (e.g., searching for cost information associated with specific management types actions or specific species), policy makers (e.g., searching for damage-related costs in order to motivate, guide and/or prioritize prevention or response actions towards invasive species), and scientists (e.g., macroecological analyses, data syntheses, or meta-analyses).

Our results also show that an English-only search missed a large number of cost entries impacting authorities and stakeholders. Species invasions are context-dependent, with developing countries typically facing challenges different to those by more developed countries. Therefore, the way invasive species are perceived by local populations, stakeholders and leaders, as well as funders, including the nature of their costs, might differ between countries (Nuñez et al., 2019). For example, the predominant number of costs from Spain and France seem to be primarily related to management costs, whereas a higher amount of costs reported in Spanish corresponded to South America and seemed to be related to damage costs. Nuñez and Pauchard (2010) found that the scarcity of scientific reports on invasive species in developing countries was associated with low funding for ecological research in comparison to other disciplines closely related to medicine, water shortage and food supply. This may explain the high proportion of reported costs related to agriculture in South American countries.

Finally, the number of cost entries coming from invasive plant species reported in non-English languages also contributed significantly, and amounted to ~30% of the total money associated with plants when considering both English and non-English datasets. Local knowledge on plants could be higher than for other taxa, as plants are resources for medicine, food, or animal breeding, and plant invasions dominate the English literature in invasion science (Lowry et al., 2013; Carboneras et al., 2018).

5. Conclusions and perspectives

The aim of this study was not to exhaustively search for information on the economic costs of biological invasions in all possible languages. Rather, we aimed at showing that sources beyond English literature are available and rich in primary data. In fact, the amount of retrieved data was dependent on multiple factors such as country or language specificities; for example, some countries have policies to make data publicly available, or have specific budgets for invasive species, while others do not. In some cases, we also observed a kind of domino effect, e.g., in France, experts increasingly sent us new cost data as they heard about the project. Also, our research was limited to the languages spoken by the authors, and many languages have not been searched at all and could provide much additional data. Non-English sources on invasive species that are often overlooked mostly include the grey literature and unpublished reports from practitioners, resource managers, and researchers. Therefore, we demonstrated the importance of multilanguage collaborations in biological invasions, which are in essence an international issue. The non-English database now complements the original English database in an updated version of InvaCost (InvaCost_3.0, Diagne et al., 2020b), and we hope that this study will encourage others that aim to bridge linguistic barriers. The benefits of these collaborations are clear: improving management efficiency, decreasing research effort, and adequately guiding policy. In that way, we have provided the Appendix S5, with abstracts and figure legends in several languages, as a proof of concept for promoting the overall message of this study. We hope that our results and our suggestions will encourage future proposals to alleviate language barriers as a means to enrich scientific knowledge, and in particular, lead to a reduction of economic costs with improved management strategies of invasive alien species.

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Authors contributions

FC, CD and EA conceived the idea. CL and WX compiled the Chinese data; DRe, CAKM, LBM, GD and TA compiled the French data; EA, LBM, VGD, MN and DRo compiled the Spanish data; NK and EAk compiled the Russian data; GH and CC compiled the Portuguese data; PH and MG compiled the German data; LV compiled the Dutch data; MG compiled the Ukrainian data; MK compiled the Greek data; YW compiled the Japanese data; AKB performed the Indian languages search; and AT performed the Arabic search. CD, LBM and EA refined and standardized the data. EA took the lead in writing the original draft of the article with inputs from all co-authors. All authors read and approved the final version of the manuscript.

CRediT authorship contribution statement

Elena Angulo: Conceptualization, Resources, Methodology, Writing – original draft, Writing – review & editing. **Christophe Diagne:** Conceptualization, Resources, Methodology, Writing – review & editing. **Liliana**

Ballesteros-Mejia: Resources, Methodology, Writing – review & editing. **Tasnime Adamjy:** Resources. **Danish A. Ahmed:** Resources, Writing – review & editing. **Evgeny Akulov:** Resources. **Achyut K. Banerjee:** Resources, Writing – review & editing. **César Capinha:** Resources, Writing – review & editing. **Cheikh A.K.M. Dia:** Resources, Writing – review & editing. **Gauthier Dobigny:** Resources, Writing – review & editing. **Virginia G. Duboscq-Carra:** Resources. **Marina Golivets:** Resources, Writing – review & editing. **Phillip J. Haubrock:** Resources, Writing – review & editing. **Gustavo Heringer:** Resources, Writing – review & editing. **Natalia Kirichenko:** Resources, Writing – review & editing. **Melina Kourantidou:** Resources, Writing – review & editing. **Chunlong Liu:** Resources, Writing – review & editing. **Martin A. Nuñez:** Resources, Writing – review & editing. **David Renault:** Resources, Writing – review & editing. **David Roiz:** Resources, Writing – review & editing. **Ahmed Taheri:** Resources, Writing – review & editing. **Laura N.H. Verbrugge:** Resources, Writing – review & editing. **Yuya Watari:** Resources, Writing – review & editing. **Wen Xiong:** Resources. **Franck Courchamp:** Conceptualization, Resources, Methodology, Writing – review & editing.

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STOTEN, Science of the Total Environment

Appendix S5

Appendix S5. Abstracts in non-English languages

Arabic/ العربية

Chinese/ 中文

Dutch / Dutch

French / Français

German / Deutsch

Greek / Ελληνικά

Hindi / हिंदी

Japanese / 日本語

Portuguese / Português

Russian / Русский

Spanish / Español

Ukrainian / Україна

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Arabic

Title / العنوان

Ar: إثراء اللغات غير الإنجليزية للمعرفة العلمية: التكاليف الاقتصادية للغزو البيولوجي نموذجا

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

Authors / المؤلفون

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Translated by the authors / ترجم من قبل المؤلفين

Fawaz Azizieh (non-author, mentioned in the acknowledgement section) / Ahmed Taheri

Abstract / ملخص البحث

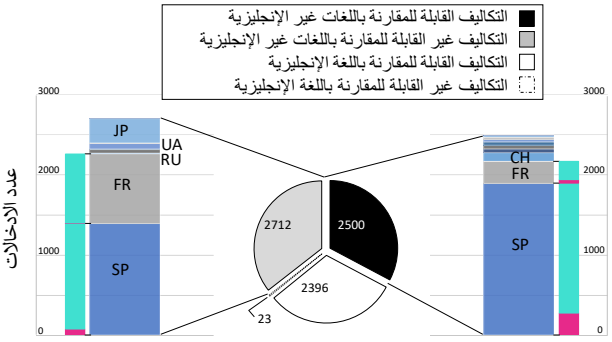
ندعي أن الاستخدام الحصري للغة الإنجليزية في البحث العلمي قد يعيق التواصل الفعال بين العلماء والممارسين أو صانعي السياسات الذين لغتهم الأم ليست الإنجليزية. من المحتمل أن يؤدي هذا الحاجز في المعرفة العلمية ونقل البيانات إلى فجوات معرفية كبيرة وقد يخلق تحيزات عند تقديم أنماط عالمية في جميع مجالات العلوم.

لإثبات ذلك، قمنا بتجميع بيانات عن التكاليف الاقتصادية العالمية للأنواع الغريبة الغازية المُبلغ عنها بخمسة عشر لغة غير إنجليزية، وقارناها بالبيانات المكافئة باللغة الإنجليزية (قاعدة بيانات InvaCost، وهي أحدث مستودع لتكاليف الغزو على مستوى العالم).

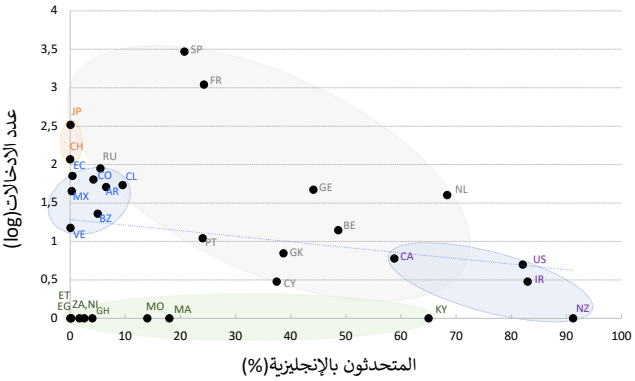
كشفت المقارنة بين قاعدتي البيانات (حوالي 7500 إدخال في المجموع) أن المصادر غير الإنجليزية: (1) تلتقط قدرًا أكبر من البيانات من المصادر الإنجليزية فقط (2500 مقابل 2396 مدخل تكلفة)، (2) التكاليف المبلغ عنها لـ 249 نوعًا غازيًا إضافيًا و15 دولة، و(3) زيادة تقديرات التكاليف العالمية للغزوات البيولوجية باللغة الإنجليزية بنسبة 16.6% (214 مليار دولار أمريكي بينما 1.288 تريليون باللغة الإنجليزية). هناك 2712 إدخالاً إضافياً مكملاً لقاعدة البيانات غير الإنجليزية ولكنها لم تكن قابلة للمقارنة مباشرة بقاعدة البيانات الإنجليزية؛ تم الحصول على معظمها مباشرة من الممارسين، مما يكشف عن قيمة تواصل العلماء والممارسين.

علاوة على ذلك، نوضح كيف أدت الثغرات الناتجة عن تجاهل البيانات غير الإنجليزية إلى تحيزات كبيرة في توزيع التكاليف عبر المكان والمجموعات التصنيفية وأنواع التكلفة والقطاعات المتأثرة. كانت التكاليف من أوروبا، على المستوى المحلي، وخاصة المتعلقة بالإدارة، ممثلة تمثيلا ناقصا إلى حد كبير في قاعدة البيانات الإنجليزية.

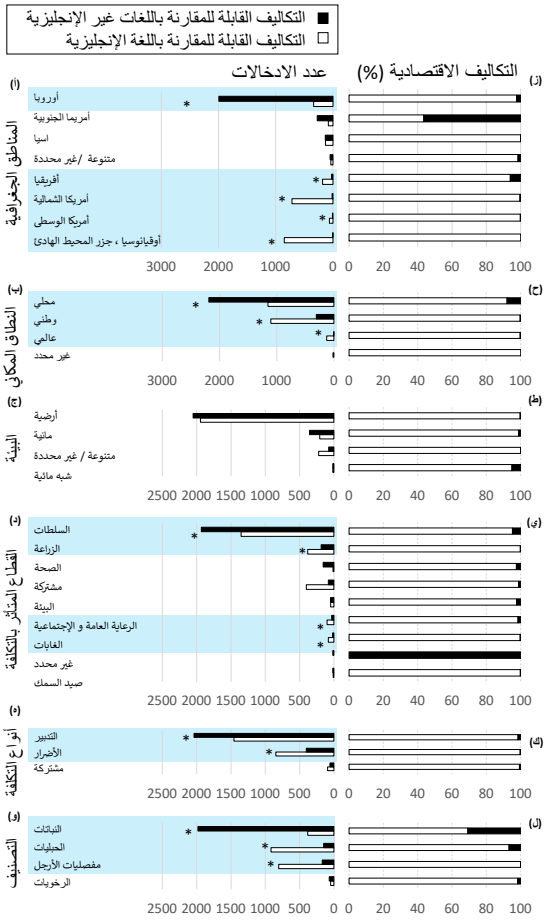
وبالتالي، فإن دمج البيانات العلمية الإنجليزية مع البيانات الواردة من مصادر غير الإنجليزية يثبت أنه أمر أساسي وسيعزز اكتمال البيانات. يساعد التفكير في المصادر غير الإنجليزية في التخفيف من التحيز في فهم تكاليف الغزو على نطاق عالمي. كما تنطوي على إمكانية تحسين أداء الإدارة، والتنسيق بين الخبراء (العلماء والممارسين) والإجراءات التعاونية عبر البلدان.



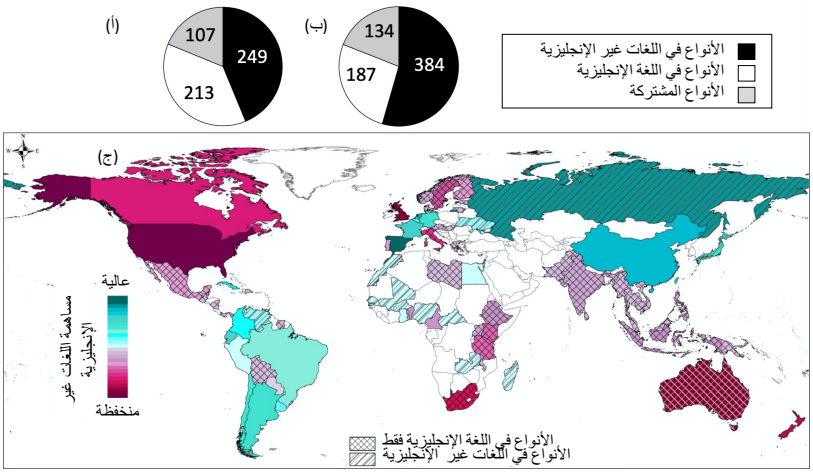
عدد إدخالات التكلفة للأنواع الغازية باللغات غير الإنجليزية وباللغة الإنجليزية (قاعدة بيانات InvaCost)، مع تمييز مجموعات البيانات القابلة للمقارنة وغير القابلة للمقارنة. لكل مجموعة بيانات غير الإنجليزية، يتم تمثيل عدد إدخالات التكلفة حسب اللغة بأعمدة المخططات البيانية. اللغات المعروضة: SP، الإسبانية؛ FR، الفرنسية؛ JP، اليابانية؛ UA، الأوكرانية؛ RU، الروسية؛ CH، الصينية. بالنسبة إلى SP وFR، تميز الأعمدة الفيروزية والأرجوانية الادخالات من إسبانيا وفرنسا (الفيروز) والادخالات من أمريكا الجنوبية والبلدان الأفريقية (الأرجواني).



الشكل 2. العلاقة بين عدد إدخالات التكاليف الاقتصادية للأنواع الغازية في اللغات غير الإنجليزية ونسبة المتحدثين باللغة الإنجليزية في كل بلد. تم تمييز خط الانحدار باللون الأزرق. تم تصنيف البلدان وفقًا لمجالها المستغل بشكل محدب وتضمينها الحذف المعياري (مع الأخذ في الاعتبار مجالات الثقة = 95% من البيانات الخاصة بكل منها)، والبلدان الأوروبية باللون الرمادي، والبلدان الأفريقية باللون الأخضر، ودول أمريكا الجنوبية باللون الأزرق، والدول الآسيوية باللون الأصفر والدول الناطقة باللغة الإنجليزية باللون الوردي. اختصارات البلدان: AR، الأرجنتين؛ BE، بلجيكا؛ BZ، البرازيل؛ CA، كندا؛ CL، تشيلي؛ CH، الصين؛ CO، كولومبيا؛ CY، قبرص؛ EC، الإكوادور؛ EG، مصر؛ ET، إثيوبيا؛ FR، فرنسا؛ GE، ألمانيا؛ GH، غانا؛ GR، اليونان؛ IR، أيرلندا؛ JP، اليابان؛ KY، كينيا؛ MA، مدغشقر؛ MX، المكسيك؛ MO، المغرب؛ NL، هولندا؛ NI، نيجيريا؛ NZ، نيوزيلاندا؛ PT، البرتغال؛ RU، روسيا؛ SP، اسبانيا؛ US، الولايات المتحدة الأمريكية؛ VE، فنزويلا؛ ZA، زامبيا.



الشكل 3. عدد الإدخالات والمبلغ النسبي للتكاليف الاقتصادية للأنواع الغريبة الغازية باللغات غير الإنجليزية وباللغة الإنجليزية (من قاعدة بيانات InvaCost)، تشير (أ و ز) إلى المناطق الجغرافية المعنية بالتكلفة، و (ب و ح) إلى النطاق المكاني للتكلفة، و(ج و ط) إلى البيئة التي حدثت فيها التكلفة، و (د و ي) إلى القطاع المتأثر من التكلفة، و(ه و ك) إلى نوع التكلفة، و (و و ل) إلى المجموعات التصنيفية الرئيسية. تم تمييز الاختلافات الكبيرة في عدد الإدخالات بين غير الإنجليزية والإنجليزية بعلامات النجمة وتم توضيحها باللون الأزرق.



الشكل 4. عدد الأنواع المشتركة وغير المشتركة بين قاعدة بيانات اللغة غير الإنجليزية وقاعدة البيانات الإنجليزية (InvaCost)، مع الأخذ في الاعتبار (a) البيانات القابلة للمقارنة فقط (N = 569 نوعًا) و (b) جميع البيانات باللغات غير الإنجليزية (N = 705 نوعًا). (c) توضح الخريطة عدد الأنواع التي ساهمت بها مجموعة البيانات القابلة للمقارنة بغير اللغة الإنجليزية في العدد الإجمالي لأنواع مجموعة البيانات الإنجليزية القابلة للمقارنة حسب البلد (المقياس الأحمر والأزرق). تم تمييز البلدان التي بها أنواع فقط في مجموعة البيانات القابلة للمقارنة بغير اللغة الإنجليزية بخطوط مائلة والبلدان التي بها أنواع فقط في مجموعة البيانات القابلة للمقارنة باللغة الإنجليزية بخطوط متقاطعة.

الحدود المبينة في الخريطة قد لا تمثل الواقع السياسي الحالي.

Title / 题目

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

Authors / 作者

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Translated by the authors / 译者

Chunlong Liu / 刘春龙

Abstract / 中文摘要:

英语在科学研究中的广泛使用可能已经成为了科学知识传递的一个重要阻碍，因为很多科学家、从业者以及政策制定者的母语都不是英语。这一阻碍不仅导致了科学知识不能被有效地传播，还可能造成对科学知识的片面而非全球性的认知。

为探讨这一阻碍的影响，我们在全球尺度上搜集了入侵外来生物造成经济损失的 15 种非英语语言的数据，并将其与 InvaCost 数据库（目前全球最完整的入侵生物经济损失的数据库）中相应的英语数据进行了比较。

非英语和英语的数据库中共有约 7500 条数据。其中，非英语数据（1）有 2500 条，超过了英语数据的 2396 条；（2）数据来自 15 个国家的 249 种入侵生物，以及（3）统计的经济损失为 2140 亿美元，占到了英语数据（总计 1.288 万亿美元）的 16.6%。非英语数据库中有 2712 条数据涉及的入侵物种是英文数据中不包含的，且这些数据的大多数都直接来自于从业者，表明了科学家与从业者之间联系的重要性。

更重要的是，我们的研究表明了忽视非英语数据将给入侵种造成经济损失的数据评估造成严重的偏差。这一偏差在欧洲尤为明显，且欧洲大多数的数据都是与入侵管理相关的。

整合英语和非英语的数据是科学研究的基本前提，也会提高数据的完整性。整合非英语的数据，不仅能够从全球尺度上消除对入侵生物造成经济损失的偏差，还对提高生物入侵的管理水平、专家之间的协调以及国家之间的合作具有重要意义。

Figures / 图

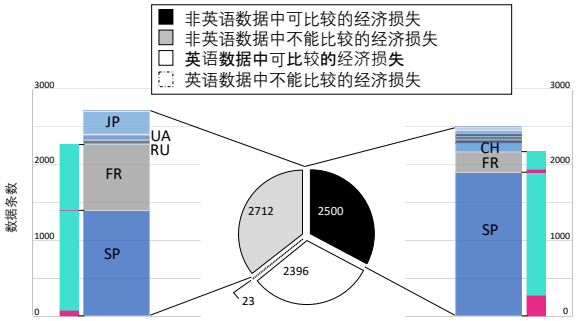

图1。非英语以及英语数据中，入侵生物造成经济损失数据的条目，以是否能够在数据间进行比较进行了区分。对非英语数据集，不同语言的变量数据的条数以柱状图来表示，语言包括：SP：西班牙语；FR：法语；JP：日语；UA：乌克兰语；RU：俄语；CH：中文。对西班牙语和法语而言，蓝绿色和粉红色分别表明数据来如西班牙及法国（蓝绿色）或者来自南美和非洲国家（粉红色）。

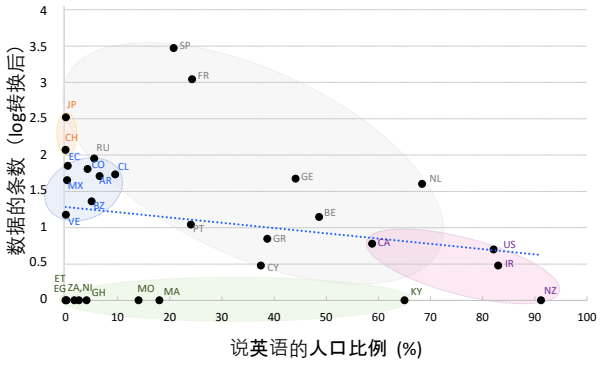

图2。非英语数据中，每个国家中入侵生物造成经济损失的数据条数与说英语人口的比例的关系。拟合的回归线用蓝色表示。不同国家根据数据的条数与说英语人口的比例被聚类，并用不同颜色的椭圆形（考虑95%的置信区间）表示：欧洲国家为棕色，非洲国家为绿色，南美洲国家为蓝色，亚洲国家为黄色，英语为母语的国家为粉色。各个国家的缩写为：AR：阿根廷；BE：比利时；BZ：巴西；CA：加拿大；CL：智利；CH：中国；CO：哥伦比亚；CY：塞浦路斯；EC：厄瓜多尔；EG：埃及；ETH：埃塞俄比亚；FR：法国；GE：德国；GH：加纳；GR：希腊；IR：爱尔兰；JP：日本；KY：肯尼亚；MAD：马达加斯加；MX：墨西哥；MO：摩纳哥；NL：荷兰；NI：尼日利亚；NZ：新西兰；PT：葡萄牙；RU：俄罗斯；SP：西班牙；US：美国；VE：委内瑞拉；ZAM：赞比亚。

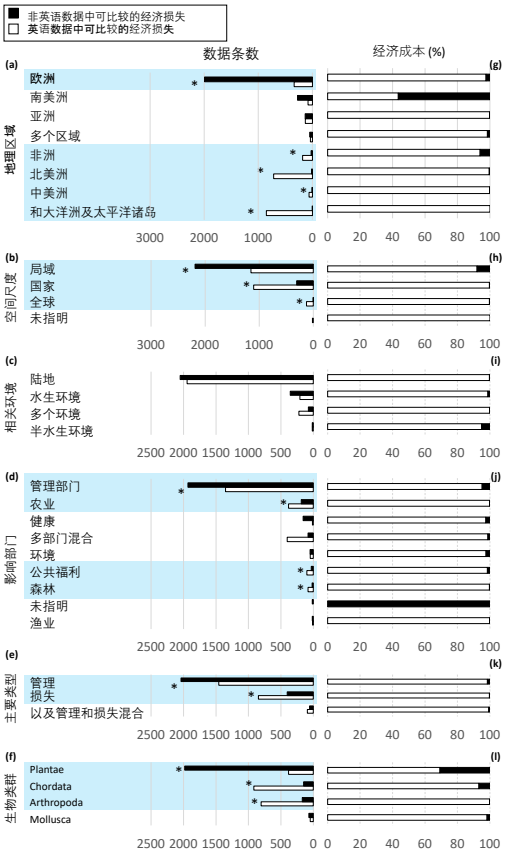

图3。非英语数据和英语数据（数据从InvaCost数据库中获得）中入侵生物造成经济损失的数据条数，以及经济损失总量的相对比例。经济损失根据以下标准加以区分：（a，g）地理区域，（b，h）空间尺度，（c，i）相关环境，（d，j）影响部门，（e，k）主要类型，和（f，l）生物类群。如果非英语数据和英语数据的数据条数具有显著差异，柱状图会被用蓝色强调并附以星号。

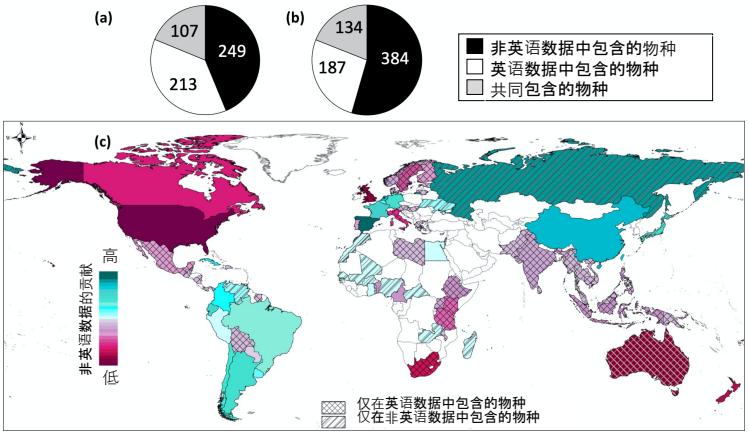

图4。非英语数据和英语数据（数据从InvaCost数据库中获得）中共同包含物种的数量，并用下列标准加以区分：（a）仅考虑可供比较的数据（569个物种），和（b）所有的非英语数据（705个物种）。（c）为非英语数据所包含的可供比较的物种的数目对英语数据所包含的可供比较的物种的数目的贡献（用不同的红-蓝颜色表示其程度）的全球地图。仅有非英语可供比较数据的国家用**条纹**标记，而仅有英语可供比较数据的国家用**网格**标记。图中边界可能不代表当前的实际边界。

Titel

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- NL: Niet-Engelse talen verrijken wetenschappelijke kennis over de economische kosten van bio-invasies

Auteurs

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Vertaling door:

Laura Verbrugge

Nederlandstalige samenvatting:

- Het exclusieve gebruik van de Engelse taal in wetenschappelijk onderzoek kan een belemmering vormen voor effectieve communicatie tussen wetenschappers en beheerders of beleidsmakers wier moedertaal niet-Engels is. Deze barrière in de overdracht van wetenschappelijke kennis en gegevens leidt mogelijk tot aanzienlijke kennishiaten en kan leiden tot afwijkingen in wereldwijde patronen op alle wetenschapsgebieden.
- Om dit aan te tonen hebben we gegevens verzameld over de economische kosten van invasieve exoten wereldwijd in 15 niet-Engelse talen, en deze vergeleken met gelijkwaardige gegevens in het Engels (i.e. de InvaCost-database met de meest actuele gegevens over kosten van bio-invasies wereldwijd).
- De vergelijking van beide databases (~ 7.500 data entries in totaal) laat zien dat niet-Engelse bronnen: (i) meer gegevens vastleggen dan alleen Engelse bronnen (2.500 vs. 2.396 data entries); (ii) aanvullende kosten rapporteren voor 249 invasieve soorten en 15 landen, en (iii) de schatting van de wereldwijde kosten van biologische invasies met 16,6% verhogen (US$ 214 miljard meer dan de 1.288 biljoen voor de Engelstalige database). Daarnaast waren er 2.712 data entries beschikbaar die niet direct vergelijkbaar waren met de Engelstalige database; de meeste hiervan waren rechtstreeks via beheerders verkregen. Dit laat de waarde zien van directe communicatie tussen wetenschappers en beheerders.
- Vervolgens laten we zien hoe kennishiaten door het weglaten van niet-Engelstalige bronnen kunnen leidden tot significante afwijkingen in de verdeling van economische kosten tussen landen/regio's, taxonomische groepen, soorten en getroffen sectoren. De economische kosten in Europa, kosten op lokale schaal, en beheerkosten zijn ondervertegenwoordigd in de Engelstalige database.
- Het combineren van Engelstalige wetenschappelijke gegevens met gegevens uit niet-Engelstalige bronnen is dus van fundamenteel belang en vergroot de volledigheid van de gegevens. Het meenemen van niet-Engelstalige bronnen geeft een accurater beeld van de kosten van bio-invasies op wereldschaal. Het biedt ook mogelijkheden voor het verbeteren van de beheerprestaties, de coördinatie tussen experts (wetenschappers en beheerders) en samenwerking tussen landen.

Figuren

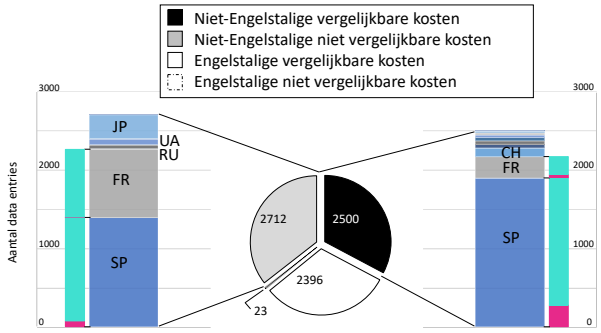


Fig. 1. **Beschikbaarheid van data over de kosten van invasieve soorten in niet-Engelse talen en in het Engels (InvaCost-database), met een onderscheid tussen vergelijkbare en niet-vergelijkbare datasets.** Voor elk van de niet-Engelstalige datasets wordt het aantal kostenposten per taal weergegeven in de staafdiagrammen. Getoonde talen: SP, Spaans; FR, Frans; JP, Japans; UA, Oekraïens; RU, Russisch; CH, Chinees. Voor SP en FR onderscheiden zwarte en witte balken inzendingen uit Spanje en Frankrijk (wit) en inzendingen uit Zuid-Amerika en Afrikaanse landen (zwart)

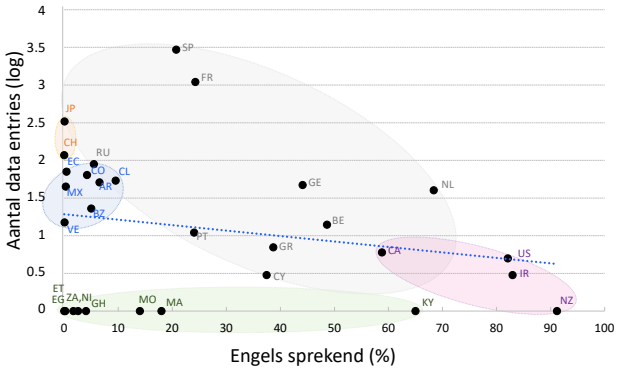


Fig. 2. **Relaties tussen de beschikbaarheid van data over economische kosten van invasieve exoten (in aantallen) in niet-Engelse talen en het percentage Engelssprekenden in elk land.** De regressielijn is blauw gemarkeerd. Landen zijn gegroepeerd op basis van hun convex hull area en omsloten door standaard ellipsen (rekening houdend met betrouwbaarheidsintervallen = 95% van hun respectievelijke gegevens), Europese landen in grijs, Afrikaanse landen in groen, Zuid-Amerikaanse landen in blauw, Aziatische landen in geel en Engelssprekende landen in roze. Afkortingen voor landen: AR, Argentinië; BE, België; BZ, Brazilië; CA, Canada; CL, Chili; CH, China; CO, Colombia; CY, Cyprus; EC, Ecuador; EG, Egypte; ET, Ethiopië; FR, Frankrijk; GE, Duitsland; GH, Ghana; GR, Griekenland; IR, Ierland; JP, Japan; KY, Kenia; MA, Madagaskar; MX, Mexico; MO, Marokko; NL, Nederland; NI, Nigeria; NZ, Nieuw-Zeeland; PT, Portugal; RU, Rusland; SP, Spanje; US, Verenigde Staten; VE, Venezuela; ZA, Zambia

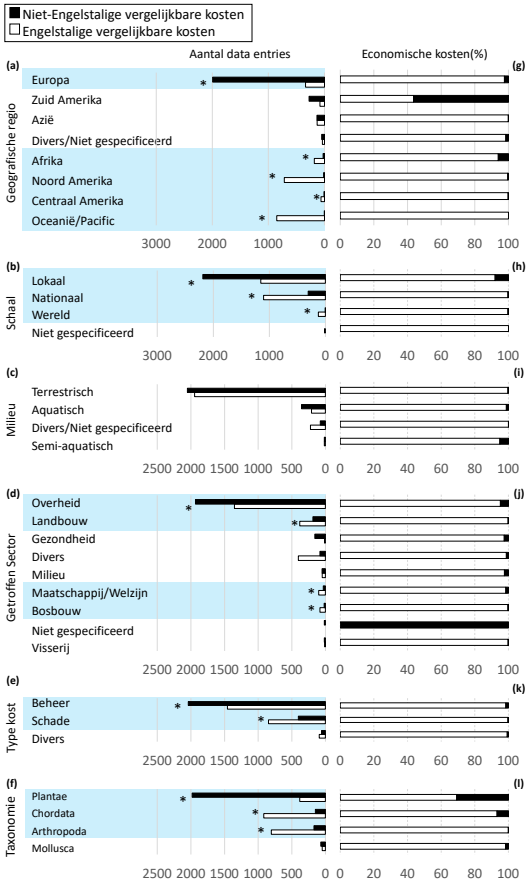
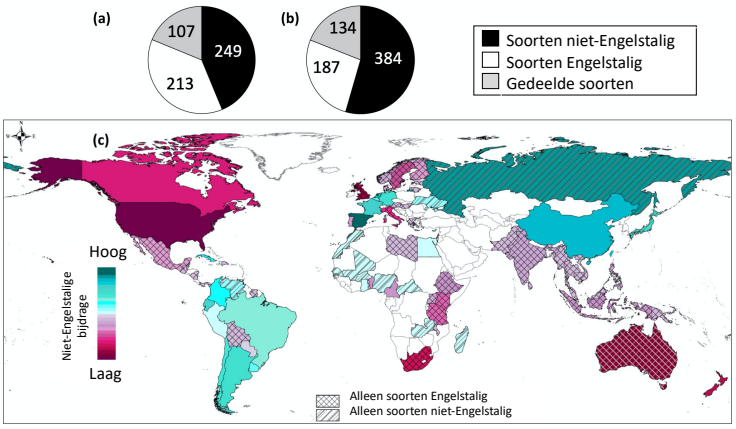


Fig. 3. **Data beschikbaarheid (in aantallen) en de relatieve economische kosten van invasieve uitheemse soorten in niet-Engelse talen en in het** Engels (uit de InvaCost-database) per (a, g) geografische regio's waar de kosten zijn gemaakt, (b, h) schaalgrootte, (c, i) type milieu waar de kosten betrekking op hebben, (d, j) sector waar de kosten betrekking op hebben, (e, k) type kosten, en (f, l) taxonomische groepen. Significante verschillen in aantallen tussen niet-Engelstalig en Engelstalig zijn gemarkeerd met asterisk en gemarkeerd in blauw.

Fig. 4. **Het aantal gelijke en ongelijke soorten in de niet-Engelstalige en de Engelstalige database (InvaCost) bij het gebruik van** (a) alleen vergelijkbare data (N = 569 soorten) en (b) alle beschikbare niet-Engelstalige data (N = 705 species). (c) De kaart toont het aantal soorten dat de niet-Engelstalige vergelijkbare dataset heeft bijgedragen aan het totaal aantal soorten van de Engelstalige vergelijkbare dataset per land (turkoois-magenta). Landen met alleen soorten in de niet-Engelstalige vergelijkbare dataset zijn gemarkeerd met lijnen, en landen met alleen soorten in de Engelstalige vergelijkbare dataset zijn gemarkeerd met ruiten. De landsgrenzen op de kaart vertegenwoordigen mogelijk niet de huidige politieke realiteit.



Title / Titre

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- FR: **Les langues non anglophones enrichissent les connaissances scientifiques : l'exemple du coût des invasions biologiques**

Authors / Auteurs :

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / Traduit par les auteurs :

Gauthier Dobigny /

Abstract / Resumé en français :

- Nous défendons l'idée que la prise en compte exclusive de l'anglais dans la recherche freine une communication efficace entre les scientifiques et les opérateurs ou les décideurs dont la langue maternelle n'est pas l'anglais. Ce frein au transfert du savoir et des données pourrait expliquer des lacunes importantes de connaissances et introduire des biais dans l'élaboration de patrons globaux dans toutes les disciplines scientifiques.
- Pour le démontrer, nous avons compilé des données sur le coût économique des espèces exotiques envahissantes disponibles en 15 langues non anglaises, et nous les avons comparées aux données équivalentes obtenues uniquement en anglais (i.e. la base de données InvaCost, la plus à jour sur les coûts des invasions biologiques globalement).
- La comparaison des deux bases de données (environ 7 500 entrées au total) montre que les sources non anglaises (1) permettent de réunir davantage de données que les sources exclusivement anglaises (2 500 vs. 2 396 entrées de coût lié aux invasions biologiques), (2) apportent des données économiques pour 249 espèces envahissantes et 15 pays supplémentaires, et (3) augmentent le coût global des invasions biologiques évalués par les données exclusivement anglaises de 16,6% (214 milliards USD, pour un total de 1288 milliards pour les données anglaises). Par ailleurs, 2712 autres entrées s'ajoutent à la base de données non anglaises mais ne sont pas directement comparables aux données anglaises. Néanmoins, la plupart ont été obtenues auprès d'opérateurs non académiques, ce qui souligne l'importance de la communication entre ce type d'acteurs et les scientifiques.
- De plus, nous démontrons que les lacunes provoquées par la non prise en compte des données non anglaises se traduit par des biais significatifs dans la distribution des coûts selon la géographie, les groupes taxonomiques concernés, le types de coût et les secteurs impactés. Les données sur les coûts en Europe, à une échelle locale, en particulier en relation avec la gestion sont largement sous-représentés dans la base de données anglaise.
- Ainsi, la combinaison de données scientifiques de langue anglaise avec des données provenant de sources non anglaises s'avère crucial et améliore la richesse des données. Elle représente aussi un potentiel intéressant pour améliorer les performances de la gestion des espèces envahissantes

Figures / Figures

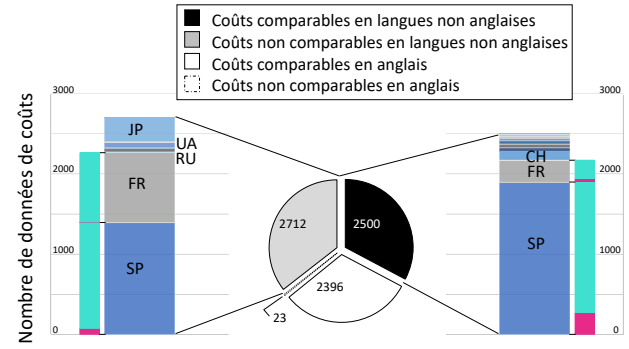


Fig. 1. **Nombre de données de coûts associées aux espèces envahissantes dans les langues non anglaises et anglaise en distinguant les jeux de données 'comparable' et 'non comparable'.** Pour chaque jeu de données en langue non anglaise, le nombre de données de coûts par langue est représenté dans l'histogramme. SP, espagnol ; FR, français ; JP, japonais ; UA, ukrainien ; RU, russe ; CH, chinois. Pour SP et FR, les barres distinguent les données d'Espagne et de France (en turquoise) de celles d'Amérique latine et d'Afrique (en magenta).

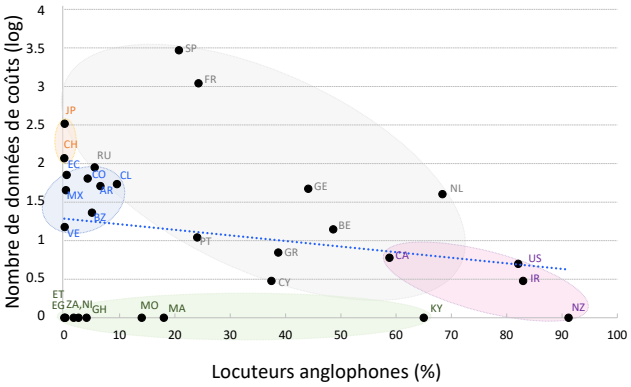


Fig. 2. **Relation entre le nombre de données de coûts économiques liés aux espèces envahissantes dans les langues non anglaises et le pourcentage de locuteurs anglophones dans chaque pays.** La droite de régression est représentée en bleu. Les pays sont groupés en fonction de la surface de leur enveloppe convexe représentées par des ellipses (en considérant l'intervalle de confiance comme égal à 95% de leur surface respective). Les pays européens, africains, Sud-américains, asiatiques et de langue anglaise sont respectivement en gris, vert, bleu, jaune et rose. AR, Argentine ; BE, Belgique ; BZ, Brésil ; CA, Canada ; CL, Chili ; CH, Chine ; CO, Colombie ; CY, Chypre ; EC, Equateur ; EG, Egypte ; ET, Ethiopie ; FR, France ; GE, Allemagne ; GH, Ghana ; GR, Grèce ; IR, Irlande ; JP, Japon ; KY, Kenya ; MA, Madagascar ; MX, Mexique ; MO, Maroc ; NL, Pays-Bas ; NI, Nigéria ; NZ, Nouvelle Zélande ; PT, Portugal ; RU, Russie ; SP, Espagne ; US, États Unis ; VE, Vénézuéla ; ZA, Zambie.

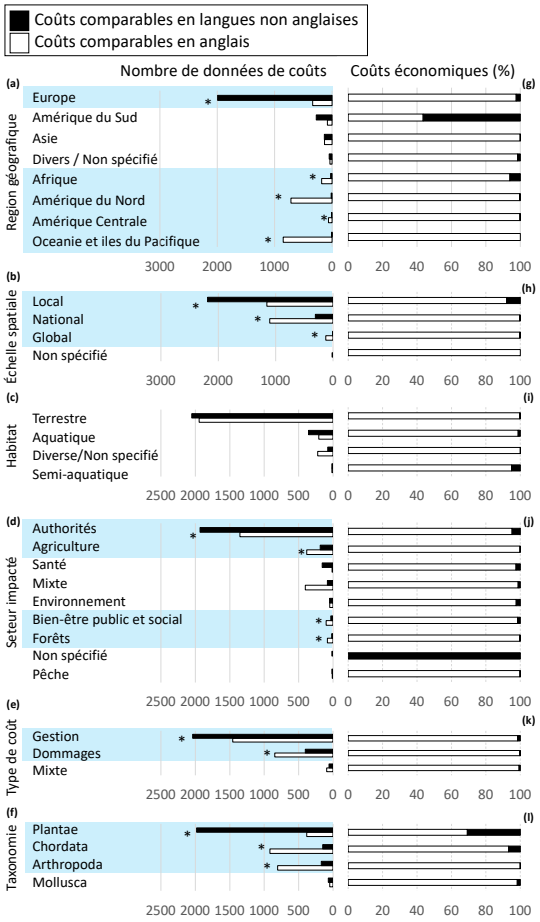
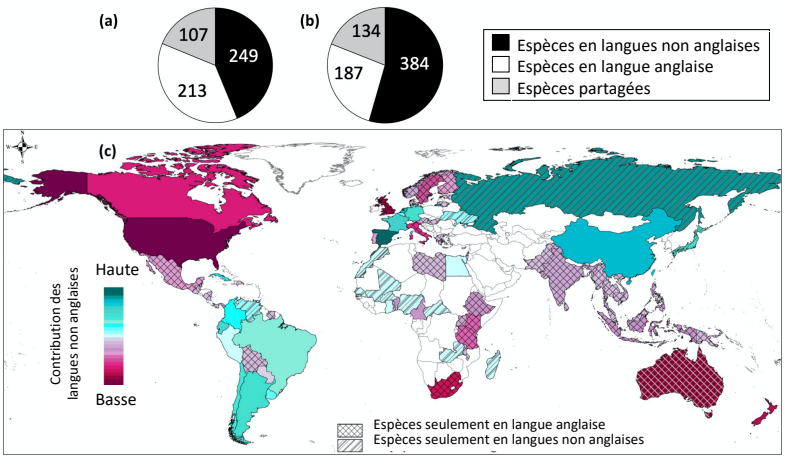


Fig. 3. **Nombre de données et de valeurs de coûts économiques associés aux espèces exotiques envahissantes en langues non anglaises et en langue anglaise** (d'après la base de données InvaCost) selon : (a) la region géographique du coût, (b) l'échelle spatiale du coût, (c) le type d'habitat où le coût a eu lieu, (d) le secteur impacté par le coût, (e) le type de coût et (f) les principaux groupes taxonomiques. Les differences significatives de nombre d'entrées de coût entre les données en langues non anglaises et les données en langue anglaise sont indiquées avec un astérisque et surlignées en bleu.

Fig. 4. **Nombre d'espèces partagées et non partagées entre la base de données en langues non anglaises et celle en langue anglaise (InvaCost)** en considérant : (a) seulement les données comparables entre les deux jeux de données (n = 569 espèces) et (b) toutes les données en langues non anglaises (n = 705 espèces). (c) La carte montre le nombre d'espèces que le jeu de données en langues non anglaises (comparable au jeu de données en langue anglaise) a permis d'inclure, et ce par pays (gradient turquoise-magenta). Les pays présentant une seule espèce dans la base de données non anglaises sont indiqués avec des hachures croisées ; ceux présentant une seule espèce dans la base de données anglaises comparable sont marqués avec des hachures simples. Les frontières illustrées dans cette carte peuvent ne pas correspondre à la réalité politique du moment.



Title / Title

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- GE: **Nicht-englishe Sprachen bereichern wissenschaftliches Wissen: Das Beispiel der wissenschaftlicher Kosten von biologischen Invasionen**

Authors / Autoren

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / Übersetzt von den Autoren:
Phillip J. Haubrock

Abstract / Zusammenfassung in deutscher Sprache:

- Wir argumentieren, dass die ausschließliche Verwendung der englischen Sprache in der wissenschaftlichen Forschung eine effektive Kommunikation zwischen Wissenschaftlern und oder politischen Entscheidungsträgern deren Muttersprache nicht Englisch ist behindern könnte. Diese Barriere bei wissenschaftlichen Erkenntnissen und Datenübertragung führt möglicherweise zu erheblichen Wissenslücken und kann zu Verzerrungen führen, wenn globale Muster in allen Bereichen der Wissenschaft bereitgestellt werden.
- Um dies zu demonstrieren, haben wir Daten zu den globalen wirtschaftlichen Kosten invasiver gebietsfremder Arten zusammengestellt, die in 15 nicht englischen Sprachen publiziert wurden, und sie mit entsprechenden Daten in englischer Sprache (der InvaCost-Datenbank, dem aktuellsten Sammelsurium für Invasionskosten weltweit) verglichen.
- Der Vergleich beider Datenbanken (insgesamt ~ 7.500 Einträge) ergab, dass nicht englische Quellen: (i) eine größere Datenmenge erfassen als nur englische Quellen (2.500 gegenüber 2.396 Kosteneinträgen); (ii) gemeldete Kosten für weitere 249 invasive Arten und 15 Länder und (iii) die Schätzungen der globalen Kosten für biologische Invasionen in englischer Sprache um 16,6% (214 Mrd. USD, 1,288 Billionen in englischer Sprache) erhöhen. Weitere 2.712 Einträge ergänzten die nicht-englische Datenbank, waren jedoch nicht direkt mit der englischen Datenbank vergleichbar. Die meisten wurden direkt von Praktikern bezogen, was den Wert der Kommunikation von Wissenschaftlern und Praktikern enthüllte.
- Darüber hinaus zeigen wir, wie Lücken, die durch das Übersehen nicht englischer Daten verursacht wurden, zu erheblichen Verzerrungen bei der Verteilung der Kosten auf taxonomische Gruppen, Kostenarten und betroffene Sektoren führten. Die Kosten aus Europa auf lokaler Ebene und insbesondere im Zusammenhang mit dem Management waren in der englischen Datenbank weitgehend unterrepräsentiert.
- Die Kombination englischer wissenschaftlicher Daten mit Daten aus nicht englischen Quellen erweist sich daher als grundlegend und verbessert die Vollständigkeit der Daten. Die Berücksichtigung nicht englischer Quellen hilft dabei, Verzerrungen beim Verständnis der Invasionskosten auf globaler Ebene zu verringern. Es birgt auch das Potenzial zur Verbesserung der Managementleistung, der Koordination zwischen Experten (Wissenschaftlern und Praktikern) und der Zusammenarbeit verschiedener Länder.

Figures / Abbildungen

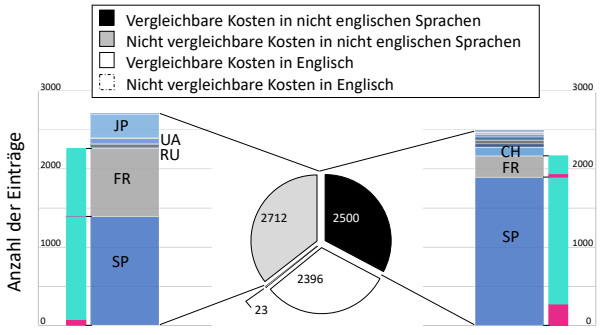


Fig. 1. Anzahl der Kosteneinträge invasiver Arten in Englisch und nicht englischen Sprachen (InvaCost-Datenbank), wobei vergleichbare und nicht vergleichbare Datensätze unterschieden werden. Für jeden nicht englischen Datensatz wird die Anzahl der Kosteneinträge nach Sprache in den Balkendiagrammen dargestellt. Gezeigte Sprachen: SP, Spanisch; FR, Französisch; JP, Japanisch; UA, Ukrainisch; RU, Russisch; CH, Chinesisch. Für SP und FR, türkis und magenta unterscheiden Datenbankeinträge für Spanien und Frankreich (türkis) von Einträgen für Südamerika und afrikanischen Ländern (magenta).

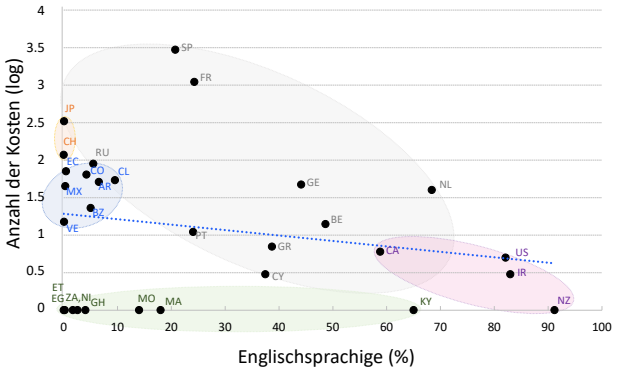


Fig. 2. Beziehung zwischen der Anzahl der Einträge der wirtschaftlichen Kosten invasiver Arten in nicht englischen Sprachen und dem Prozentsatz der englischsprachigen Personen in jedem Land. Die Regressionslinie ist blau markiert. Die Länder werden nach ihrem besetzten Areal gruppiert und mit Standardellipsen (unter Berücksichtigung von Konfidenzintervallen = 95% ihrer jeweiligen Daten; Europäische Länder in grau, afrikanische Länder in grün, südamerikanische Länder in blau, asiatischen Ländern in gelb, und englischsprachigen Ländern in pink) umfasst. Länderabkürzungen: AR, Argentinien; BE, Belgien; BZ, Brasilien; CA, Kanada; CL, Chile; CH, China; CO, Kolumbien; CY, Zypern; EG, Ecuador; EG, Ägypten; ET, Äthiopien; FR, Frankreich; GE, Deutschland; GH, Ghana; GR, Griechenland; IR, Irland; JP, Japan; KY, Kenia; MA, Madagaskar; MX, Mexiko; MO, Marokko; NL, Niederlande; NI, Nigeria; NZ, Neu Seeland; PT, Portugal; RU, Russland; SP, Spanien; US, Vereinige Staaten; VE, Venezuela; ZA, Sambia

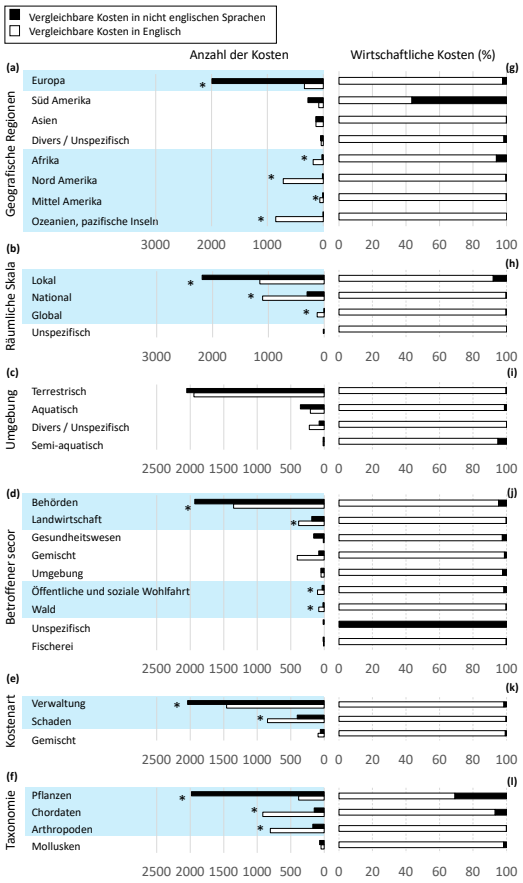
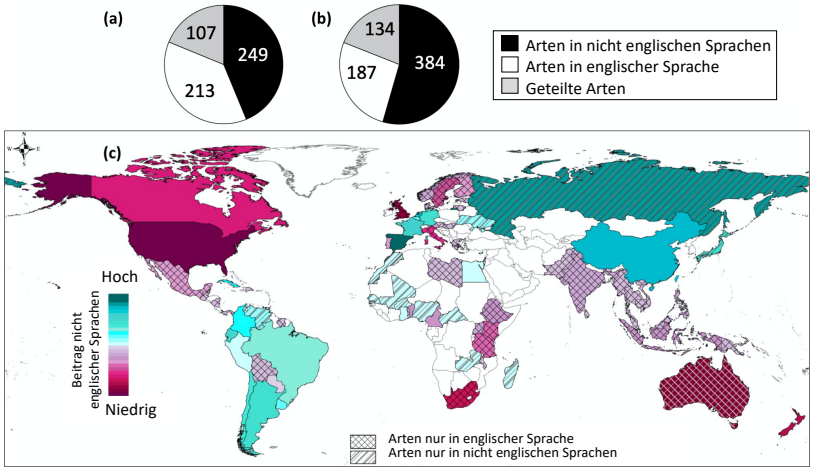


Fig. 3. Anzahl der Einträge und relative Höhe der wirtschaftlichen Kosten invasiver gebietsfremder Arten in nicht englischen Sprachen und in englischer Sprache (aus der InvaCost-Datenbank) nach (a, g) geografischen Regionen, in denen die Kosten entstanden sind, (b, h) räumlicher Umfang der Kosten , (c, i) Umfeld, in dem die Kosten entstanden sind, (d, j) Auswirkungen auf den Kostensektor, (e, k) Art der Kosten und (f, l) taxonomische Hauptgruppen. Signifikante Unterschiede in der Anzahl der Einträge zwischen Nicht-Englischen und Englischen Daten sind mit Sternchen markiert und blau hervorgehoben.

Fig. 4. Anzahl der gemeinsam genutzten und nicht gemeinsam genutzten Arten zwischen der nicht englischsprachigen Datenbank und der englischen Datenbank (InvaCost) unter Berücksichtigung (a) nur vergleichbarer Daten (n = 569 Arten) und (b) aller Daten in nicht englischsprachigen Sprachen (n = 705 Arten). (c) Die Karte zeigt die Anzahl der Arten, welche die nicht englisch sprachige Datenbank zur Gesamtzahl der Arten der englisch sprachigen Datenbank je nach Land beigetragen hat (rot-blaue Skala). Länder mit nur Arten im nicht englischsprachigen Datensatz sind mit Linien markiert, und Länder mit nur Arten im englisch Datensatz sind mit Rauten markiert. Die auf der Karte dargestellten Die abgebildeten Grenzen repräsentieren möglicherweise nicht die aktuelle politische Realität.



Title / Τίτλος

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- GR: **Γλώσσες διαφορετικές της Αγγλικής εμπλουτίζουν την επιστημονική γνώση: παράδειγμα από τα οικονομικά κόστη βιολογικών εισβολών**

Authors / Συγγραφείς

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / Μετάφραση από τους συγγραφείς:

Melina Kourantidou / Μελίνα Κουραντίδου

Abstract / Περίληψη στα ελληνικά:

- Υποστηρίζουμε ότι η αποκλειστική χρήση της Αγγλικής γλώσσας στην επιστημονική έρευνα ενδέχεται να εμποδίσει την αποτελεσματική επικοινωνία μεταξύ επιστημόνων, επαγγελματιών και αρμοδίων χάραξης πολιτικής των οποίων η μητρική γλώσσα δεν είναι τα Αγγλικά. Το εμπόδιο αυτό στην μεταφορά επιστημονικής γνώσης και δεδομένων ενδέχεται να οδηγήσει σε σημαντικά κενά γνώσης καθώς επίσης και να δημιουργήσει εσφαλμένη εικόνα στην περιγραφή διεθνών τάσεων, σε όλους τους επιστημονικούς τομείς.
- Προκειμένου να το αποδείξουμε, συλλέξαμε δεδομένα για τα κόστη των εισβολικών ξενικών ειδών σε διεθνές επίπεδο σε 15 γλώσσες διαφορετικές της Αγγλικής και τα συγκρίναμε με τα αντίστοιχα δεδομένα στην Αγγλική (από την βάση δεδομένων InvaCost, την πιο επικαιροποιημένη βάση για κόστη εισβολικών ειδών σε διεθνές επίπεδο).
- Η σύγκριση μεταξύ των δύο βάσεων δεδομένων (~7,500 καταχωρίσεις στο σύνολο) έφεραν στην επιφάνεια τα παρακάτω για τις πηγές σε γλώσσες διαφορετικές από την Αγγλική: (i) αποτυπώνουν περισσότερα δεδομένα συγκριτικά με πηγές αποκλειστικά στην Αγγλική (2,500 vs. 2,396 καταχωρίσεις για κόστη); (ii) κόστη για επιπλέον 249 εισβολικά είδη και 15 χώρες, και (iii) αυξάνουν τις εκτιμήσεις για τα διεθνή κόστη από εισβολικά είδη κατά 16.6% (US$ 214 δισεκατομμύρια, με US$ 1.288 τρισεκατομμύρια στην Αγγλική). Επιπλέον 2,712 καταχωρίσεις συμπλήρωσαν την μη-Αγγλική βάση δεδομένων, ωστόσο οι καταχωρίσεις δεν ήταν άμεσα συγκρίσιμες με την Αγγλική βάση δεδομένων; οι περισσότερες από αυτές ήταν αποτέλεσμα επικοινωνίας με επαγγελματίες του χώρου, αποτυπώνοντας την αξία της επικοινωνίας μεταξύ επιστημόνων και επαγγελματιών.
- Επιπρόσθετα, αποτυπώνουμε πως τα κενά που δημιουργούνται από την παράβλεψη δεδομένων σε γλώσσες πέραν της Αγγλικής, διαστρεβλώνουν την εικόνα για την κατανομή του κόστους στο χώρο, μεταξύ ταξινομικών ομάδων, κατηγορίες κόστους και τομείς που επηρεάζονται. Τα κόστη από την Ευρώπη, σε τοπική κλίμακα, και συγκεκριμένα αυτά που είχαν να κάνουν με την διαχείριση, σε μεγάλο βαθμό έλειπαν ή δεν εκπροσωπούνταν επαρκώς στην Αγγλική βάση δεδομένων.
- Επομένως, ο συνδυασμός επιστημονικών δεδομένων στα Αγγλικά με δεδομένα από πηγές σε γλώσσες διαφορετικές της Αγγλικής αποδεικνύεται θεμελιώδης και ενισχύει την πληρότητα των δεδομένων. Με την συμπερίληψη πηγών σε γλώσσες διαφορετικές της Αγγλικής, υπάρχει μικρότερος κίνδυνος για διαστρέβλωση της εικόνας για τα κόστη των εισβολικών ειδών σε διεθνές επίπεδο. Επιπρόσθετα μπορεί να βοηθήσει στην βελτίωση της διαχείρισης και συντονισμού μεταξύ ειδικών (επιστημόνων και επαγγλεματιών) καθώς επίσης και σε συνεργατικές δράσεις μεταξύ χωρών.

Figures / Γραφήματα

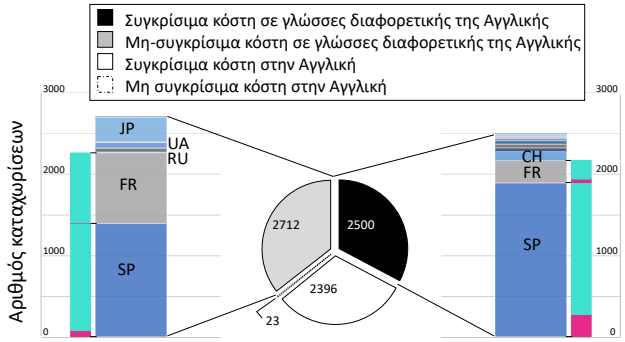


Fig. 1. **Αριθμός καταχωρίσεων κόστους εισβολικών ειδών στην Αγγλική και σε άλλες γλώσσες (InvaCost βάση δεδομένων), διακρίνοντας συγκρίσιμα και μη συγκρίσιμα σύνολα δεδομένων. Για κάθε ένα από σύνολα δεδομένων που δεν είναι στην Αγγλική, ο αριθμός των καταχωρίσεων ανά γλώσσα παρουσιάζεται σε διαγράμματα ράβδων. Απεικονίζονται οι παρακάτω γλώσσες:** SP, Ισπανικά; FR, Γαλλικά; JP, Ιαπωνικά; UA, Ουκρανικά; RU, Ρωσικά; CH, Κινέζικα. Για SP και FR, ράβδοι σε χρώματα turquoise και magenta διαφοροποιούν τις καταχωρίσεις της Ισπανίας και Γαλλίας (turquoise) και χώρες της Νότιας Αμερικής και Αφρικής (magenta).

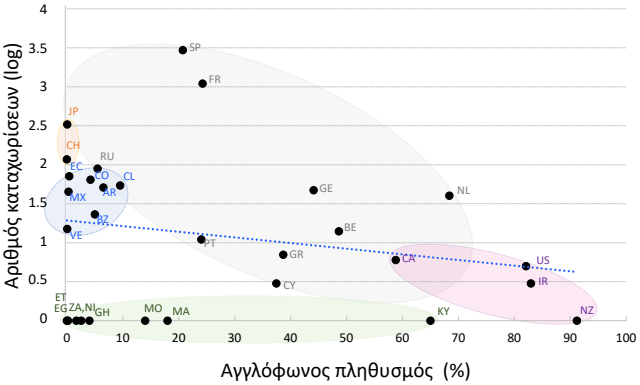


Fig. 2. Σχέση μεταξύ αριθμού καταχωρίσεων για κόστη εισβολικών ειδών σε γλώσσες διαφορετικές της Αγγλικής και ποσοστό αγγλόφωνου πληθυσμού σε κάθε χώρα. Η γραμμή παλινδρόμησης επισημαίνεται με μπλε χρώμα. Οι χώρες ομαδοποιούνται σύμφωνα με την κυρτή περιοχή που καταλαμβάνουν και συμπεριλαμβάνονται στις ελλείψεις κανονικής μορφής (λαμβάνοντας υπόψιν τα διαστήματα εμπιστοσύνης = 95% των αντίστοιχων δεδομένων), Ευρωπαϊκές χώρες σε γκρί, Αφρικανικές χώρες σε πράσινο, χώρες της Νότιας Αμερικής σε μπλε, Ασιατικές χώρες σε κίτρινο, και Αγγλόφωνες χώρες σε ροζ. Συντομογραφίες χωρών: AR, Αργεντινή; BE, Βέλγιο; BZ, Βραζιλία; CA, Καναδάς; CL, Χιλή; CH, Κίνα; CO, Κολομβία; CY, Κύπρος; EC, Εκουαδόρ; EG, Αίγυπτος; ET, Αιθιοπία; FR, Γαλλία; GE, Γερμανία; GH, Γκάνα; GR, Ελλάδα; IR, Ιρλανδία; JP, Ιαπωνία; KY, Κένυα; MA, Μαδαγασκάρη; MX, Μεξικό; MO, Μαρόκο; NL, Ολλανδία; NI, Νιγηρία; NZ, Νέα Ζηλανδία; PT, Πορτογαλία; RU, Ρωσία; SP, Ισπανία; ΗΠΑ, Ηνωμένες Πολιτείες Αμερικής; VE, Βενεζουέλα; ZA, Ζάμπια

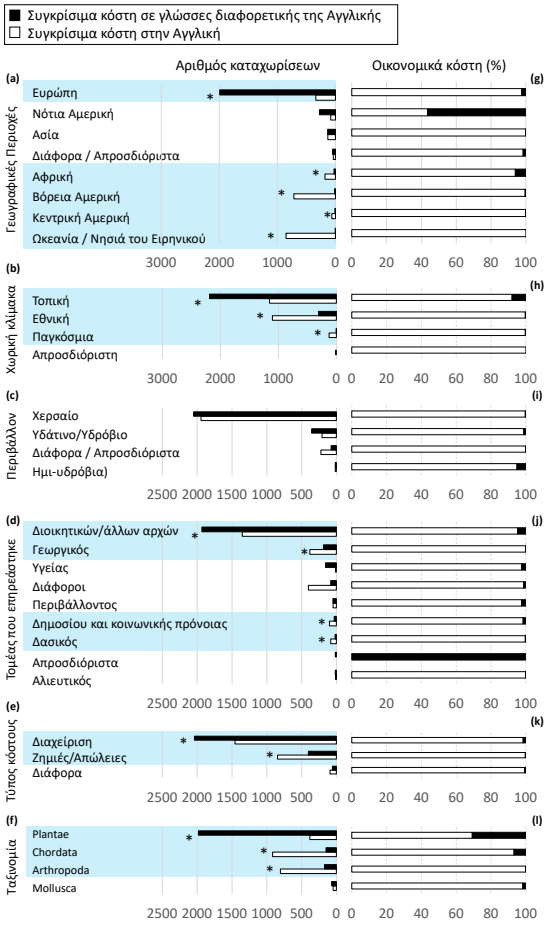
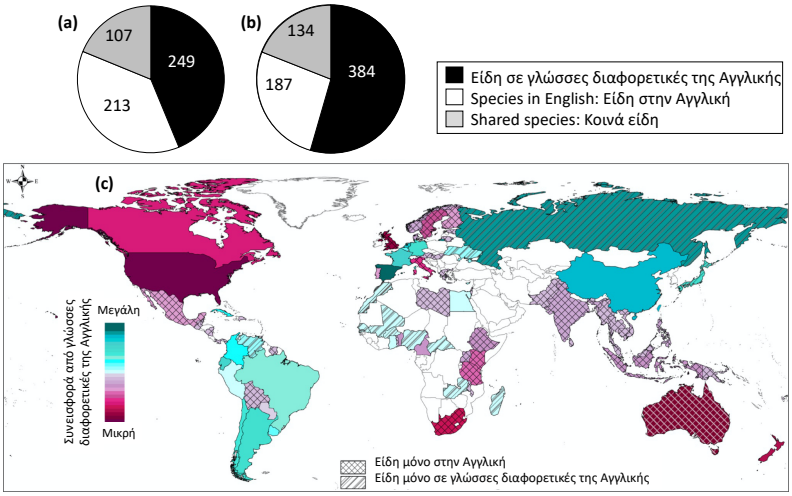


Fig. 3. **Αριθμός καταχωρίσεων και οικονομικό κόστος εισβολικών ειδών στην Αγγλική και σε γλώσσες διαφορετικές της Αγγλικής** (από την InvaCost βάση δεδομένων), ανά (a,g) γεωγραφικές περιοχές όπου το κόστος έλαβε χώρα, (b,h) χωρική κλίμακα του κόστους, (c,i) περιβάλλον στο οποίο το κόστος έλαβε χώρα, (d,j) τομέας που επηρεάστηκε από το κόστος, (e,k) τύπος κόστους, και (f,l) κύριες ταξινομικές ομάδες. Σημαντικές διαφορές στον αριθμό των καταχωρίσεων επισημαίνονται με αστερίσκους και με μπλε χρώμα.

Fig. 4. **Αριθμός κοινών και μη-κοινών ειδών μεταξύ της βάσης δεδομένων στην Αγγλική (InvaCost) και της βάσης δεδομένων σε γλώσσες διαφορετικές της Αγγλικής, λαμβάνοντας υπόψιν** (a) μόνο τα συγκρίσιμα δεδομένα (N = 569 είδη) και (b) όλα τα δεδομένα σε γλώσσες διαφορετικές της Αγγλικής (N = 705 είδη). (c) Ο χάρτης δείχνει τον αριθμό των ειδών τα οποία συνείσφερε το συγκρίσιμο σύνολο δεδομένων σε γλώσσες διαφορετικές της Αγγλικής εκτός/πλήν του συνολικού αριθμού ειδών του συγκρίσιμου συνόλου δεδομένων στην Αγγλική ανά χώρα (magenta - turquoise κλίμακα). Οι χώρες με είδη μόνο στο συγκρίσιμο σύνολο δεδομένων σε γλώσσες διαφορετικές της Αγγλικής επισημαίνονται με stripes (λωρίδες) και οι χώρες με είδη μόνο στο σύνολο δεδομένων στην Αγγλική επισημαίνονται με grid (πλέγμα). Τα σύνορα που απεικονίζονται στον χάρτη ενδέχεται να μην αντιπροσωπεύουν την τρέχουσα πολιτική πραγματικότητα



Title / शीर्षक

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- HD: गैर-अंग्रेजी भाषाएं वैज्ञानिक ज्ञान को समृद्ध करती हैं: जैविक आक्रमणों की आर्थिक लागत का उदाहरण

Authors / लेखक

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Translated by the authors / लेखकों द्वारा अनुवादित**:**
Achyut Kumar Banerjee /

Abstract / सारांश:

- हम मानते हैं कि वैज्ञानिक अनुसंधान में अंग्रेजी भाषा का विशेष उपयोग वैज्ञानिकों और चिकित्सकों या नीति निर्माताओं जिनकी मातृभाषा गैर अंग्रेजी है के बीच प्रभावी संचार में बाधा हो सकती है । वैज्ञानिक ज्ञान और डेटा हस्तांतरण में यह बाधा संभावित रूप से महत्वपूर्ण ज्ञान अंतराल की ओर ले जाती है और विज्ञान के सभी क्षेत्रों में वैश्विक पैटर्न प्रदान करते समय पूर्वाग्रह पैदा कर सकती है।
- इसे प्रदर्शित करने के लिए, हमने दस गैर-अंग्रेजी भाषाओं में रिपोर्ट की गई आक्रामक विदेशी प्रजातियों की वैश्विक आर्थिक लागतों पर डेटा संकलित किया, और इसकी तुलना अंग्रेजी में समकक्ष डेटा (InvaCost डेटाबेस, विश्व स्तर पर आक्रमण लागत का सबसे अद्यतित भंडार) के साथ की।
- दोनों डेटाबेस (कुल में ~ 7,500 प्रविष्टियों) की तुलना से पता चला है कि गैर-अंग्रेजी स्रोत: (i) केवल अंग्रेजी स्रोतों की तुलना में अधिक मात्रा में डेटा कैप्चर करते हैं (2,500 बनाम 2,396 लागत प्रविष्टियां); (ii) अतिरिक्त 249 आक्रामक प्रजातियों और 15 देशों के लिए लागत की सूचना दी गई है, और (iii) अंग्रेजी में जैविक आक्रमणों की वैश्विक लागतों के अनुमानों में 166% (214 बिलियन अमेरिकी डॉलर जबकि अंग्रेजी में 1.288 ट्रिलियन) की वृद्धि करती है। एक अतिरिक्त 2,712 प्रविष्टियों गैर अंग्रेजी डेटाबेस पूरक लेकिन सीधे अंग्रेजी डेटाबेस के लिए तुलनीय नहीं थे; अधिकांश चिकित्सकों से सीधे प्राप्त किए गए थे, वैज्ञानिकों और चिकित्सकों के संचार के मूल्य का खुलासा करते थे।
- इसके अलावा, हम प्रदर्शित करते हैं कि गैर-अंग्रेजी डेटा को देखने से कैसे अंतराल होता है, जिसके परिणामस्वरूप अंतरिक्ष, टैक्सोनॉमिक समूहों, लागत के प्रकार और प्रभावित क्षेत्रों में लागत के वितरण में महत्वपूर्ण पक्षपात होता है। यूरोप से, स्थानीय स्तर पर, और विशेष रूप से प्रबंधन से संबंधित लागत, बड़े पैमाने पर अंग्रेजी डेटाबेस में कम प्रतिनिधित्व करते थे।
- इस प्रकार, गैर-अंग्रेजी स्रोतों से आने वाले डेटा के साथ अंग्रेजी वैज्ञानिक डेटा का संयोजन मौलिक साबित होता है और डेटा पूर्णता को बढ़ाएगा। गैर-अंग्रेजी स्रोतों पर विचार करने से वैश्विक स्तर पर आक्रमण की लागत को समझने में पूर्वाग्रहों को कम करने में मदद मिलती है। यह प्रबंधन प्रदर्शन, विशेषज्ञों (वैज्ञानिकों और चिकित्सकों) के बीच समन्वय और देशों में सहयोगात्मक कार्यों में सुधार करने की क्षमता रखता है।

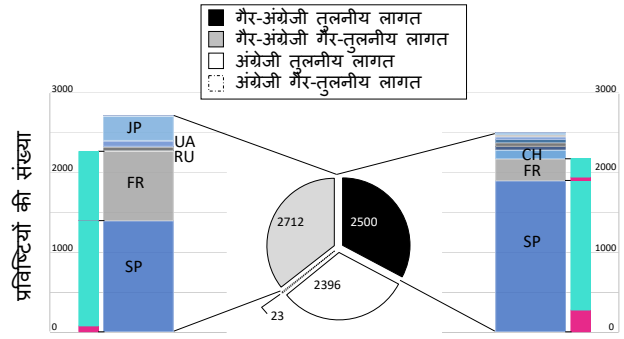


Fig. 1. **गैर-अंग्रेजी भाषाओं और अंग्रेजी (InvaCost डेटाबेस) में आक्रामक प्रजातियों की लागत प्रविष्टियों की संख्या, तुलनीय और गैर-तुलनीय डेटासेट को भेद करती है।** प्रत्येक गैर-अंग्रेजी डेटासेट के लिए, बार डायग्राम में भाषा द्वारा लागत प्रविष्टियों की संख्या का प्रतिनिधित्व किया जाता है। दिखाया गया भाषा: SP, स्पेनिश; FR, फ्रेंच; जेपी, जापानी; यूए, उक्रानियन; आरयू, रूसी; CH, चीनी। SP और FR के लिए, फ़िरोज़ा और मैजेंटा बार स्पेन और फ्रांस (फ़िरोज़ा) और स्पेनिश बोलने वाले दक्षिण अमेरिकी देशों और फ्रैंकोफ़ोन अफ्रीकी देशों (मैजेंटा) से प्रविष्टियों को भेदते हैं।

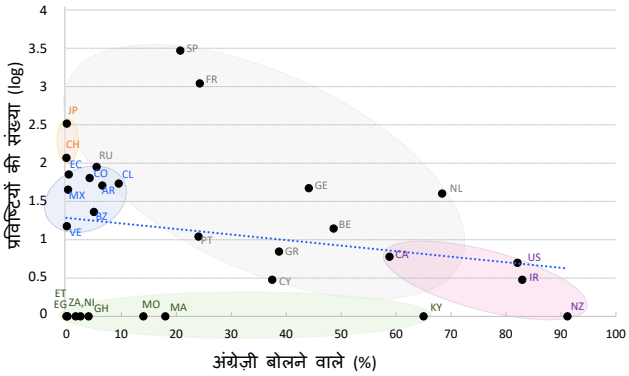


Fig. 2. **गैर-अंग्रेजी भाषाओं में आक्रामक प्रजातियों की आर्थिक लागतों की प्रविष्टियों की संख्या और प्रत्येक देश में अंग्रेजी बोलने वालों के प्रतिशत के बीच संबंध।** प्रतिगमन रेखा नीले रंग में चिह्नित है। देशों को उनके कब्जे वाले उत्तल पतवार क्षेत्र के अनुसार वर्गीकृत किया गया है और मानक दीर्घवृत्त (विश्वास अंतराल = उनके संबंधित डेटा का 95% पर विचार), ग्रे में यूरोपीय देशों, हरे रंग में अफ्रीकी देशों, नीले रंग में दक्षिण अमेरिकी देशों और पीले रंग में एशियाई देशों के साथ शामिल किया गया है। देश के संक्षिप्त विवरण: AR, अर्जेंटीना; BE, बेल्जियम; BZ, ब्राजील; CA, कनाडा; CL, चिली; CH, चीन; CO, कोलम्बिया; CY, साइप्रस; EC, इक्वाडोर; EG, मिस्र; ET, इथियोपिया; FR, फ्रांस; GE, जर्मनी; GH, घाना; GR, ग्रीस; IR, आयरलैंड; JP, जापान; KY, केन्या; MA, मेडागास्कर; MX, मेक्सिको; MO, मोरक्को; NL, नीदरलैंड; NI, नाइजीरिया; NZ, न्यूजीलैंड; PT, पुर्तगाल; RU, रूस; SP, स्पेन; US, संयुक्त राज्य अमेरिका; VE, वेनेजुएला; ZA, ज़ाम्बिया।

Fig. 3. गैर-अंग्रेजी भाषाओं और अंग्रेजी में (**InvaCost** से) आक्रामक विदेशी प्रजातियों की आर्थिक लागतों की प्रविष्टियों (**a,b,c,d,e,f**) और रिश्तेदार राशि (**g,h,I,j,k,l**) की संख्या डेटाबेस), **(a,g)** औगोलिक क्षेत्रों में जहां लागत हुई, **(b,h)** लागत के स्थानिक पैमाने, **(c,i)** पर्यावरण जहां लागत हुई, **(d,j)** लागत के प्रभावित क्षेत्र, **(e,k)** प्रकार की लागत, और **(f,l)** मुख्य वर्गीकरण समूह। गैर-अंग्रेजी और अंग्रेजी के बीच प्रविष्टियों की संख्या में महत्वपूर्ण अंतर तारांकन के साथ चिह्नित हैं और नीले रंग में हाइलाइट किए गए हैं

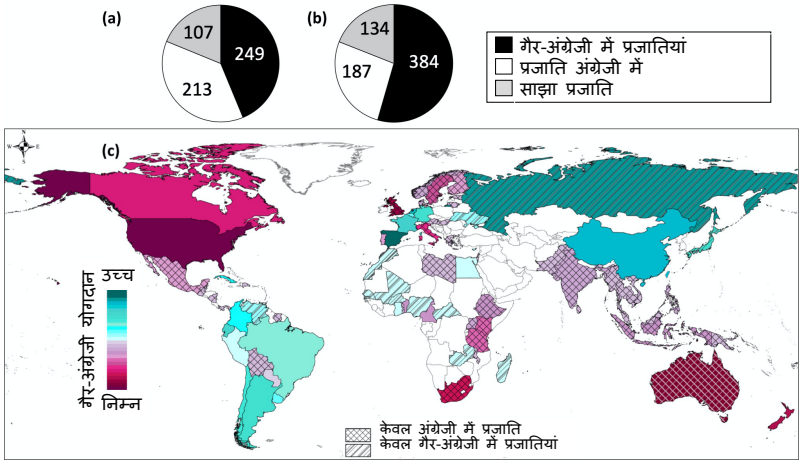


Fig. 4. गैर-अंग्रेज़ी डेटाबेस और अंग्रेज़ी डेटाबेस (**InvaCost**) के बीच साझा और साझा की गई प्रजातियों की संख्या, **(a)** केवल तुलनीय डेटा (**N = 569** प्रजातियाँ) और (**b**) सभी डेटा गैर-अंग्रेज़ी भाषाओं में (**N = 705** प्रजातियाँ) । (ग) मानचित्र में उन प्रजातियों की संख्या को दिखाया गया है, जो गैर-अंग्रेजी तुलनीय डेटासेट में देश (फ़िरोज़ा-मैजेंटा पैमाने) द्वारा अंग्रेजी तुलनीय डेटासेट की प्रजातियों की कुल संख्या का योगदान देती हैं। नक्शे मैं सचित्र सीमाओं वर्तमान राजनीतिक वास्तविकता का प्रतिनिधित्व नहीं कर सकते है।

Title / タイトル

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- JP: 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.

Authors / 著者

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / 著者による翻訳:

Yuya Watari / 亘 悠哉

Abstract / 要旨:

• 科学研究における英語の独占的な使用は，科学者と英語以外の言語を母国語とする実務者や政策立案者の間の効果的なコミュニケーションを阻害する可能性がある．この科学的知見とデータの受け渡しにおける障壁は，潜在的に大きな知識のギャップを引き起こし，科学のあらゆる分野においてグローバルなパターンを解き明かす際にバイアスを生じさせるであろう.

• このことを実証するために，英語以外の 15 言語で報告された侵略的外来種の世界的な経済コストに関するデータを集積し，英語で報告されて同様の手法で集積されたデータ（世界的な外来種の侵入による経済コストの最新のリポジトリである InvaCost データベース）と比較した.

• 両データベース（合計約 7,500 件）を比較した結果，非英語の情報ソースによって，(i) 英語のみの情報ソースよりも多くのデータが得られたこと（2,500 件対 2,396 件），(ii)新たに 249 種の侵略的外来種と 15 か国からのコスト情報が追加で報告されたこと，(iii) 外来種の侵入の世界的経済コストの推定値を，英語のみの情報ソースによる推定値より 16.6%引き上げたこと（非英語情報ソース：2,140 億米ドル，英語情報ソース：1 兆 2,880 億米ドル），が明らかになった．その他に，非英語データベースには，英語データベースとは情報集積の手法が異なり，直接比較可能ではない 2,712 件のコスト情報があるが，これらのほとんどは実務者から直接受け取ったものである．このことは，科学者と実務者間のコミュニケーションがいかに重要であるかを示している.

• さらに，非英語データを見過ごすことで生じるギャップが，空間，分類群，コストのタイプ，外来種の影響が及ぶ対象におけるコストの分布に確かなバイアスを生じさせていることを示した．ヨーロッパにおけるコスト，特にローカルスケールにおける外来種管理のコストは，英語のデータベースにおいて大いに過小評価されていた.

• このように，英語のデータと非英語情報ソースによるデータを組み合わせることで本質が明らかになり，データの完全性が向上するであろう．非英語言語の情報ソースを検討することは，世界規模での外来種の侵入のコストを理解する際のバイアスを軽減することに役立つ．また，外来種管理のパフォーマンスの向上や，専門家（科学者と実務者）の間の連携，国を超えた協働につながる可能性を秘めている.

Figures /図と表

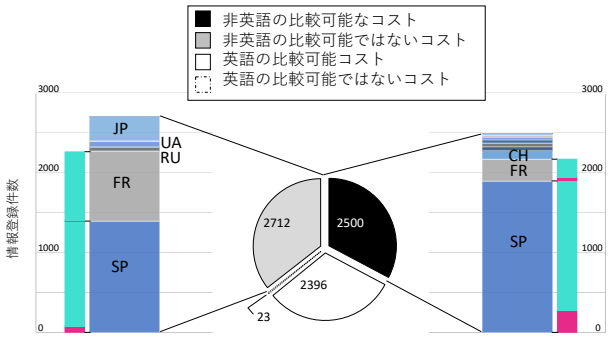


Fig. 1.**非英語言語と英語（InvaCostデータベース）における，比較可能なデータセットと比較可能でなはないデータセットを区別したコストのデータベース情報登録件数．**非英語データセットごとに，言語別のコスト情報登録件数の数を棒グラフで示す．表示されている言語： SP, スペイン語; FR, フランス語; JP, 日本語; UA, ウクライナ語; RU, ロシア語; CH, 中国語. SPとFRについては，ターコイズブルーとマゼンタのバーは，スペインとフランスからの情報（ターコイズブルー）と南アメリカとアフリカの国からの情報（マゼンタ）を区別している

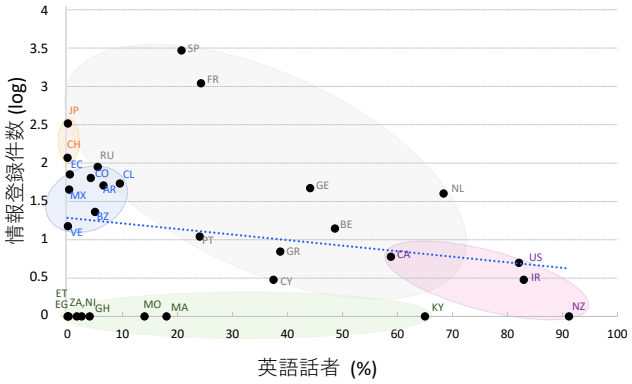


Fig. 2.**非英語言語における侵略的外来種の経済コストの情報登録件数とそれぞれの国の英語話者割合の関係．**回帰直線は青線で示す．国のグループ化は，占有凸包領域に従ってなされ，標準楕円（それぞれのデータの信頼区間=95%を考慮）で囲まれ，ヨーロッパ諸国は灰，アフリカ諸国は緑，南アメリカ諸国は青，アジア諸国は黄色，英語圏諸国はピンクで示した．国の略語: AR, アルゼンチン; BE, ベルギー; BZ, ブラジル; CA, カナダ; CL, チリ; CH, 中国; CO, コロンビア; CY, キプロス; EC, エクアドル; EG, エジプト; ET, エチオピア; FR, フランス; GE, ドイツ; GH, ガーナ; GR, ギリシャ; IR, アイルランド; JP, 日本; KY, ケニア; MA, マダガスカル; MX, メキシコ; MO, モロッコ; NL, オランダ; NI, ナイジェリア; NZ, ニュージーランド; PT, ポルトガル; RU, ロシア; SP, スペイン; US, アメリカ合衆国; VE, ベネズエラ; ZA, ザンビア

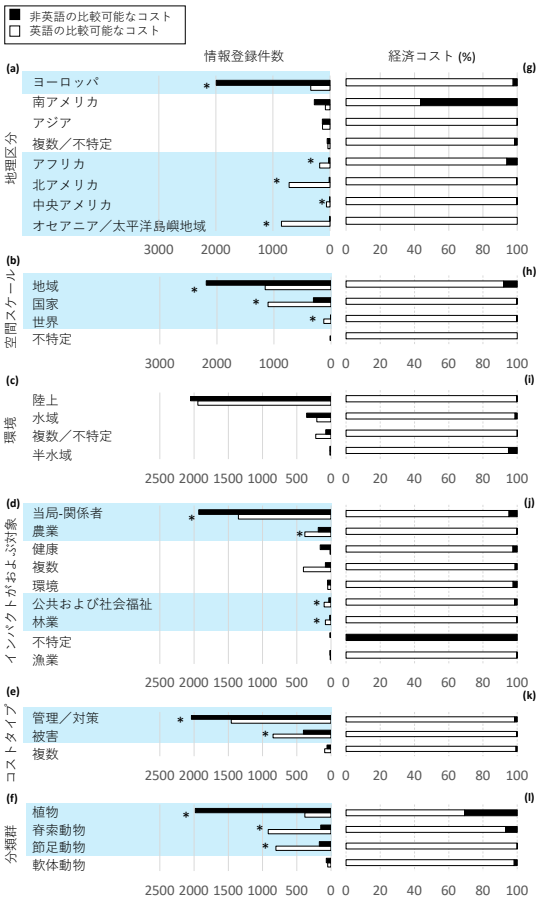


Fig. 3.**非英語言語と英語（InvaCost データベース）における侵略的外来種による経済コストの情報登録数と相対額．**(a,g) コストが発生した地理的地域，(b,h) コストの空間スケール，(c,i) コストが発生した環境，(d,j) 外来種によるコストが生じる対象，(e,k) コストのタイプ，(f,l) 主要な分類グループ．非英語言語と英語言語の情報登録件数の有意な差は，アスタリスクと青いエリアで表示している．

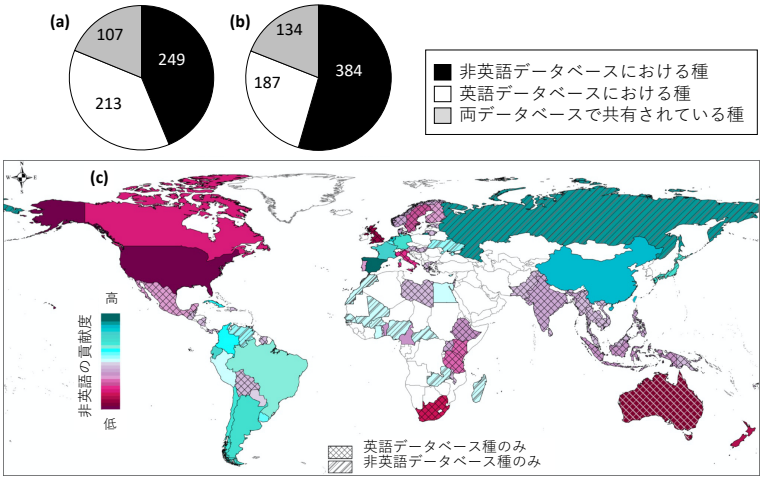


Fig. 4.**非英語言語データベースと英語データベース（InvaCost）の共有種数および非共有種数．**(a) 比較可能データのみを使用 (569種)，(b) 非英語言語のすべてのデータを使用（705種）．(c) 比較可能データセットにおける非英語言語データセットの種数と英語データセットの種数の差で示される国ごとの非英語言語の貢献度の地図（マゼンタからターコイズのスケール）．非英語データセットの種のみが記録されている国は斜線，英語データセットの種のみが記録されている国は格子で示した．なお， 地図に描かれている国境は，現在の政治的状況を表していない場合がある．

Title / Título

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- PT: **Línguas que não o inglês enriquecem o conhecimento científico: o exemplo dos custos econômicos de invasões biológicas**

Authors / Autores

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / Traduzido pelos autores:

Gustavo Heringer & César Capinha

Abstract / Resumo em português:

- Nós consideramos que o uso exclusivo da língua inglesa em investigação científica pode prejudicar a comunicação efetiva entre cientistas e técnicos ou decisores cuja língua materna não é o inglês. A falta de transferência de conhecimento científico e de dados pode originar lacunas significativas de conhecimento e criar enviesamentos no estudo de padrões globais em todas as áreas da ciência.
- Para demonstrar isto, nós compilamos dados de custos econômicos de espécies exóticas invasoras pelo mundo em 15 línguas que não a inglesa e comparamos os resultados obtidos com os existentes em inglês (oriundos da base de dados InvaCost, um repositório global de custos de invasão biológicas).
- A comparação das duas bases de dados (~7 500 entradas no total) mostra que as fontes de dados não em inglês: (i) obtiveram uma maior quantidade de registos de custo (2 500 vs. 2 396 em inglês); (ii) reportaram custos para 249 novas espécies invasoras e 15 novos países, e (iii) aumentaram as estimativas dos custos globais das invasões biológicas em 16,6% (214 bilhões de dólares vs. 1 288 biliões de dólares de referências em inglês). Um aumento de 2 712 entradas suplementou o conjunto de dados não em inglês, mas estas não são diretamente comparáveis com a base de dados em inglês. A maior parte desses dados foi obtida diretamente de profissionais técnicos e gestores, revelando o valor da comunicação entre cientistas e estes.
- Adicionalmente, nós demonstramos como as lacunas de conhecimento geradas pela omissão de dados não em inglês resultam num enviesamento significativo nos padrões de distribuição dos custos em relação ao espaço, grupo taxonômico, tipos de custo e setores afetados. Os custos para a Europa, em escala local e, particularmente, relacionados com manejo, foram significativamente sub-representados na base de dados em inglês.
- Desta forma, a junção de dados científicos em inglês com dados oriundos de fontes não em inglês proporciona uma melhoria fundamental e necessária na qualidade dos dados. A inclusão de dados não em inglês ajuda a diminuir enviesamentos no estudo dos custos das invasões biológicas à escala global. Esta tem também um potencial para aumentar a eficiência na gestão, a coordenação entre especialistas (cientistas, técnicos e decisores) e as ações conjuntas entre países.

Figures / Figuras

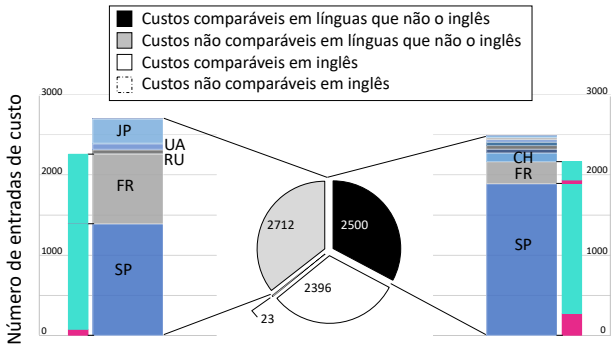


Fig. 1. **Número de entradas de custos de espécies invasoras de fontes não em inglês e em inglês (base de dados InvaCost) com distinção entre dados comparáveis e não comparáveis.** Para cada conjunto de dados não em inglês o número de entradas por idioma é representado no diagrama de barras. Os idiomas representados são: SP, Espanhol; FR, Francês; JP, Japão; UA, Ucraniano; RU, Russo; CH, Chinês. Para SP e FR, as barras turquesa e magenta diferenciam as entradas da Espanha e França (turquesa) das entradas de países que falam espanhol na América do Sul e dos países que falam francês na África (magenta).

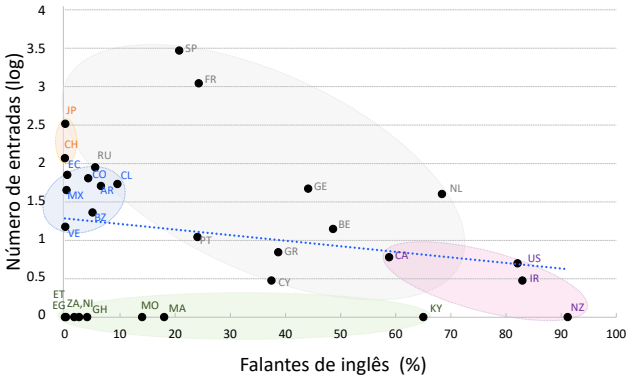


Fig. 2. **Relação entre o número de entradas de custos econômicos de espécies invasoras não em inglês e porcentagem de falantes de inglês em cada país.** A linha da regressão está destacada em azul. Os países estão agrupados de acordo com a área convexa de hull e correspondem às elipses padronizadas (considerando intervalo de confiança = 95% dos dados); os países europeus estão representados em cinza, os africanos em verde, os sul-americanos em azul, os asiáticos em amarelo e os países falantes de inglês em rosa. Abreviações dos países: AR, Argentina; BE, Bélgica; BZ, Brasil; CA, Canadá; CL, Chile; CH, China; CO, Colômbia; CY, Chipre; EC, Equador; EG, Egito; ET, Etiópia; FR, França; GE, Alemanha; GH, Gana; GR, Grécia; IR; Irlanda; JP, Japão; KY, Quênia; MA, Madagascar; MX, México; MO, Marrocos; NL, Holanda; NI, Nigéria; NZ, Nova Zelândia; PT, Portugal; RU, Rússia; SP, Espanha; US, Estados Unidos; VE, Venezuela; ZA, Zâmbia.

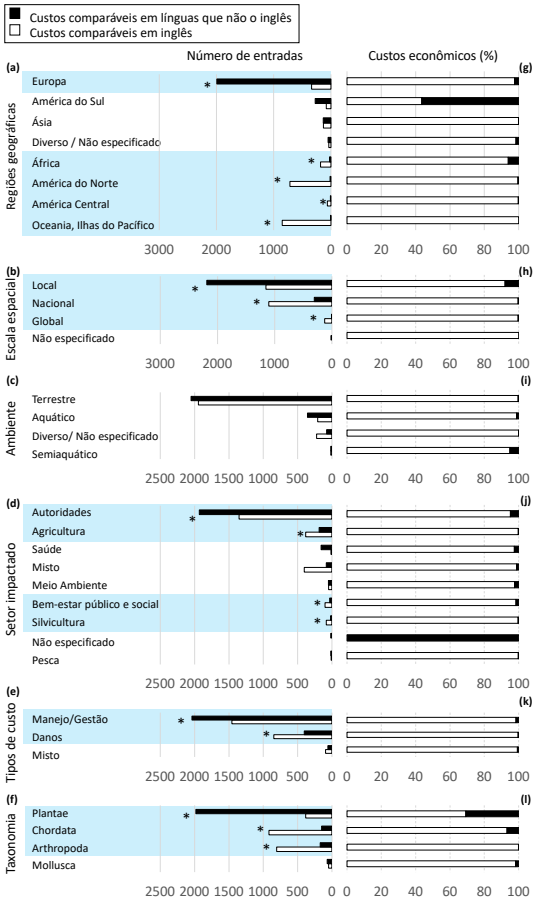
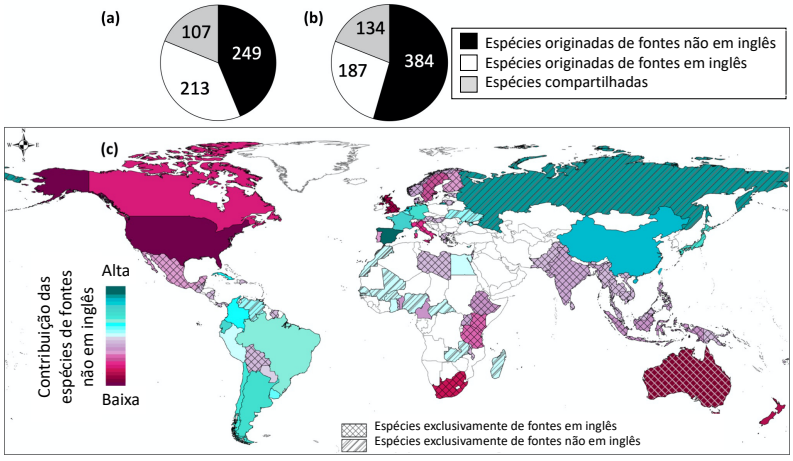


Fig. 3. **Número de entradas de custos e custos relativos de espécies invasoras em fontes de línguas que não o inglês e fontes em inglês** (a partir da base de dados InvaCost), distribuídas por (a.g) regiões geográficas onde o custo ocorre, (b.h) escala espacial do custo, (c.i) ambiente onde o custo ocorre, (d.j) setor impactado pelo custo, (e.k) tipo de custo e (f.l) principais grupos taxonômicos. As diferenças significativas entre o número de entradas de fontes não em inglês e em inglês estão marcadas com asterisco e destacadas em azul.

Fig. 4. **Número de espécies compartilhadas e não compartilhadas entre a base de dados de fontes que não em inglês e a base de dados em inglês** (InvaCost), considerando (a) apenas dados comparáveis (N = 569 espécies) e (b) todos os dados não em inglês (N = 705 espécies). (c) O mapa mostra a contribuição da base de dados comparável não em inglês no número total de espécies do banco de dados comparável em inglês (escala de turquesa-magenta). Países com apenas espécies oriundas da base de dados comparáveis não em inglês estão destacados com linhas transversais e países com apenas espécies oriundas da base de dados comparável em inglês estão destacados com linhas em xadrez. As fronteiras ilustradas no mapa podem não representar a realidade política atual.



Русский Title / Заголовок

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- RU: **Неанглийские языки обогащают научные знания: пример экономических потерь в связи с биологическими инвазиями**

Authors / Авторы

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Елена Ангуло, Кристоф Диань, Лилиана Бальестерос-Мехиа, Тасниме Адамджи, Даниш Али Ахмед, Евгений Акулов, Ачьют Кумар Банерджи, Цезарь Капинья, Шейх А. К. М. Диа, Готье Добиньи, Вирджиния Г. Дубоск-Карра, Марина Голивец, Филипп Йошка Хауброк, Густаво Херингер, Наталья Кириченко, Мелина Курантиду, Чунлонг Лью, Мартин А. Нуньес, Дэвид Рено, Дэвид Ройз, Ахмед Тахери, Лаура Вербрюгге, Юя Ватари, Вен Сюн, Франк Куршамп

Translated by the authors / Авторы перевода на русский язык:

Natalia Kirichenko, Evgeny Akulov / Наталья Кириченко, Евгений Акулов

Abstract / Абстракт на русском языке:

- Наши исследования убеждают в том, что использование только английского языка в научных исследованиях может в значительной мере препятствовать эффективному сотрудничеству ученых, практиков и политиков, родным языком которых английский не является. Этот барьер на пути к обнародованию научных знаний может приводить к искаженному пониманию глобальных процессов во всех областях науки.
- Чтобы это продемонстрировать мы собрали и проанализировали опубликованные на 15 языках данные по глобальным экономическим затратам, сопряженным с инвазиями чужеродных видов, и сравнили их с данными, опубликованными на английском языке (для анализа использовалась база данных InvaCost, самый современный депозитарий данных по затратам, связанным с биологическими инвазиями в мире).
- Сравнение двух наборов данных (содержащих в совокупности ~ 7500 сведений по экономическим потерям) показало, что источники, опубликованные на языках, отличных от английского: (i) содержат больший объем данных, чем источники, опубликованные на английском языке (2500 против 2396 данных); (ii) содержат сведения об экономических затратах, связанных с другими 249 инвазивными видами и 15 странами, и (iii) увеличивают оценку глобальных экономических потерь от биологических инвазий на 16,6% (214 миллиардов долларов США согласно данным из публикаций на языках, отличных от английского, против 1,288 триллионов долларов США согласно публикациям на английском языке). Дополнительно было получено 2712 сведений по экономическим потерям, пополнившим неанглийскую базу данных, которые не были напрямую сопоставимы с базой данных, построенной на основе данных из англоязычных работ; большинство этих сведений были получены непосредственно от практиков, что свидетельствует о ценности сотрудничества ученых и практиков.
- Более того мы показали, что игнорирование сведений по экономическим потерям из публикаций на языках, отличных от английского, приводит к значительным отклонениям в распределении затрат по географическим регионами, таксономическим группам, типам затрат и экономическим секторам. Затраты в регионах Европы, в особенности связанные с управлением, были скудно представлены в базе данных, основанной исключительно на данных из англоязычных работ.
- Таким образом, использование научных данных из работ, опубликованных на прочих языках, в совокупности с данными из англоязычных публикаций, является основополагающим для получения наиболее полных сведений о глобальных экономических потерях. Учет данных из неанглоязычных источников поможет в значительной мере уточнить оценки глобальных затрат, связанных с биологическими инвазиями. Это также имеет большое значение для эффективного управления, кооперации экспертов (ученых и практиков) и международного сотрудничества.

Figures / Рисунки

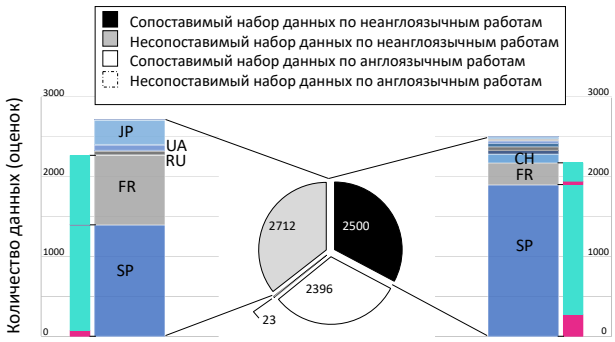


Рис. 1. Количество данных (оценок) по экономическим потерям от инвазионных видов из неанглоязычных работ и из работ, опубликованных на английском языке (база данных InvaCost), с выделением сопоставимых и несопоставимых наборов данных. Для каждого набора данных из неанглоязычных работ в столбчатых диаграммах приведено количество данных (оценок) по экономическим потерям и язык. Обозначения языков: SP, испанский; FR, французский; JP, японский; UA, украинский; RU, русский; CH, китайский. Во внешних столбцах показано количество данных (оценок) из Испании и Франции (бирюзовый цвет) и стран Южной Америки и Африки (пурпурный цвет).

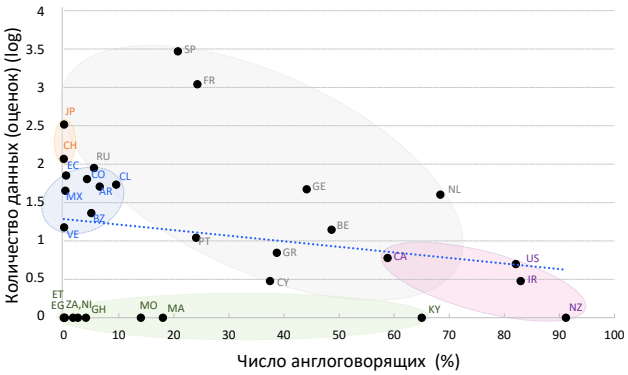


Рис. 2. Связь между количеством данных (оценок) по экономическим потерям от инвазионных видов из неанглоязычных работ и процентом англоговорящих в каждой стране. Линия регрессии отмечена синим цветом. Страны сгруппированы в соответствии с занимаемым ими векторным пространством и заключены в овальные области (доверительный интервал = 95% для соответствующих наборов данных); европейские страны отмечены серым цветом, африканские страны – зеленым, страны Южной Америки – синим, азиатские страны – желтым, англоговорящие страны – розовым. Обозначения стран: AR, Аргентина; BE, Бельгия; BZ, Бразилия; CA, Канада; CL, Чили; CH, Китай; CO, Колумбия; CY, Кипр; EC, Эквадор; EG, Египет; ET, Эфиопия; FR, Франция; GE, Германия; GH, Гана; GR, Греция; IR, Ирландия; JP, Япония; KY, Кения; MA, Мадагаскар; MX, Мексика; MO, Марокко; NL, Нидерланды; NI, Нигерия; NZ, Новая Зеландия; PT, Португалия; RU, Россия; SP, Испания; US, Соединенный штаты; VE, Венесуэла; ZA, Замбия.

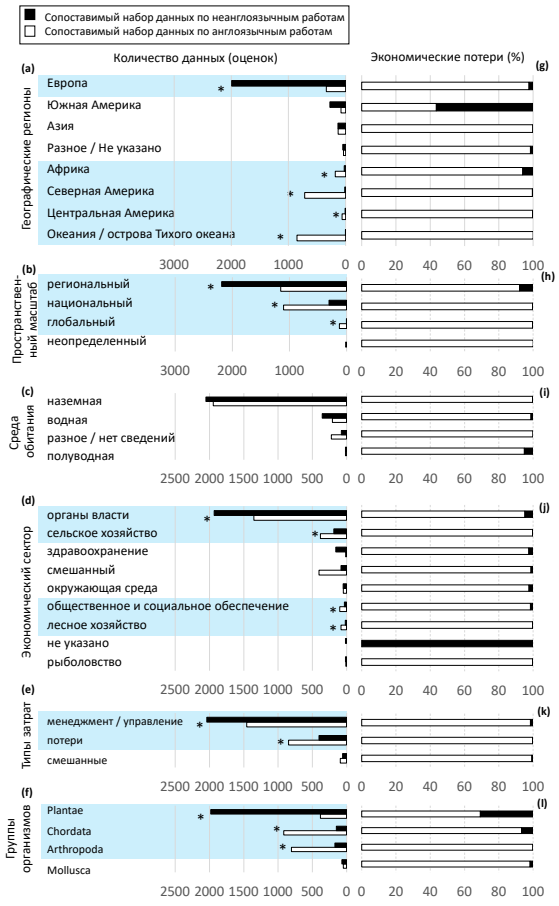


Рис. 3. Количество данных (оценок) и относительная величина экономических потерь от инвазионных видов из неанглоязычных работ и из работ, опубликованных на английском языке (база данных InvaCost), (a, g) по географическим регионам, (b, h) пространственному масштабу, (c, i) среде обитания, (d, j) экономическому сектору, (e, k) типу затрат и (f, l) основным группам организмов. Значимые различия по количеству данных (оценок) из неанглоязычных и англоязычных работ отмечены звездочками и выделены синим цветом.

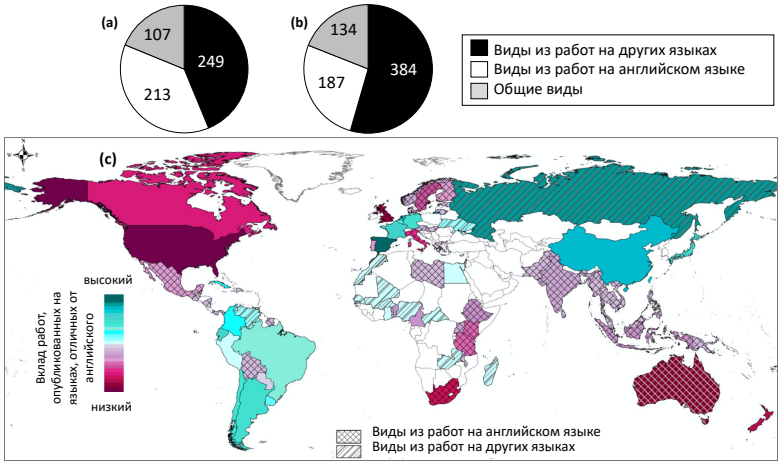


Рис. 4. Число общих и отличающихся видов-инвайдеров по данным из неанглоязычных и англоязычных работ (база данных InvaCost), с учетом (a) только сопоставимых данных (N = 569 видов) и (b) всех данных на языках, отличных от английского (N = 705 видов). (c) На карте показано число видов по сопоставимым данным из неангоязычной базы данных за вычетом данным из сопоставимой англоязычной базы данных по каждой стране (бирюзово-пурпурная шкала). Границы, отмеченные на карте, могут не отражать текущую политическую реальность.

SPANISH Title / Título

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- SP: **Las lenguas no inglesas enriquecen el conocimiento científico: ejemplo de los costes económicos de las invasiones biológicas.**

Authors / Autores

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / Traducido por los autores:
Liliana Ballesteros-Mejia / Elena Angulo

Abstract / Resumen en español:

- El uso exclusivo del inglés para divulgación de resultados de investigación puede afectar la comunicación entre investigadores y gestores, o políticos cuya lengua materna es diferente al inglés. Esta barrera en el conocimiento científico y en la transferencia de los datos puede potencialmente causar lagunas en el conocimiento y sesgos a la hora de estimar patrones globales en todos los campos de la ciencia.
- Para demostrar estos hechos compilamos datos sobre el costo económico de las invasiones biológicas a nivel global, a partir de documentación en quince idiomas diferentes al inglés, y los comparamos con datos recopilados en la base de datos InvaCost (i.e. el repositorio más actualizado sobre los costos de las invasiones biológicas a nivel mundial, en inglés).
- La comparación de las dos bases de datos (~7 500 entradas en total) reveló que las fuentes no inglesas: (i) capturan un mayor número de datos que si se usaran sólo fuentes inglesas (2 500 vs. 2 396 entradas); (ii) ofrecen datos para 249 nuevas especies y 15 nuevos países que no son reportados en inglés; (iii) incrementan las estimaciones globales en inglés de los costos de las invasiones biológicas en un 16.6% (US$ 214 mil millones de los 1.288 billones de la base de datos en inglés). La base de datos no inglesa incluye además de 2 712 entradas complementarias, que no son directamente comparables con los datos ingleses, ya que la mayoría fueron obtenidos a partir del contacto directo con los gestores, revelando así el valor de la comunicación entre investigadores y gestores.
- Demostramos además que las lagunas causadas por la omisión de los datos no ingleses, causaron sesgos significativos en la distribución de los costos, tanto geográficamente como taxonómicamente, al igual que en cuanto al tipo de costo y al sector que atañe. Los costos para Europa, a escala local, y particularmente relativos al manejo de especies invasoras, estuvieron sub-representados en la base de datos en inglés.
- Por lo tanto, combinar datos científicos en inglés con datos que proceden de otros idiomas es fundamental, y mejora la integridad de los datos. Además, mejora potencialmente la eficacia de las estrategias de manejo, la coordinación entre expertos (investigadores y gestores) y la colaboración entre países.

Figures / Figuras

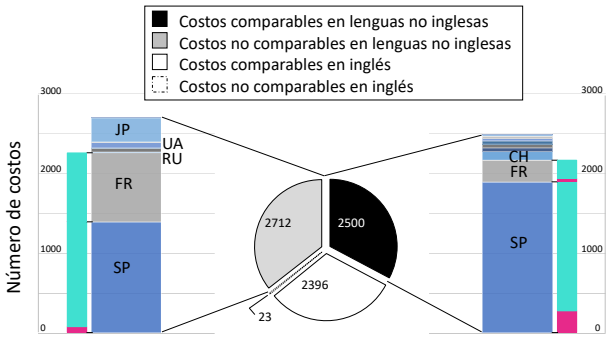


Fig. 1. **Número de entradas de costos económicos de especies invasoras en lenguas no inglesas, y en inglés (base de datos InvaCost), distinguiendo los conjuntos de datos comparables y no comparables.** Para cada conjunto de datos en lenguas no inglesas, el número de entradas por idioma están representados en los diagramas de barras. Idiomas mostrados: SP, Español, FR, Francés; JP, Japonés; UA, Ucraniano; RU, Ruso; CH, Chino. Para SP y FR, las barras turquesa y magenta distinguen las entradas de España y Francia (turquesa) de las de Sudamérica y los países francoparlantes de África (magenta).

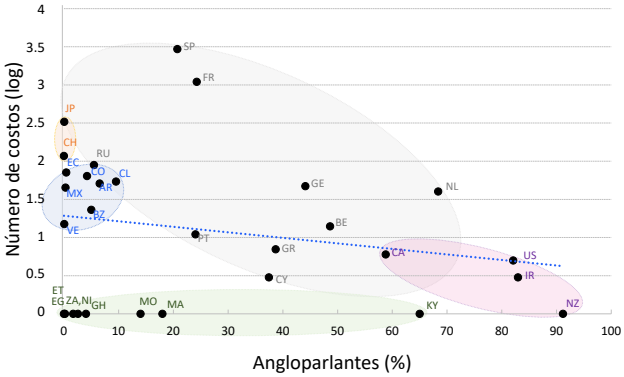


Fig. 2. **Relación entre el número de entradas de costos económicos de especies invasoras en lenguas no inglesas y el porcentaje de angloparlantes en cada país.** La línea de regresión está marcada en azul. Los países están agrupados según el área convexa de hull, teniendo en cuenta las elipses estándar (considerando los intervalos de confianza al 95% de sus datos): los países Europeos en gris, los Africanos en verde, los Sudamericanos en azul, los Asiáticos en amarillo y los de habla inglesa en rosa. Abreviaturas de los países: AR, Argentina; BE, Bélgica; BZ, Brasil; CA, Canadá; CL, Chile; CH, China; CO, Colombia; CY, Chipre; EC, Ecuador; EG, Egipto; ET, Etiopía; FR, Francia; GE, Alemania; GH, Gana; GR, Grecia; IR, Irlanda; JP, Japón; KY, Kenia; MA, Madagascar; MX, México; MO, Marruecos; NL, Holanda; NI, Nigeria; NZ, Nueva Zelanda; PT, Portugal; RU, Rusia; SP, España; US, Estados Unidos; VE, Venezuela; ZA, Zambia.

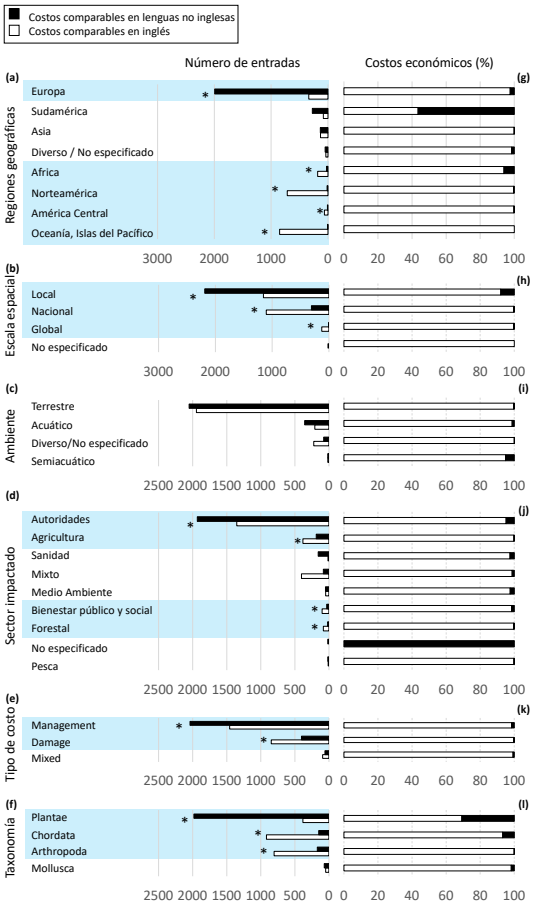
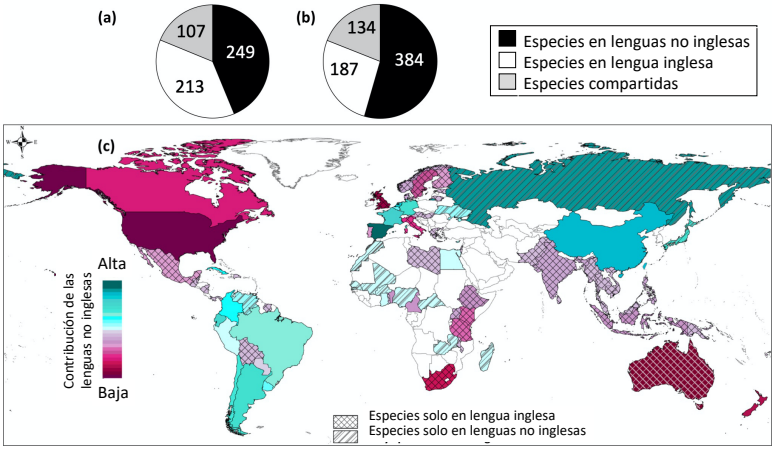


Fig. 3. **Número de entradas de costos (a,b,c,d,e,f) y costo relativo (g,h,i,j, k, l) de las especies invasoras en lenguas no inglesas y en inglés** (a partir de la base de datos InvaCost), distribuidas por (a,g) regiones geográficas donde el costo ocurre, (b,h) escala espacial del costo, (c,i) ambiente donde ocurre el costo, (d,j) sector impactado por el costo, (e,k) tipo de costo, y (f,l) grupos taxonómicos principales. Las diferencias significativas en el número de entradas entre la lengua no inglesa y el inglés están marcadas con asteriscos y destacadas en azul.

Fig. 4. **Número de especies compartidas o no entre los conjuntos de datos en lenguas no inglesas y en inglés** (InvaCost), considerando (a) sólo los datos comparables (n = 569 especies) and (b) todos los datos en lenguas no inglesas (n = 705 especies). (c) El mapa muestra el número de especies con las que el conjunto de datos en lenguas no inglesas contribuye al número total de especies del conjunto de datos en inglés por país (escala turquesa-magenta). Los países que tienen sólo especies en los conjuntos de datos en lenguas no inglesas están marcados con rayas diagonales y los países que tienen especies sólo en el conjunto de datos inglés están marcados con rombos. Las fronteras ilustradas en el mapa pueden no representar la realidad política actual.



Title / Заголовок

- EN: **Non-English languages enrich scientific knowledge: the example of economic costs of biological invasions**
- UK: **Неанглійські мови збагачують наукові знання: приклад економічних збитків від біологічних інвазій.**

Authors / Автори

Elena Angulo, Christophe Diagne, Liliana Ballesteros-Mejia, Tasnime Adamjy, Danish Ali Ahmed, Evgeny N. Akulov, Achyut Kumar Banerjee, César Capinha, Cheikh A. K. M. Dia, Gauthier Dobigny, Virginia G. Duboscq-Carra, Marina Golivets, Phillip Joschka Haubrock, Gustavo Heringer, Natalia Kirichenko, Melina Kourantidou, Chunlong Liu, Martin A. Nuñez, David Renault, David Roiz, Ahmed Taheri, Laura Verbrugge, Yuya Watari, Wen Xiong, Franck Courchamp.

Translated by the authors / Автори перекладів:

UA: Marina Golivets / Марина Голівець

Abstract / Резюме українською:

- Ми стверджуємо, що виключне використання англійської мови в наукових дослідженнях перешкоджає ефективній комунікації між науковцями та практиками й посадовцями, рідною мовою яких не є англійська. Цей бар'єр на шляху до обміну інформацією та знаннями потенційно веде до спотвореного розуміння глобальних закономірностей у всіх галузях науки.
- Щоб продемонструвати це, ми зібрали дані щодо глобальних економічних збитків від інвазійних чужорідних видів із неангломовних джерел (десять мов), і порівняли їх з еквівалентними даними, отриманими з англомовних джерел (InvaCost, найповніша база даних щодо глобальних збитків від біологічних інвазій).
- Порівняння обох баз даних (всього близько 7500 записів) показало, що неангломовні джерела: (i) охоплюють більший обсяг даних, ніж англомовні джерела (2500 проти 2396 записів); (ii) містять інформацію про 249 інвазійних видів і 15 країн, що не представлені в англомовних джерелах; і (iii) збільшують загальні збитки від біологічних інвазій на 16,6% (неангломовні – 214 млрд. дол. США, англомовні – 1,278 трлн. дол. США). Додатково, 2712 записів, не співставних з англомовними даними, були переважно отримані від практиків, що вказує на важливість співпраці між вченими та практиками.
- Більше того, ми показали, яким чином прогалини, спричинені ігноруванням неангломовних даних, призвели до значущих спотворень у розподілі збитків у просторі, по таксономічних групах, типах витрат та економічних секторах. Зокрема, в Європі збитки на місцевому рівні, найпаче пов'язані з витратами на управління, були значно недопредставлені в агломовних джерелах.
- Таким чином, одночасне використання англомовних і неангломовних джерел є вкрай важливим, адже це дозволяє збільшити повноту даних і зменшити ризик спотворення нашого розуміння збитків від біологічних інвазій на глобальному рівні. Це також потенційно дозволить покращити ефективність управління, координацію зусиль між експертами (вченими та практиками) та міжнародну співпрацю.

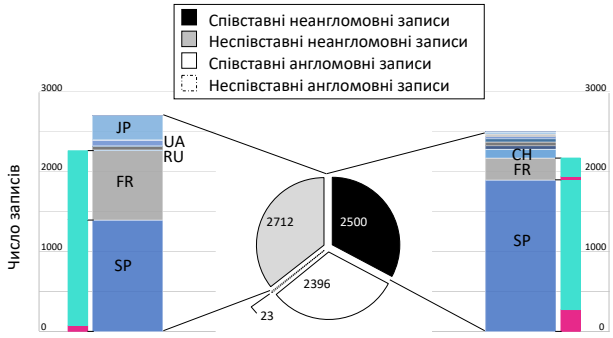


Рис. 1. Число співставних і неспівставних записів щодо збитків від інвазійних чужорідних видів неанглійськими мовами та англійською (база даних InvaCost). Розподіл записів за мовами показано на стовпчикових діаграмах. Мови: SP, іспанська; FR, французька; JP, японська; UA, українська; RU, російська; CH, китайська. Для SP і FR, бірюзові стовпці показують дані з Іспанії та Франції, пурпурові – з країн Південної Америки та Африки.

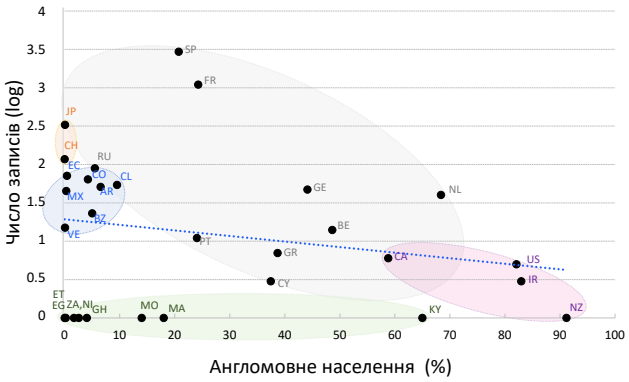


Рис. 2. Зв'язок між числом записів щодо збитків від інвазійних чужорідних видів неанглійськими мовами та часткою англомовного населення в країні. Лінію регресії показано синім пунктиром. Країни згруповано відповідно до площі їхнього опуклого корпусу; групи окреслено стандартними еліпсами, що охоплюють 95% довірчі інтервали. Країни Європи показано сірим кольором, Африки – зеленим, Південної Америки – синім, Азії – жовтим, англомовні країни – рожевим. Скорочені назви країн: AR, Аргентина; BE, Бельгія; BZ, Бразилія; CA, Канада; CL, Чилі; CH, Китай; CO, Колумбія; CY, Кіпр; EC, Еквадор; EG, Єгипет; ET, Ефіопія; FR, Франція; GE, Німеччина; GH, Гана; GR, Греція; IR, Ірландія; JP, Японія; KY, Кенія; MA, Мадагаскар; MX, Мексика; MO, Марокко; NL, Нідерланди; NI, Нігерія; NZ, Нова Зеландія; PT, Португалія; RU, Росія; SP, Іспанія; US, Сполучені Штати Америки; VE, Венесуела; ZA, Замбія.

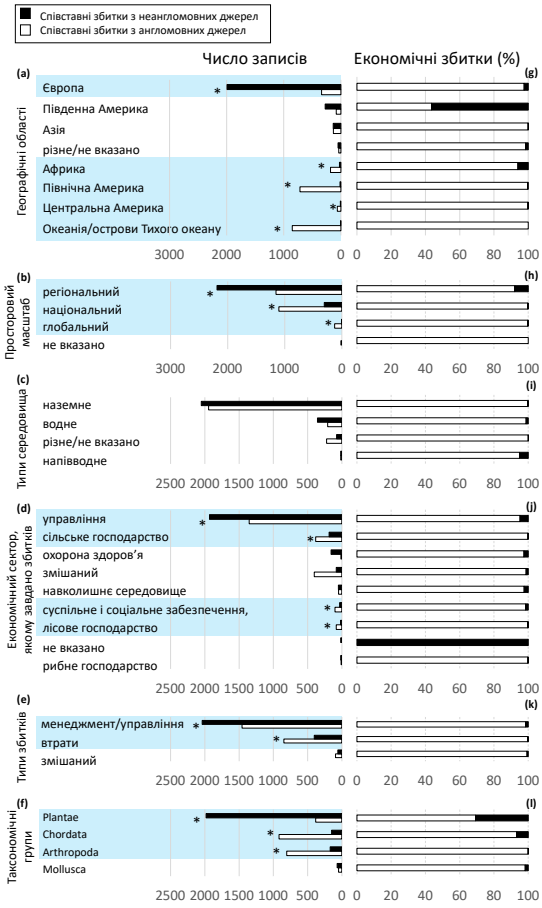


Рис. 3. Розподіл записів (a,b,c,d,e,f) та відносних сумарних значень (g,h,i,j,k,l) економічних збитків від інвазійних чужорідних видів у неангломовних джерелах і англомовних джерелах (база даних InvaCost), за (a,g) географічним походженням збитків, (b,h) просторовим масштабом збитків, (c,i) типами середовища, (d,j) економічними секторами, (e,k) типами збитків і (f,l) головними таксономічними групами. Значущі різниці між неангломовними і англомовними джерелами позначені зірочкою та виділені блакитним кольором.

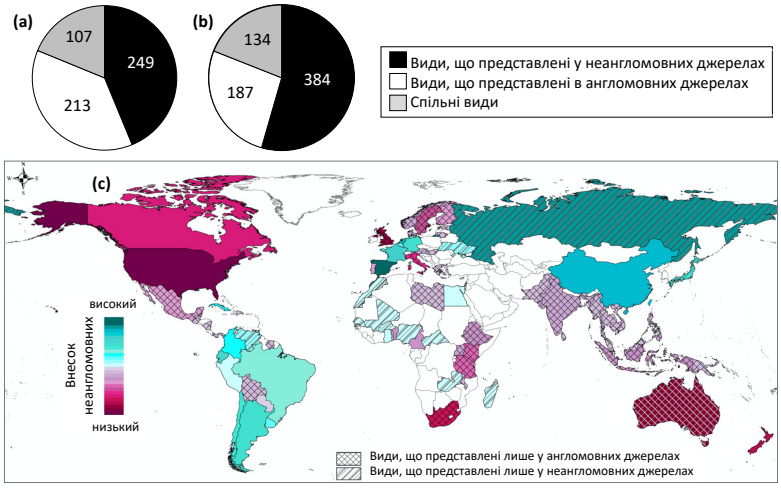


Рис. 4. Число спільних та унікальних видів у неангломовних джерелах і англомовних джерелах (база даних InvaCost), із врахуванням (a) лише співставних даних (N = 569 видів) і (b) всіх даних із неангломовних джерел (N = 705 видів). (c) На карті показано частку видів, що представлені лише в даних із неангломовних джерел, для різних країн (пурпурово-бірюзова шкала). Країни, для яких є лише співставні дані з неангломовних джерел і англомовних джерел, позначені заливкою діагональними лініями та сіткою, відповідно. Вказані кордони країн можуть не відповідати сучасним політичним реаліям.