

#### **IUCN/SSC Invasive Species Specialist Group**

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# COMPARING U.S. ANIMAL IMPORT LIST TO GLOBAL INVASIVE SPECIES DATA

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# Introduction

Knowing which species have proven to be invasive, how they spread and where they occur can facilitate more effective prevention activities. "Only one factor has consistently high correlation with invasiveness: whether or not the species is invasive elsewhere"<sup>1</sup>. Conservation agencies and national and regional implementation agencies for international agreements addressing invasive species have expressed a need for this information.

Panetta *et.*  $al^2$  (2001) pointed out that while development of the World Wide Web has been a tremendous boon to the sharing of information about invasive species, "...*the lack* of a long-term commitment of any international agency to maintaining a universal data base for invasive species is hindering the full utilisation of this approach; rectification of this deficiency is a matter of the highest priority."

The IUCN SSC Invasive Species Specialist Group (ISSG) has been developing plans for a Global Register of Invasive Species (GRIS) ever since work began on the Global Invasive Species Database  $(GISD)^3$  in 1998. We saw that there was a need for a list of all known invasive species with annotations providing evidence of their invasiveness to

<sup>2</sup> Panetta, F.D., Mackey, A.P., Virtue, John G., Groves, R.H. (2001). <u>Weed risk assessment: core issues and future directions</u>. In Weed Risk Assessment (2001) eds. Groves, R.H., Panetta, F.D., Virtue, John G. CSIRO, Victoria, Australia.

<sup>3</sup> The <u>Global Invasive Species Database</u> (<u>www.issg.org/database</u>) is a free online source of information about invasive alien species. It covers all taxonomic groups from micro-organisms to animals and plants, in all ecosystems (terrestrial, freshwater and marine).

<sup>&</sup>lt;sup>1</sup> Wittenberg R. and C. M.J.W., Eds. (2001). <u>Invasive Alien Species: A Toolkit of Best Prevention and</u> <u>Management Practices</u>. Wallingford, Oxon, UK, CAB International.

complement the comprehensive information we were providing for a limited number of invasive species in the GISD and to support pre-import screening for proposed imports.

Independently, Peter Jenkins, from Defenders of Wildlife, in Washington, DC (hereafter referred to as Defenders), was looking for ways to identify "potentially risky" species on a list of approximately 2,300 scientific names of non U.S.-native animal species (all taxa, but primarily fish, reptiles, molluscs, birds, mammals and insects) that were imported into the United States in the period 2000-2004, according to government records. In recognition of the need to develop tools to improve the analysis and regulation of potentially invasive species in international trade, he provided sufficient funding for ISSG to build a prototype GRIS.

### Methods

With the support of UK bioinformatics and taxonomy expert, Charles Copp, we completed a prototype GRIS in March 2007 using a standalone MS Access database. The prototype compiles and integrates lists of taxon names and associated information from multiple sources. All taxon names are linked to records of occurrence, native/alien status and invasiveness in specific geographical areas, along with associated information such as impact, spread or abundance. Annotated reports containing this information are available for individual taxa.

The GRIS maintains links between this information and metadata about the various data sources. Sources include checklists generated by national and regional collection and observation databanks around the world, invasive species databases and programmes, journal articles, and individual experts.

Records of invasiveness must be related to a specific geographical location and are derived either from explicit statements of invasiveness in the data, statements of concern about impacts, spread or abundance, or where the data includes records of prevention or management activities taking place. The following Biostatus<sup>4</sup> terms trigger a 'yes' for 'GRIS Risk', indicating that the taxon has a record of invasiveness:

1. Any of the following 3 'Occurrence' terms: Eradicated Border intercept Present/controlled

2. Any of the following 3 'Invasiveness' terms: Invasive Not specified but clearly of concern Not specified but ISAPorM<sup>5</sup> recorded

<sup>&</sup>lt;sup>4</sup> Biostatus defines the status of a particular taxon in a particular location and includes parameters such as presence/absence, native/alien status and invasiveness. The parameters of biostatus are currently being reviewed as part of the Global Invasive Species Information Network (GISIN) project.

<sup>&</sup>lt;sup>5</sup> The abbreviation ISAPorM refers to Impacts, Spread, Abundance, Prevention or Management.

While 'GRIS Risk' identifies species with an <u>actual</u> history of invasiveness, there is also an option to identify <u>potential</u> invasives, which are labelled 'Potential GRIS Risk'. Records of potential invasiveness are usually the result of risk assessment procedures and are usually generated by national or regional agencies. They can not be assigned to a specific geographic location because we can not be sure if the assessed taxa are present there or not. For this reason they are assigned to the geographical term 'Earth' in GRIS. Another option is to request an annotated report for alien (introduced, exotic, nonindigenous, etc.) species, if the user wishes to use this criterion for risk assessment without reference to invasiveness.

The GRIS prototype includes controlled data entry and data browsing, and a taxonomic dictionary with tree views to navigate lists and look at contents. Taxon names, synonyms and common names can be added or deleted in the taxon editor.

The synonymy is marked by taxa having the same meaning key with the term marked as 'preferred' being used as the listing term. New terms are added and linked by their meaning key, resulting in a self-correcting system that improves over time. However, it is important to bear in mind that GRIS is not intended to be a taxonomic database. Whilst every effort was made to check scientific names and list all synonyms, annotations indicating invasiveness were our prime concern. When relating annotations from different sources to a taxonomic entity (e.g. a species), it is possible that another, or several other names can have the same meaning (i.e. they refer to the same species). Our prime concern was that all of those names can access the correct annotations.

The GRIS geographic hierarchy has been used by the GISD since 1998 and is relatively robust. Geographic terms are sorted by type and have hierarchies indicated by a parent key. On the other hand, building the taxonomic hierarchy has yet to be completed. While a lot of time has already been spent on reviewing taxon lists, they will be further reviewed to make sure that the meaning keys correctly identify synonyms.

With a little more development, it should be possible to extract records from any point in the taxon or geographic hierarchies to include all 'children' (i.e. all terms with the same parent term) and to develop a tree view report generator that can make an annotated list for any taxon or taxon group (e.g. one mollusc or all molluscs). A 'report wizard' that will generate any combination of data in XML reports will also be developed.

GRIS has been structured so that all the essential information can be managed in a relatively simple way whilst ensuring validation of terms and names. All efforts were made to ensure that GRIS information can be made compatible with other data models used for biological recording.

### Lists and sources used

It was clear that with limited resources and time available, it was necessary to limit the scope of the project. Defenders of Wildlife and ISSG agreed to limit the searches for records of harmful or potentially harmful species to 16 countries selected by Defenders, plus records from the Global Invasive Species Database and any other authoritative databases and scientific sources that list potentially invasive or harmful non U.S.-native animals readily available to ISSG. The 16 countries are: Australia, Canada, China,

France, Indonesia, Mexico, New Zealand, Philippines, Russia, Singapore, South Africa, Taiwan, Thailand, Trinidad and Tobago, United Kingdom, and Vietnam. Defenders chose these countries primarily because they were either leading sources of U.S. animal imports or were known to have accessible data on invasive species.

More than 50 sources were surveyed and processed, with preference given to data relating to the Kingdom Animalia in response to Defenders' particular requirements. A large proportion of the datasets were held in the ISSG library, which has been maintained since 1998. This information was supplemented by a web survey which identified new information sources and updates and revisions to existing information. Approximately 20% of all the sources used can be characterized as global, regional and thematic (e.g. marine invasives). Another 10% of the sources were national databases and checklists. The largest proportion of data sources (70%) were reports, journal articles and responses to requests for information from ISSG's large, informal, global network of experts and practitioners.

Our observations indicate that the global, regional, thematic and national datasets provided approximately 75% of all GRIS records. Whilst reports, journal articles and experts only provided 25% of GRIS records, they helped to redress geographical gaps (e.g. Asia) and taxonomic gaps in the larger datasets. For example, few of the larger datasets included records of invasive reptiles.

The nature of the data available varied from country to country and source to source. Key challenges included understanding the criteria used by different sources to characterize the biostatus of taxa and identifying and extracting the impact, spread, abundance, prevention and management information we required. Some higher taxonomy was available in data sources for most taxa, notably at the Phylum and Family level, but the effort to complete all of the taxonomic information is ongoing.

Source metadata, references and the taxonomic, geographic and associated information were collected using a standard template in MS Excel. Some sample data were used to test the tool and then the remaining records were uploaded.

### Results

The GRIS database currently contains 38,606 geographic records for 16,051 taxa. Of these taxa, 1,453 species have records of invasiveness (GRIS risk=yes) and 14,121 taxa are considered potentially invasive according to sources that have conducted risk assessments (Potential GRIS Risk=Yes). Most of the potentially invasive species were identified by a single source; the Unwanted Organisms Register published by the Ministry of Agriculture and Forestry (MAF), New Zealand. <sup>6</sup> This resource names any organism a chief technical officer from MAF believes capable of causing unwanted harm to any natural and physical resources or human health.

GRIS reports include an alphabetical list of all GRIS taxa, a list of introduced taxa, a list of invasive taxa, a list of potentially invasive taxa and a combined list. There are also

<sup>&</sup>lt;sup>6</sup> See the Unwanted Organisms Register at http://www.biosecurity.govt.nz/commercial-imports/unwantedorganisms-register-

individual lists of taxa from different sources, a combined list of all sources and their taxa, and a list of sources and records for a single taxon.

The primary deliverable was an annotated list of potentially harmful species on the Defenders list of species imported to the U.S. in the period 2000-2004. The GRIS prototype identified 191 species on the Defenders list that are invasive and/or potentially invasive. These 191 species names are sorted by higher taxonomy with annotations that include:

DataSourceName ListDate PotentialGRISRisk GRISRisk Occurrence Origin Invasiveness ListInvasiveTerm (terms used by the original source) PopulationAbundance PopulationTrend Impact IASType (biodiversity, agriculture, livelihoods, human health, mixed, unknown) Management (records of prevention or management activities)

In a parallel effort, Defenders themselves identified 190 species on the U.S. import list that are invasive, potentially invasive, and/or disease risks, relying mostly on U.S. sources.<sup>7</sup> The fact that only 74 species appear on both the GRIS and Defenders lists may be partially explained by the different geographic scope of the two efforts (a selection of non-U.S. sources versus mostly U.S. internal sources, the latter including extensive U.S. disease risk data).

While the U.S. sources used by Defenders point to invasive, potentially invasive, and/or disease risk outcomes for 190 (8.5%) of the 2,242 non-native species imported there, the international sources used by GRIS indicate that an additional 117 species (i.e., 191 less the 74 species in common) may eventually become invasive in the U.S. based on their records of invasiveness elsewhere.

Together, the two efforts identified a total of 307 species on the Defenders list as being invasive, potentially invasive, and/or disease risks somewhere in the world. That represents 14% of the non-native animal species imported to the U.S. in the period 2000-2004.

### **Future developments**

Future development of GRIS include its evolution into a web-based application and reporting site which could be linked to sources of taxonomic names and observation data such as Global Biodiversity Information Facility (GBIF) and Species 2000, and to

 $<sup>^7</sup>$  The term "and/or" is used because several species' annotations include both invasiveness and disease risks.

sources of invasive species data and information such as the Global Invasive Species Information Network (GISIN) and the Global Invasive Species Database (GISD).

The online GRIS tool will be able to capture location data for known invasive species from sources such as GBIF, integrate their data with alien/native status data and serve it with protocols developed by the Taxonomic Database Working Group (DiGIR and TAPIR), thereby making it available to GBIF. This will give users of GRIS access to better distribution data, and users of GBIF will get access to alien/native status data. GRIS data will be provided to GISIN, and data from other GISIN providers will be used to enhance GRIS distribution data.

The GRIS database currently contains the names of many thousands of the world's known invasive species. But, it needs support if it aims to grow to a point where the Convention on Biological Diversity (CBD), presumably in collaboration with the Global Invasive Species Programme (GISP), can identify its use as a valuable tool for member nations to use in conducting pre-import screening of proposed imports. This aim fits with recent CBD decisions.

Paragraph 12 of the CBD COP 8 decision in 2006, "Urges Parties and other Governments to communicate to potential importing countries relevant information about particular species that are subject to export and are known to be potentially invasive, through, for example, web-based databases, alert lists or other appropriate information-sharing mechanisms at global and regional levels, and to provide information that is relevant for risk analysis and other proactive measures as appropriate to prevent or minimize effects of invasive alien species in other countries, in accordance with Article 3 of the Convention" and paragraph 61, "Urges Parties and other Governments to share information on domestic occurrences of alien species that may be invasive elsewhere, through appropriate information-sharing mechanisms."<sup>8</sup>

GRIS can address plants as well as animals. In the International Plant Protection Convention (IPPC) context, the plant pest risk analysis process (PRA) provides a scientific basis for determining appropriate national phytosanitary measures. The IPPC's mandate, and hence that of its national and regional implementing agencies, includes essentially all plants and plant pests that would be considered under the CBD as invasive alien species. The draft revision of International Standard for Phytosanitary Measures (ISPM) No. 2, on Pest Risk Analysis, includes "indicators for determining if an organism may be a pest" and states that "the early step of determining whether an organism is a pest or not is sometimes referred to as pre-selection or screening." "Predictive indicators of an organism are characteristics that, if found, would suggest the organism may be a pest." It goes on to provide "examples of indicators to consider", including "previous history of successful establishment in areas of new introduction" and "detection in situations where harm to plants, beneficial organisms, etc. has been encountered." Moreover, the revised ISPM specifically states that "The primary indicator that a plant species or cultivar may become a threat to ecosystems, habitats or plant

<sup>&</sup>lt;sup>8</sup> Report of the Eighth Meeting of the Parties to the Convention on Biological Diversity, decision VIII/27, at p. 70 and Annex 1, pp. 316-323, UNEP/CBD/COP/8/31, 2006; online at: www.biodiv.org/doc/meetings/cop/cop-08/official/cop-08-31-en.pdf

species in the PRA area is the existence of reports of such harm having occurred elsewhere." GRIS would significantly improve access to this kind of information.

These CBD and draft IPPC statements confirm the need to develop GRIS further to ensure that all such records of harm are widely and freely available internationally.

The Defenders of Wildlife demonstration project for U.S. animal imports shows that, even with limited content, GRIS can deliver relevant information. It can also provide a valuable service to countries as both a repository for their invasive alien species data and as a resource for conducting pre-import screening for proposed imports, thus helping to reduce the spread and impact of invasive species.

The basic elements needed to steadily grow, update and validate GRIS content, make it available online to regulators, international programs and researchers around the world, and to improve its functionality are estimated to cost USD 210,000. This level of support would ensure that GRIS would rapidly move to a point where it contained globally representative data that would be relevant to most potential users.

Operating costs will reduce over time as the infrastructure matures and automation reduces the labour intensive components. However, it is important to realise that since fewer than 50 countries have online invasive species information systems at present, and many countries have made limited progress towards surveying for invasive species and collating, analysing and sharing their IAS data and information, the manual collection and digitisation of content from diverse sources for GRIS would have to continue for some extended period.

In conclusion, if the GRIS database receives an appropriate level of support in the future, it will allow the CBD and GISP to identify the use of GRIS as an accepted international best practice, perhaps even as a recommended standard, for nations to use in conducting pre-import screening for proposed imports of alien animals and plants.

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