

## Some tools for international exchange of information about prior invasiveness, and why they are critical to pre-import screening

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Invasive alien species (IAS) are one of the most significant drivers of environmental change worldwide, causing damage to infrastructure, amenity and human health values, as well as extinctions and severe modifications of ecological relationships. Loss of biodiversity has itself resulted in further negative effects on peoples' livelihoods, including reduced ecosystem services and changes in traditional/cultural practices and values<sup>1</sup>.

There are numerous references to the importance of information exchange in the fight against IAS. One of the supporting activities in the Programme of Work on Island Biodiversity as adopted by COP8 of the CBD (Dec VIII/ 1, appendix – Goal 6, activity: 6.1.1.3) is to; “*Collect baseline data on invasive alien species introductions, and support regional and global databases providing comprehensive information on invasive species.*” The practical steps required to achieve effective collection and dissemination of information are often poorly understood. Existing international information exchange mechanisms are, in effect, already implementing proposed priority actions and can provide immediate, low-cost support for local, national and regional invasive species programmes. However the role that these tools and services play is often taken for granted. They will need sustainable financial support to continue in this role. Given that similar IAS problems are a continuing problem in different parts of the world, sharing information and expertise internationally is critical for all stages of management of IAS, from prevention (including risk analysis) to eradication, containment and control. This presentation will focus on the exchange of IAS information that is most relevant for early warning and risk analysis, paying particular attention to tools that are primarily of relevance to biodiversity and livelihood impacts of invasive species.

Risk analysis plays an important role in preventing the spread of IAS across national boundaries by underpinning decision-making in compliance with international trade-related obligations. The crucial question for risk analysis is how to predict which alien species would become problems if they were introduced somewhere, and which would remain innocuous. Biological invasion is an interaction between an introduced alien species on one hand and the receiving environment on the other hand. Hence, two very different questions apply in risk analysis for intentional introductions: 1) is this species likely to have the “innate” capability to develop invasiveness? and 2) is it likely to become invasive in a particular receiving environment?

Elsewhere in this workshop the role of species traits and climate or habitat suitability have been discussed, especially with regard to identifying the next as-yet-unknown invasive species, but the ability to use these factors to predict “intrinsic” ability to develop invasiveness remains elusive. Indeed, it has been described by Hal Mooney as “*the holy grail of invasion biology*”. However, “[Only] one factor has consistently high correlation with invasiveness: whether or not the species is invasive elsewhere” (Wittenberg and Cock 2001). Prior invasiveness provides risk analysis practitioners with a definite answer to the question; “Is this species likely to have the ‘innate’ capability to develop invasiveness?” That is why it is of critical importance that knowledge about the prior invasiveness of species anywhere in the world is widely available. We can use this knowledge to launch a full risk assessment to determine if it is likely to be invasive in a particular biogeographical context.

Records of prior invasiveness can be used for screening, risk assessment, writing import health standards, planning border control and quarantine measures, prioritising management activities, and tagging collection and observation data so that it can be leveraged for applications such as potential distribution modelling. A number of tools that provide access to globally sourced information on prior invasiveness are briefly described.

### Global and regional-scale IAS information exchange tools and services:

#### 1) The Global Register of Invasive Species

The prototype Global Register of Invasive Species (GRIS) is a universal reference list of the names of known IAS in MS Access. It currently contains the names of 16,051 invasive species along with 38,606 annotated geographical records of their introductions and/or invasions. It can be used for pre-screening proposed imports, prioritising candidates for risk analysis (e.g. when resources are limited), as a source of information for risk assessment and for prioritising management activities. GRIS was developed with support from Defenders of Wildlife, for whom it was able to identify 302 (13.5%) species with records of invasiveness or disease risk amongst 2,241 animal species imported into the United States between 2000 and 2005 as a proof of concept<sup>2</sup>.

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<sup>1</sup> McNeely J. A., H.A. Mooney, L.E. Neville, P.J. Schei, J.K. Waage (editors). 2001 *Global Strategy on Invasive Alien Species* Published by IUCN, Gland, Switzerland, on behalf of the Global Invasive Species Programme (GISP). x + 50pp.

<sup>2</sup> Consultant's Report to Defenders of Wildlife, March 2007

[http://www.defenders.org/resources/publications/programs\\_and\\_policy/international\\_conservation/broken\\_screens/comparing\\_u.s.\\_a](http://www.defenders.org/resources/publications/programs_and_policy/international_conservation/broken_screens/comparing_u.s._a)

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).

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 so that users can exercise their own judgement as to the reliability of sources. Data sources include checklists, databases, scientific journals, technical reports, invasive species programmes and individual experts. Records of invasiveness are 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. 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.

With adequate funding, GRIS is expected to evolve into a free web-based application and reporting site linked to nomenclatural databases for validation of species names. Web services will expose GRIS data to potential consumers such as the Global Biodiversity Information Infrastructure (GBIF) and harvest invasive species data from the Global Invasive Species Information Network (GISIN), which is described below. Funding is sought for the next immediate step in development of GRIS, which is to improve its geographic and taxonomic representativeness by importing a number of large datasets (Fig 1.).

## **2) The Global Invasive Species Database**

The Global Invasive Species Database (GISD) was designed by practitioners to provide support for awareness raising, inventory and response, including capacity building and site-based activities. It delivers detailed peer reviewed biological, ecological and management information about more than 500 of the world's worst IAS, tracking where they occur, their status, how and when they were introduced and their impacts. It also helps share lessons learned by disseminating case study information from eradication and control projects. Each GISD profile includes the contact details of experts and a full bibliography. Information about cause, route and vector of introduction can be used for effective pathway management, evidence of impacts can be used to estimate potential damage, and global distribution data indicates potential sources of infestation. Images, descriptions and identification tools are needed for early detection and rapid response, and access to expertise is especially important in places with limited resources.

This dynamic information exchange tool is strongly supported by thousands of expert contributors and a very broad user community, but it does not receive adequate financial support. More than 2,500 volunteer experts have contributed to the GISD to date, but a great deal of information they provide can not be processed, reviewed and presented due to lack of funds.

The GISD will be integrated with GRIS when funding permits, providing a resource which can grow vertically, in terms of invasive species names, and horizontally, in terms of detailed information about each species, and the combined resource will be regularly and automatically updated with data from data Global Invasive Species Information Network (GISIN) providers (Fig. 1). The GISD has an annual budget of USD 230,000 and receives an average of 1,100 unique visitors per day (75,000 hits per day). It is available at [www.issg.org/database](http://www.issg.org/database) and mirrored by our longstanding partners at the National Biological Information Infrastructure (NBII) of the US Geological Survey at [www.invasivespecies.net/database](http://www.invasivespecies.net/database) The GISD is also available in CD-ROM format for use 'in the field' or in parts of the world where access to the internet is slow, unreliable or limited.

## **3) The Invasive Species Compendium**

In 2001 CABI's Compendia programme consortia identified a need for a Compendium on Invasive Species in recognition of the threat posed by invasive species to the global economy and environment which coincided with a similar recognition by the US National Invasive Species Management Plan. A preliminary version of the Invasive Species Compendium (ISC) will be launched in July 2008. It is intended to be a time-saving encyclopaedic, interactive database that draws together scientific information on all aspects of invasive species. It will be designed to help a wide variety of users to save time, by providing instant access to vital information, prepare lecture notes, reports, presentations and public information resources, compile maps, graphs and tables and perform statistical analyses, teach/train/study, advise others and carry out risk analysis. CABI's long-standing expertise in invasive species makes it ideally placed to develop this resource, in partnership with other expert organisations, such as ISSG who are key providers of biodiversity related content to the ISC. The US Department of Agriculture is a lead partner with CABI in the project.

#### **4) The Global Invasive Species Information Network**

The Global Invasive Species Information Network (GISIN) is developing a system for the exchange of invasive species data and information between local, national, regional and international databases over the Internet. The GISIN project, which is lead by Annie Simpson at the National Biological Information Infrastructure (NBII), is making good progress thanks to a significant voluntary effort and in spite of low levels of funding. It needs better financial support if it is to fully realise its potential. The basic components of GISIN are a portal that allows users to search across providers, a registry of data providers, and a specification for a web services protocol<sup>3</sup> for exchanging basic IAS data types between computers. The basic data types are IAS observation data; species profile URLs; biostatus (concepts for presence/absence, native/alien and invasiveness); management status; impact status and dispersal status. The specification uses existing standards for species names and location data. At the first data providers' workshop (2-5 June 2008) at the University of Georgia in Athens, USA, nine IAS data providers with different geographic and thematic foci will use the GISIN web services protocol to link their databases to GISIN.

#### **5. DAISIE**

Delivering Alien Invasive Species Inventories for Europe (DAISIE) is an example of a regional resource that provides a 'one-stop-shop' for information on biological invasions in Europe to help those tackling the invasive species challenge. The general objectives of DAISIE are to create an inventory of invasive species that threaten European terrestrial, fresh-water and marine environments, to structure the inventory to provide the basis for prevention and control of biological invasions through the understanding of the environmental, social, economic and other factors involved, to assess and summarise the ecological, economic and health risks and impacts of the most widespread and/or noxious invasive species, and to use distribution data and the experiences of the individual Member States as a framework for considering indicators for early warning. You can search DAISIE for information on 8,996 alien species occurring in Europe, or one of the 1598 experts on biological invasions in Europe, or search regions to explore the alien species threats across Europe, for 63 countries/regions (including islands) and 39 coastal and marine areas. Species accounts for these species provide information on their biology and ecology, habitat and distributions (including detailed maps), introduction pathways, invasion trends, impacts and management methods including ways of prevention. DAISIE will become a GISIN data provider.

#### **6) I3N**

I3N is the invasive species thematic network of the Inter-American Biodiversity Information Network (IABIN).<sup>4</sup> I3N is using World Bank GEF funds to promote the standardization of invasive species information tools in the western hemisphere. NBII coordinates I3N, but Sergio Zalba (Argentina) and Silvia Ziller (Brazil) are the developers and trainers in the use of I3N tools. I3N will share the tools (Access database, Microsoft Server Web template, and manuals in Spanish, English, or Portuguese) with anyone who requests them, but so far has funding to provide help desk support only to I3N member countries (in the Americas). I3N's latest addition to the suite of freely-available tools is a beta Spanish version of a Risk Assessment and Pathway Analysis Tool in Microsoft Excel, with manuals and a PowerPoint presentation, freely downloadable. English and Portuguese versions are in development. These tools are designed to work using the information provided in the I3N information systems and to help decision makers prioritize their response to IAS.

#### **7) Aliens-L and other list servers**

A helpful contribution to information exchange on IAS can be achieved through the use of list servers. For example, a message posted on the well-established Aliens-L<sup>5</sup> list server along the lines of "there is some deliberation about plans to use alien species 'X' for purpose 'Y' in our country or region will usually flush out several responses if the species in question has been problematic elsewhere. Another list server with an Asia-Pacific regional range and more of an agricultural pest and weed emphasis is PestNet<sup>6</sup>. It offers a preliminary species identification service using expert taxonomists to identify pest and weed species from users' images. List servers may be lacking in some aspects of consistency, standardisation, and quality control, but they offer an important contribution to empowerment and horizontal information transfer (e.g. practitioners helping each other and others) because of their great flexibility and their ability to deal quickly with ad-hoc, time-critical issues.

#### **8) How the systems fit together: A Comprehensive Invasive Species Information System (CISIS)**

The GISD and GRIS will be key data providers to GISIN, particularly for information they provide from regions without online databases and for material they digitise that would otherwise be unavailable on the internet. In turn, the GISD and GRIS will use GISIN data providers as a source of invasive species information and updates from countries that have online IAS databases. I3N is helping to increase the number of countries that have online IAS database by providing a model I3N database, plus training and support. CABI have been informally invited to participate in the proposal. The draft GISIN web services protocol is the key to linking these systems with local, national and regional online IAS databases.

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<sup>3</sup> The draft GISIN web service protocol is available at:

<http://www.niiss.org/cwis438/websites/GISINTech/Documentation/ProtocolSpecification.html?WebSiteID=5>

<sup>4</sup> IABIN: <http://www.iabin.net>

<sup>5</sup> To subscribe, send a blank email to: [aliens-l-join@indaba.iucn.org](mailto:aliens-l-join@indaba.iucn.org)

<sup>6</sup> To subscribe, send a blank email to: [PestNet-subscribe@yahogroups.com](mailto:PestNet-subscribe@yahogroups.com)

The IUCN SSC Invasive Species Specialist Group (ISSG) and its partners are developing a proposal aimed at securing GEF funding for a Comprehensive Invasive Species Information System (CISIS) that leverages the strengths of existing global-scale initiatives and works closely with partners to improve services and address gaps. While many IAS are cosmopolitan, and some seem ubiquitous, most IAS are unique to a particular region or regions for biogeographical and historic reasons. However, with fewer than 30 of the world's countries possessing online IAS information systems, it is clear that there is a lack of readily available data about the IAS impacting most parts of the world. It is important to know more about these invasive species because, with increasing global movements of people and products, it is probably only a matter of time before they become somebody else's invasive species. Information about these invasions does exist in checklists, scientific journals, technical reports, etc. but it is widely dispersed and difficult to access.

After 8 years of creating invasive species profiles, ISSG has the skills and infrastructure needed to address these gaps by locating and synthesising information and using networks of experts and practitioners for peer review. ISSG monitors IAS networks to access the latest information and maintains an extensive electronic library of IAS information. ISSG engages with IAS practitioners and programmes at all levels from local capacity building (through coordination of the Cooperative Initiative on Invasive Alien Species on Islands<sup>7</sup>) to providing technical advice and support for regulation, policy and mainstreaming IAS issues at international fora. ISSG is fortunate that many experts and programmes share important IAS datasets with us and we have a good track record of working collaboratively.

The CISIS proposal will highlight the massive voluntary effort that has produced today's invasive species information systems and data provider networks, identify priorities and gaps, and seek better funding to sustain and improve current efforts. CISIS will include support for those countries that want I3N to help them build a network of contributors and a national invasive species database. For those countries that choose not to, CISIS will include dedicated funding to create detailed information about their particular invasive species in the GISD and GRIS. Global benefits accrue from these efforts because many invasive species impact multiple countries and one country's current problem can be another's potential next threat. CISIS will include a thematic information resource (for high-level information such as equipment suppliers, public awareness materials, identification and taxonomic services, donor information, contact list, etc.) and an advice and referral service such as that operated by the IUCN SSC Invasive Species Specialist Group (ISSG). CISIS will be the subject of a 'Knowledge Café' event at the World Conservation Congress in Barcelona in October 2008.

### **The Conservation Commons**

The IUCN SSC Invasive Species Specialist Group and the National Biological Information Infrastructure (NBII) are amongst those organisations who have formally endorsed the Principles of the Conservation Commons<sup>8</sup>, which works to remove barriers to the free flow of information related to biodiversity conservation. The *Conservation Commons* promotes the principles of open access, mutual benefit and fair use. Users of the Conservation Commons are expected to comply, in good faith, with terms of uses specified by contributors and in accordance with these principles.

### **Conclusion**

Information exchange is needed for all stages of management of IAS, from prevention (including risk analysis), to eradication, to containment and control, and it must occur at all scales: local national, regional and global. Clear synergies exist between the concept of pre-import risk screening and the availability of information about biological invasions to allow officials to conduct screening in a timely fashion. Global databases serve as repositories or "clearinghouses" where globally-sourced invasive species data and information can be maintained and shared in a transparent form. This presentation focuses on tools operating at the global and regional scale, given their particular relevance for early warning and risk analysis. These tools are supported by thousands of expert contributors and a very broad user community. A relatively modest ongoing investment in existing global-scale information exchange systems would quickly provide the world with access to authoritative information about the majority of known invaders.

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<sup>7</sup> The Cooperative Initiative on Invasive Alien Species on Islands: <http://www.issg.org/cii>

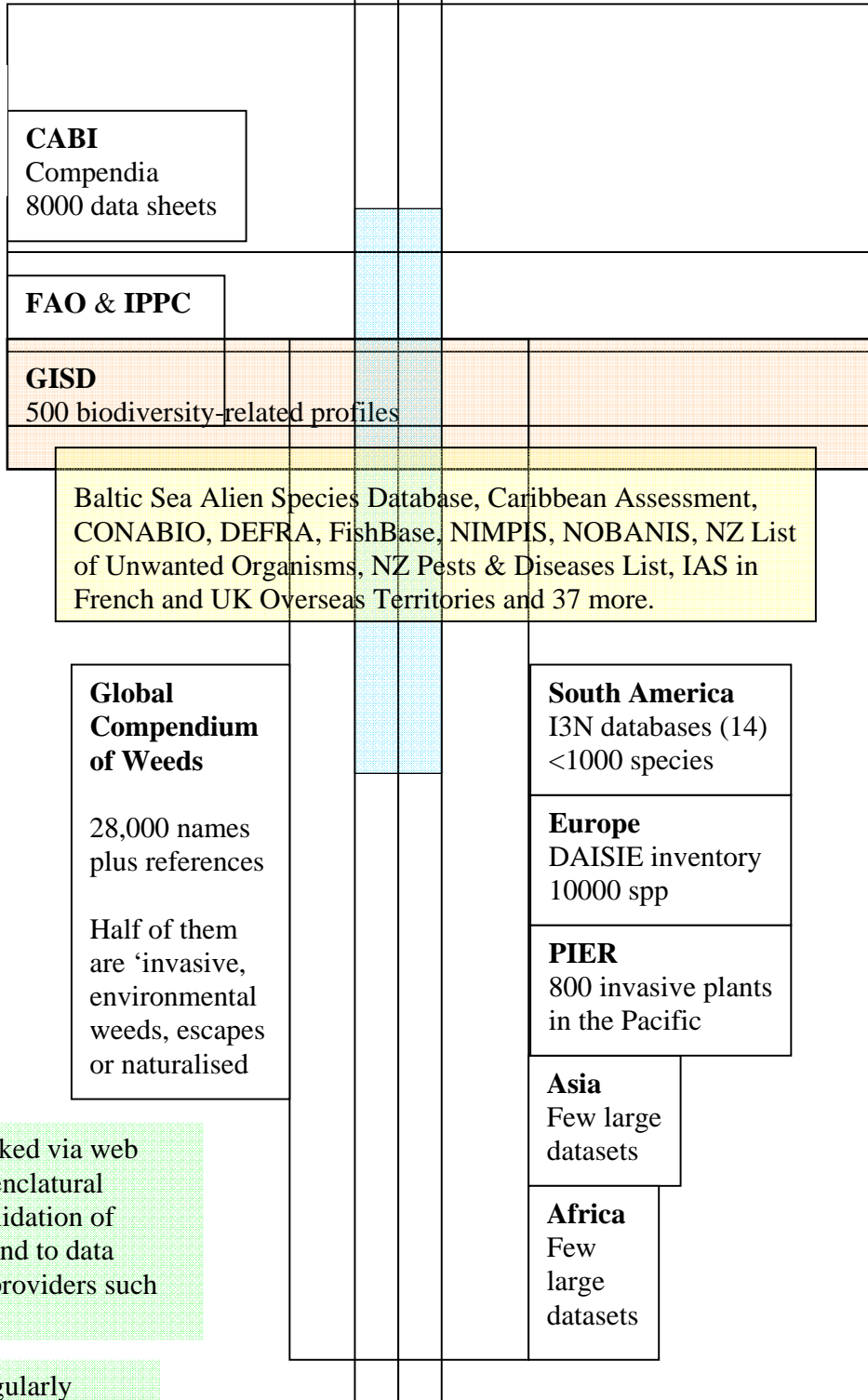
<sup>8</sup> Conservation Commons: <http://www.conservationcommons.org/>

**Fig. 1 Addressing gaps in the Global Register of Invasive Species (GRIS)**

The GRIS prototype has 16,051 scientific names & synonyms (mostly animals) & 38,606 geographic records of invasiveness (GRIS Risk) or potential invasiveness (RAs).

The online GRIS will have an administrative interface for data upload, and a simple web interface where risk analysts and other users can access reports on individual species.

Agricultural pests, weeds and pathogens



GRIS will be linked via web services to nomenclatural databases for validation of species names, and to data consumers and providers such as GBIF, OBIS.

GRIS will be regularly updated with data from GISIN data providers