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Information Management

IUCN SSC Invasive Species Specialist Group: invasive alien species information management supporting practitioners, policy makers and decision takers

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Abstract

The Invasive Species Specialist Group (ISSG) is a global network of scientific and policy experts on invasive species, organized under the auspices of the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN). ISSG aims to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them. Since its establishment, over two decades ago, ISSG has taken the lead on collating, managing and disseminating global invasive species information, promoting practitioner networks and supporting development of policy and regulation aimed at reducing the insidious threat of biological invasions. All this has been accomplished through the development of knowledge products (such as the Global Invasive Species Database (GISD)), promoting dynamic networks such as Aliens-L, advocacy and publications. ISSG has actively catered to emerging needs with activities directed at key areas such as islands, threatened species, protected areas and developing invasive species indicators to support prioritising and monitoring management action. ISSG is working with partners advancing the adoption of a standardised framework of pathway categories and developing criteria for the ranking of known invasive species based on the type and magnitude of impacts. ISSG through participation in the Global Invasive Alien Species Information Partnership (GIASIPartnership) is working with other information providers supporting countries with current and authoritative information to effectively implement Article 8(h), Aichi Biodiversity Target 9 and other related decisions of the Convention on Biological Diversity (CBD) and other Multilateral Environmental Agreements (MEAs) such as the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Ramsar Convention on Wetlands.

Key words: information management, networks, knowledge product, Aichi Biodiversity Target, indicators, islands, protected areas

Introduction

The International Union for Conservation of Nature (IUCN) founded in 1948 is the largest and the oldest global environmental organisation. The vision of the IUCN is "a *just world that values and conserves nature" and its mission is "to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable* " (IUCN 2014a).

A global IUCN programme is developed through a process of consultation with its members and commissions and approved by its member organisations. The current programme runs through 2012–2016. IUCN's three main priority areas of work are (1) Valuing and conserving nature, (2) Fair and effective governance of nature's use, and (3) Nature-based solutions to global challenges (IUCN 2013).

IUCN has focused on generating knowledge and the development of knowledge products (e.g. IUCN Red List of Threatened Species) to influence policy and action on the ground.

IUCN's programme is implemented through its secretariat and its members and its six commissions (Species Survival Commission (SSC), World Commission on Protected Areas (WCPA), Commission on Education and Communication (CEC), Commission on Environmental, Economic and Social Policy (CEESP), World Commission on Environmental Law (WCEL) and Commission on Ecosystem Management (CEM)).

The SSC is a science-based network comprising of over 9000 experts on all taxa-mammals, birds, reptiles, amphibians and reptiles, fishes, plants, fungi and invertebrates. These experts belong to more than 130 Specialist Groups, Task Groups and Red List Authorities. Most Specialist Groups are focused on specific taxa, few are focused on cross-cutting issues such as Wildlife Health and Invasive Alien Species (IUCN 2014b).

This paper outlines the activities of the Invasive Species Specialist Group (ISSG), related to global invasive alien species (IAS) data and information management, and dissemination.

Invasive Species Specialist Group - Inception and Historical overview

Recognizing the magnitude of the threats of IAS to biodiversity, the SSC decided in 1993 to establish the Invasive Species Specialist Group (ISSG), comprising a global network of scientific and policy experts on invasive species. The ISSG in 2014 is made up of 202 experts drawn from over 35 countries. A wider informal membership of over 1700 practitioners and researchers contribute to its work.

ISSG aims to '*reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them'*. The ISSG promotes and facilitates the exchange of IAS information and knowledge across the globe and ensures the linkage between knowledge, practice and policy so that decision making is informed. The core activity areas of the ISSG are policy and technical advice, and information management and exchange through development of knowledge products and networks. The ISSG was chaired by Mick Clout (1993–2008) and is currently chaired by Piero Genovesi (2009–present).

From its inception the ISSG concentrated on preventing or reducing the adverse effects of IAS on native biodiversity and ecosystems. It rapidly built up an effective international network of experts, and, shared information (from March 1995) *via* the twice-yearly '*Aliens*' Newsletter. International policy guidelines on species introduced outside their natural range were drafted by ISSG (following a resolution at the 1993 IUCN General Assembly) and presented at the 1996 IUCN World Conservation Congress in Montreal. These guidelines were also presented at the Norway/UN Conference on Alien Species in July 1996 and are summarised in the proceedings of that conference (Clout and Lowe 1996). The Global Invasive Species Database (GISD) also had its beginning in 1996 (this is described in more detail below).

Policy and technical advice

ISSG activities over the past two decades have contributed to major achievements in terms of policy support and advocacy. Some recent examples that demonstrate this aspect of ISSG's work are described below.

- ISSG members led by the Chair provided inputs to the wording of the Aichi Biodiversity Target 9 (one of 20 new Biodiversity targets set in the Convention of Biological Diversity' s (CBD) Strategic Plan for Biodiversity 2011–2020).

- The development of this Target and strategic engagement by the ISSG Chair and members has contributed to the debate that led to the adoption of the EU Regulation on invasive alien species (Genovesi et al. 2014), and to the establishment of numerous recommendations and decisions adopted in several international *fora*, including the CBD, the Council of Europe, and the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals – CMS, http://www.cms.int).

- ISSG were contracted by the CMS during 2012–2013 to complete an assessment on the impacts of invasive alien species on migratory species listed in Appendix I and II. The extensive archives of the ISSG, and data and information held in ISSG databases were used to develop the report. The report (CMS 2013) and recommendations were key documents used in the discussions on invasive species during the 18th Scientific meeting of the CMS in Bonn during July 2014; resulting in Resolution 11.28 '*Future CMS Activities Related to Invasive Alien Species*' that was adopted during the CMS Conference of the Parties (COP) 11.

- GISD inventories have been used by several countries in setting targets, and measuring success of management and control options. For

e.g. GISD has been the major contributor of IAS data and information in the development of compendia of country-wise information supporting the development of National Invasive Species Strategy and Action Plan (NISSAPs) in several Pacific Island nations (Vanuatu, Cook Islands, Niue, Tonga, Kiribati, Marshall Islands and the Federated States of Micronesia). The development of NISSAPs is a key activity of the GEF (Global Environment Facility) supported project (see SPREP 2014a).

• GISD data as well as information from the archives of the ISSG formed the baseline information for the assessment of progress in the achievement of Aichi Biodiversity Target 9, in the review of the State of Conservation in Oceania (SOCO) report (SPREP 2014b).

• The information products developed by ISSG are the core basis for the development of the global IAS indicators within the Biodiversity Indicator Partnership (BIP), published in the Global Biodiversity Outlook 3 and 4 (Secretariat of the Convention on Biological Diversity 2014), and in several related publications (Butchart et al. 2010; Tittensor et al. 2014).

Information Management

ISSG Archives

One of the first activities that the ISSG undertook was to set up a filing system to manage data and information that the group collated related to the prevention and management of IAS. Data and information are filed using 'Species', 'Location' (at the country level) and 'Theme' as primary identifiers.

In the 'Species' section folders were created for each of the taxonomic groups (for e.g. Mammals, Amphibians, Plants, Reptiles, Micro-organisms). Within these main folders species level sub-folders have been created for storage of species specific information. Folders have been maintained for all global countries. Country level information related to policy, legal instruments and other country specific information are stored in country folders. Thematic folders (for e.g. CBD, CMS, CITES, Ramsar, IPPC, EPPO, Climate change, Biofuels, Wetlands, Protected Areas, Islands, Eradication, Freshwater, Marine, Sub-Antarctic, Polar, Pathways, NBSAPs, NISSAPs, Datasets etc.) have been created to store thematic level data and information. Major updates are implemented cyclically every six months for limited numbers of folders and incrementally on an on-going basis. Journals, reports, book chapters,

other databases and even personal communication are the source for these updates.

The ISSG archives which have been populated and maintained over 20 years are a rich source of global IAS data and information and form the backbone for the Aliens-Referral Service, as well as the population of the knowledge products of the ISSG.

The core activity of IAS information management and dissemination is conducted through (a) web-based freely available knowledge products and (b) through dynamic practitioner networks.

Key Knowledge Products

Key knowledge products include the Global Invasive Species Database (GISD), Island Bio-diversity and Invasive Species Database (IBIS), and the Global Register of Introduced and Invasive Species (GRIIS). While IAS related data and information are the primary focus of these knowledge products and several information components common to the databases, the emphasis of each of these products is on different features. The GISD presents comprehensive profiles, GRIIS annotated country inventories and IBIS presents data and information on the impacts of IAS on island biodiversity and natural areas.

Global Invasive Species Database (GISD)

The premier knowledge product of the ISSG is the GISD, developed over a decade ago. The creation and development of this global database on IAS had its inception in 1996 (Clout and Lowe 1996) and the concept was further developed at a workshop organised by the Global Invasive Species Programme (GISP).The main aim of the workshop was to draft a design for the development of a toolkit for early warning and management of IAS in developing countries. The consensus reached by the participants on the format and content of the toolkit was to develop a manual on the prevention and management of IAS and a global database to support the manual. GISP produced two key publications in 2000–2001: 1) *A toolkit for best-practice IAS prevention and management* (Wittenburg and Cock 2001) and 2) *A Guide to develop legal and institutional frameworks for IAS* (Shine et al. 2000).

The ISSG coordinated the creation of the '100 of the World's Worst Invasive Alien Species' (Lowe et al. 2000) which was published in 2000. The '100 of the World's Worst' List is a key publication used for both communication and

scientific purposes (e.g. Bellard et al. 2013; Luque et al. 2013) and as such has contributed to raise awareness on the impact of a selection of IAS in a number of local and global initiatives. Besides, it has inspired many other similar attempts to develop priority lists of IAS at the national or regional level (e.g. Delivering Alien Invasive Species Inventories for Europe (DAISIE), Streamlining European Biodiversity Indicators (SEBI 2010, etc.) accompanied by the development relevant datasets.

The prototype of the GISD was created in 2000 and populated with species profiles from the Lowe et al. (2000) list. Other priorities identified in the population of the GISD were focus on areas where information and resources are comparatively scarce, including small-island developing states and other island nations (ISSG 2001).

A timeline of progress in the development of the GISD after 2001 is provided below.

- 2002 - ISSG signs a Memorandum of Understanding (MOU) with the National Biological Information Infrastructure (NBII) of the US Geological Survey.

- The MOU provides for a two-stage database enhancement programme as well as doubling the input of species information.
  - 2003- Progress report.
    - More than 100 profiles created and reviewed by experts.
    - The GISD receives 160 unique visitors per day (3000 hits/day).
    - The GISD supports a number of other invasive species database initiatives.
  - 2004-2012 Progress report.
    - More than 200 profiles created. The GISD receives numerous endorsements and congratulatory emails and visitor traffic reaches 30,000 hits/day.
    - Support for other invasive species database initiatives.
    - 2005- More than 350 profiles created and visitor traffic reaches 700 unique visitors per day (50,000 hits/day).
    - Deep links to the IUCN Red List of Threatened Species and Ramsar Sites Database added where invasive species are identified as threats.
    - Interim profiles (or basic profiles) introduced in addition to 'full profiles'.
    - 2012- Multi-language functionality- limited numbers of species profiles in French, and Chinese (both Traditional and Simplified Chinese characters).

- 891 species profiles (110,000 hits per day).
- 2012–2015 Restructuring of the GISD underway.
  - Enhanced database structure to facilitate interoperability between heterogeneous databases.
  - Improved search function.
  - Improved presentation of data and information.
  - More User-friendly- facilitates analysis.

Source: ISSG Global Invasive Species Database 2014.

The GISD focuses on IAS that threaten native biodiversity and natural ecosystems. It covers all taxonomic groups from micro-organisms to animals and plants in all ecosystems. Species information is either supplied by or reviewed by expert contributors from around the world. Species information is presented in the form of species profiles.

In the species profile data and information is recorded against two primary identifiers- species and location.

- Species: data and information recorded include
  o Higher taxonomy, synonyms, organism type, common names
  o Species description including habitat, images for identification and a list of similar species
  o Species life stages, nutrition and reproduction
  o Geographical range of the species including both its native range and known introduced range
  o A summary of the known impacts of the species on biodiversity, natural areas and related ecosystem services
  o A summary of management options available to prevent the introduction of the species including eradication, control and/or containment. Links have been provided to over 150 risk assessments of mostly plant species
  o Inventory of threatened species assessed in the IUCN Red List and under threat by IAS
  o Known pathways of introduction of the species as well as spread.
- Location: location types include multi-country features, regions, country, administrative units, and detailed locations such as protected areas and islands. Location specific data and information recorded include
  o Biological status of the species (provenance, occurrence and invasiveness)
  o Date of introduction or first report
  o Introduction type
  o Invasive species impacts on biodiversity and natural areas including mechanisms of impact and outcomes as a result of these impacts

o   Management action undertaken, completed or planned in that location.

Invasive species impacts on threatened species listed in the IUCN Red List of Threatened Species (IUCN 2014c) are highlighted in the impact section. At present links are provided from the threatened species name to the IUCN Red List species datasheet. Reciprocal links are planned from the IUCN Red List species datasheet to the GISD species profile. The usefulness of this functionality has been successfully tested during a recent exercise aimed at the collection of information to fill information gaps on risk assessed species in a study carried out to inform the development of a preliminary list of species of EU concern (see Roy et al. 2014; Genovesi et al. 2014).

Standard information descriptors have been used for the following information components, biological status (provenance, occurrence and invasiveness), abundance, and introduction type, management type including preventative measures, eradication type and status, impact mechanism and outcomes, pathway classification including two levels (see Appendix 1).

All source information is recorded and listed in the Reference list. All source information is maintained in species folders in the ISSG archives.

The restructured GISD allows advanced search options including queries on taxonomy, location (country, protected areas and islands), environment/ system, threatened species, pathway type, impact type and management options. The results of all searches are downloadable in comma separated (.csv), Excel (.xls) and PDF format.

The relational database has been developed using PostgresSQL 9.1, an open source system that supports many data types and storage of large binary objects, including pictures, maps and videos.

The GISD features 891 profiles of known IAS, 650 of which are comprehensive profiles and the remaining basic or interim profiles with limited information. The GISD stores and presents 36467 distribution records, 3651 records of location specific management information, 5325 location specific impact notes including 3436 impact mechanism records and 5466 impact outcome records. 22447 references have been recorded of source information and are featured in species specific reference lists.

The GISD offers multi-language functionality; over 600 profiles have been translated into Chinese Language (both Simplified and Traditional Chinese characters) (as a result of collaboration with *Biodiversity Research Centre - Academia Sinica*, Taiwan). The GISD includes limited French

language profiles including over 1000 distribution records of IAS in French Overseas Territories and Regions (as a result of collaboration and support from the IUCN French Committee).

Future planned enhancements include inter-operability with other IUCN knowledge products including the IUCN Red List of Threatened Species and World Database on Protected Areas (WDPA). Integration of GISD data and information to the Global Invasive Alien Species Information Partnership (GIASIPartnership) portal is on-going (ISSG 2014b).

A promising initiative which is clearly benefitting from the comprehensiveness of the GISD dataset is the development of a method to rank invasive species by the magnitude of their environmental impact; this process is similar to the one used in the development of criteria used in the conservation assessment of species in IUCN Red List. The methodology and relevant protocols are being fine-tuned, and will soon be tested on a selection of taxa by the IUCN and other stakeholders. The method is based on the mechanisms of impact described in GISD (see Blackburn et al. 2014). The methodology was presented at the Eighteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to the COP of the CBD, and included in the COP decision XII/17, that invites ISSG to continue to develop this approach of ranking IAS.

Global Register of Introduced and Invasive Species (GRIIS)

The Global Register of Invasive Species (GRIS) was developed as a concept and prototype by the ISSG in 2006 as part of a project undertaken for the Defenders of Wildlife on the Regulation of Live Animal Imports into the United States (Jenkins et al. 2007). The concept was revisited and expanded by the ISSG to address Aichi Target 9 and support its achievement- with the development the Global Register of Introduced and Invasive Species (GRIIS).

The development of GRIIS is supported by the Secretariat of the CBD and is implemented within the framework of the GIASIPartnership. The GIASIP is a partnership of IAS information providers whose aim is to support Parties to the CBD effectively implement Article 8(h) CBD Aichi Biodiversity Target 9 (CBD) and related decisions focused on the prevention of introduction and management and control of IAS (GIASIP 2013). The Partnership intends to publish key elements of IAS information provided by GIASIP Partners

and other data publishers through a portal (GIASIP 2014).

GRIIS is presented online in the form of validated and verified country level annotated inventories of introduced and invasive species. Annotations include higher taxonomy and biological status at the country level (provenance –native or alien status and invasiveness). Also included are evidence and type of impact. Species records including biological status are verified by a network of identified teams of country editors. The country profile page includes all source information used as well as a list of the country editors. Taxon and IAS experts are identified in every country and editors' invitations submitted, on acceptance editors are nominated and listed online on the country profile page.

The resource will be a support tool to countries to effectively implement Aichi Target 9, and in the development of their National Biodiversity Strategy and Action Plans (NBSAPs), their National Invasive Alien Species Strategy and Action Plans (NISSAPs), target setting and monitoring. GRIIS could also serve as an early warning and alert system.

Phase 1 of the GRIIS project is nearing completion and includes the compilation and verification of 100 country inventories. Phase 2 will achieve global coverage and is planned for completion by the end of 2015. GRIIS is a searchable resource developed using PostgresSQL 9.1- advanced search options allows queries on country, species taxonomy-kingdom, environment/system, species verification status and evidence of impact. The results of queries are available in comma separated (.csv), Excel (.xls) and PDF formats (ISSG 2014c).

Island Biodiversity and Invasive Species Database (IBIS)

The Island Biodiversity and Invasive Species Database (IBIS) concept was developed by the ISSG in 2010 in response to feedback from island conservation managers that there was a need for better access to IAS data and information specific to islands and how to manage this threat

IBIS aims to record and provide information on the impacts of IAS on native species on islands (especially those that are classified as 'threatened' in the IUCN Red List of Threatened Species and National Red Lists) and their management.

The geographical scope of IBIS includes both oceanic islands and continental. The taxonomic coverage is broad including all taxa.

Data and information compiled includes:

• Annotated inventories of native species on the IUCN Red List of Threatened Species and National Red Lists under threat by IAS. Annotations include the identification of the native species under threat, the invasive species' that cause the impact, common names, mechanism of impact and source information. All this information is recorded for the following location types – Region, Country, Island Group, Island, Protected areas (available from the World Database on Protected Areas- WDPA (IUCN and UNEP-WCMC 2014)) and designated sites of high bio-diversity value such as an Important Bird Areas (IBA), Endemic Bird Areas (EBA) (BirdLife International 2014), and Key Biodiversity Areas (KBA) (IUCN 2010)

• Annotated inventories of introduced and invasive species at island and designated site level. Distribution records are recorded in the location types listed above

• For every native species that is under threat by an IAS –summary descriptions are compiled of the invasive species threat including management action completed, ongoing and planned with links to more information. Also included is a summary of conservation outcomes as a result of management action. A bibliography/ reference list is included in each datasheet.

Links are provided to IAS profiles on the GISD, threatened species datasheets on the IUCN Red List of Threatened Species and to any Eradication events on the Database of Island Invasive Eradications (DIISE) (DIISE 2014).

The IBIS prototype was developed with the completion of the Pacific pilot in 2012. This included limited information types. Since 2013 IBIS is under restructure by the Joint Research Centre (JRC) of the European Commission (EC) within the framework of the Biodiversity and Protected Areas Management Programme (BIOPA-MA 2014). Web services being developed include an enhanced search function, better presentation of data and spatial functionality. IBIS will also form an integral part of the proposed Regional Observatories in the Pacific, Caribbean and Africa Regions.

IBIS has been developed using PostgresSQL 9.1 (ISSG 2014d).

Other information resources

The ISSG within the framework of the Ocean Biogeographic Information System (OBIS) (2006–2009) and the Biology Project of the European Marine Observation and Data Network (EMODnet) (2013- on-going) is working with the Flanders Marine Institute on the development of the **World Register of Introduced Marine Species (WRIMS)**. WRIMS records which marine species in the World Register of Marine Species (WoRMS) have been introduced deliberately or accidentally by human activities to geographic areas outside their native range. WRIMS was launched in early 2015.

The ISSG has developed an operational prototype of **'the Invasive Alien Species Pathway Management Resource'** with the co-funding from the European Union through the GIASIPartnership. Based on the ISSG's vocabulary of 'Pathways/vectors of introduction and spread of Invasive Alien Species' framework the resource records

- Lists of species that are known to be introduced through each pathway

- A compendium of legal instruments/regulations/codes of conduct that have been enacted/established globally, regionally, nationally, locally for the management of this pathway

- A bibliography relevant to this 'pathway.

ISSG is one of several partners in the development and maintenance of the Database on Island Invasive Species Eradications (DIISE) (DIISE 2014) and the Threatened Island Biodiversity Database (TIB) (TIB 2014). DIISE is a searchable database which documents all known events of invasive vertebrate eradications on islands including unsuccessful attempts. TIB is a global dataset of threatened island species at risk from invasive vertebrates.

Networking

Since its inception in 1993 the ISSG has built and maintained extensive archives on global IAS information. In the late 1990's and early 2000's there was increasing awareness about introduced and invasive species and their impacts on biodiversity and natural areas. However, access to available information including literature, new research, best-practice (including management experiences) was limited. ISSG played a useful role in disseminating authoritative information through a mailing list and a dedicated referral service. Both of these services continue to be active today. The Aliens-L list with 1345 members continues to be active and provides a platform for robust discussions on the threats posed by invasive species and their management. The Aliens referral service receives requests from a variety of stakeholders, including representatives of national governments, practitioners and civil society (ISSG 2014a).

Thanks to its well established and acknowledged network of experts, the ISSG is playing a key role in a number of regional initiatives. In the Pacific region participating in the Pacific Invasives Partnership (PIP, http://www.sprep.org/Pacific-Invasives-Partnership/invasive-partnerships) and supporting the Pacific Invasive Learning Network (PILN, http://www.sprep.org/piln); in Europe participating in key working groups, such as those within the COST actions ALIEN Challenge (http://www.brc.ac.uk/alien-challenge/home) and ParrotNet (http://www.kent.ac.uk/parrotnet/), the working group on IAS of the Bern Convention (http://www.coe.int/t/dg4/cultureheritage/nature/bern/IAS/default_en.asp), the ESENIAS network (http://www.esenias.org), NEOBIOTA (http://www.neobiota.eu) etc.; and in the Caribbean contributing to the Caribbean Invasive Alien Species Network (CIASNET, http://www.ciasnet.org).

ISSG- Advanced technology, Networking and the Changing information landscape

Advances in computing technology, networking ability and the changing information landscape has motivated ISSG to adopt new approaches to information management and dissemination with an increased focus on interoperability and collaboration leading to an enhanced discovery process for users.

The restructuring of the GISD, proposed integration of ISSG's heterogeneous databases, and integration with the Species Information System of the IUCN are activities which will take advantage of advances in computing technology to better link databases, increase efficiency and reduce duplication. ISSG is an active partner in the GIASIPartnership; one of the primary goals of the partnership is to integrate selected elements of IAS data and information from participating information providers to a central repository and provide users access to query and retrieve this information from a portal. Semantic challenges remain.

ISSG is working on developing standardised frameworks such as the one classifying pathway of introduction of alien and invasive species (CBD 2014). The Pathway schema was presented in an information document by the Executive Secretary of the CBD at SBSTTA 18th

(UNEP/CBD/SBS TTA/18/9/Add.1) and adopted by the Conference of the Parties of the CBD in decision XII/17, that invites the IUCN ISSG to continue the analysis of pathways, and calls CBD Parties and other governments to make use of the categorization of pathways of introduction of IAS.

Appendix I outlines the vocabularies used by ISSG information resources to describe all the information components featured in the databases. Adoption of standardised vocabularies by key IAS information providers remains crucial to sharing of information and any potential inter-operability.

The changing information landscape has seen increases in the quantity and availability of information, speed of information dissemination, and development of new ways of engaging information for different purposes. ISSG has endeavoured to keep in step with emerging trends in order to optimise information management and delivery.

Acknowledgements

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Supplementary material

The following supplementary material is available for this article:

Appendix 1. Outlines the vocabularies used by the resources of the ISSG to describe the information components that the databases feature.

This material is available as part of online article from:
http://www.reabic.net/journals/mbi/2015/Supplements/MBI_2015_Pagad_etal_Supplement.xls