

Planning for long term sustainability of an open access global database

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Abstract

In 2002 a gap in the world's knowledge in invasive species was identified by USDA. Increased trade, changing environmental patterns and increased travel have created opportunities for organisms, including plants, animal and micro-organisms to move into new habitats. This movement may adversely affect health of indigenous plants and animals and local biodiversity. USDA and CABI are working together to design and develop an encyclopaedic database of all known invasive species of all genera, except human pathogens. The database will be an important tool for those working in agriculture, biodiversity and the environment. To be effective in supporting people to manage invasive species it is important that everyone who needs to will be able to access and use it. Since 2002 other governments' agencies and private sector companies have joined USDA and CABI in working on this initiative. This paper describes the consortium model and the planning phases of the database of invasive species, and importantly highlights the decision making process, business case and business model for opening access of the information to all.

Introduction

Some governments are increasingly expecting publicly funded work to be published in open access formats. In a recent report, Ballantyne (2009) outlined five major justifications for DFID Research and Evidence Division to support open access: it reinforces the free circulation of knowledge; is an empowering strategy for researchers and others in developing countries; research supported by DFID has the potential to become international public goods with high social benefits and thus open access can increase the potential for uptake and use of research outputs; it eliminates the subscription barrier; and it will help DFID itself to make use of the research it has financed.

In the United States of America (USA) the National Institutes for Health formulated a Public Access Policy (2008) whereby the Director of the National Institutes of Health 'shall require that all investigators funded by the NIH submit or have submitted for them to the National Library of Medicine's PubMed Central an electronic version of their final, peer-reviewed manuscripts upon acceptance for publication, to be made publicly available no later than 12 months after the official date of publication: *Provided*, That the NIH shall implement the public access policy in a manner consistent with copyright law.' More recently, in December 2009, The Office of Science and Technology Policy, in the Executive Office of the President, USA, launched a 6-week public consultation to seek views from citizens to inform the development of public access policies.

The Budapest Open Access Initiative focuses on scholarly communications and research papers. In this paper we use open access in the context of providing free access to a database of verified scientific information that is not categorized as scholarly or research. At a global and sectoral level the CIARD (Coherence in Information for Agricultural Development) initiative's manifesto expresses a vision to make public domain agricultural research information and knowledge truly accessible to all (2009). CIARD also embraces this wider view of open access, focussing on accessibility, removing barriers to access (which includes payment for access), and usability.

So we are now seeing a convergence of thoughts and requirements for global knowledge bases which address global public goods needs. The direction is that any collection of information addressing global knowledge needs should be openly accessible to all. With this requirement comes the significant challenge of funding efforts for long term sustainability to assure the quality of the product and the question of who pays for this open service.

In 2001 the United States Department of Agriculture (USDA) and CABI embarked on a programme to create the *Invasive Species Compendium*, identified in Action Item 53 of the USA National Invasive Species Management Plan. This paper describes the challenges faced in the development of the Invasive Species Compendium.

Background

The United Nations (UN) declared 2010 to be the International Year of Biodiversity. It is to be a celebration of life on earth and of the value of biodiversity for our lives. The need to recognize this value stems from the real threat to biodiversity posed by population growth, and the consequent growing demand for food, energy and local, national and international resources which ultimately results in habitat and species loss. The second greatest threat to biodiversity, particularly in developing countries, arises paradoxically from the addition of invasive species, not their removal (Conway and Waage, 2010). These introduced species that become invasive threaten not only biodiversity and ecosystem services, but also economic development and, animal and human well-being. Invasives reduce yields of agricultural crops, forests and fisheries; decrease water availability, quality and quantity; cause costly land degradation; block transport routes; and, contribute to the spread of disease in animals, plants and humans. Invasives reduce the effectiveness of development investments by choking irrigation canals, fouling industrial pipelines and impeding hydroelectric facilities. Therefore, they contribute to social instability and economic hardship, placing constraints on sustainable development, economic growth, trade, poverty alleviation and food security. Moreover, the spread of invasive species has increased with global trade and development and is likely to be further exacerbated by continuing global change, especially climate change. The estimated damage from invasive species worldwide totals more than \$1.4 trillion per annum, i.e., five percent of the global economy (Pimental, et al., 2001). Managing invasive species requires an understanding of their ecology, in order to find the best way of preventing, eliminating or containing their populations (Conway and Waage, 2010). The global character of the invasive species threat led to the convening of the first major meeting on invasive species in Trondheim, Norway in 1996, convened by the Norwegian government and various United Nations (UN) organizations.

It became increasingly obvious that to tackle the threat of invasive species at a global level would require bringing together scientific knowledge of the invasiveness of intentionally or unintentionally introduced species, how to manage them and evaluating the risk they pose.

In 2001, the USA National Invasive Species Management Plan was published. The need for new compilations of national and global datasets was identified to support better decision making and policies. Action Item 53 in the plan states ‘The National Invasive Species Council (NISC), led by USDA, will produce an *Invasive Species Compendium* for North America. The Compendium will include a broad array of searchable information relevant to the biology, distribution, and management of invasive species. The project will be undertaken in close cooperation with CABI and with the intention of bringing together an international consortium of partners.’

So the stage was set to plan the development of a global invasive species knowledge base. The planning process covered market research on the audiences, scope, short term development funding, and long term sustainability funding. In the past CABI has used financially sound sustainability models which focus on a publisher subscription model, but for the Invasive Species Compendium (ISC) other models

for long term financial sustainability will be discussed and investigated. This is especially important as since 2001 policy makers, researchers, practitioners and citizens increasingly expect significant bodies of vital information to be made open and freely available and accessible to all, as evidenced by the approaches of DFID, USA NIH and the USA Office of Science and Technology. It is especially important to address long term funding and financial support head on as all too often web-based information resources become easy targets for budget savings. For example The Nature Conservancy's Global Invasive Species Team was disbanded in March 2009 with the result that their web site is no longer being managed upkept. However, the University of Georgia has offered to maintain the site in their archives, preserving the knowledge generated by the team.

Consortium model

CABI has led the development of Development Consortia for four Compendia Consortia (Crop Protection Compendium; Forestry Compendium; Animal Health and Production Compendium; and Aquaculture Compendium), through a total investment of more than US\$10M. The financial investment in building and compiling the content for global datasets where new content is commissioned to experts, validated by peers and standardized is substantial. An independent cost-benefit analysis commissioned by ACIAR put the value of the Crop Protection Compendium through time saving by Australian public-service research staff at median time savings per researcher of between 37 and 54 days per year, leading to an annual cost saving of more than US\$1M per year (Pearce and Monck, 2006). This type of analysis helps to explain why public and private sector agencies are keen to support the development of global databases.

Building the case for a Consortium

To implement the US National Invasive Species Management Plan the USDA and NISC led an international Expert Consultation (USDA NISC, 2002) to verify the gaps in access to knowledge about invasive species, their ecology and management and to recommend the scope, approaches, and partners for the ISC. At this meeting it was agreed by the majority that there were a lot of advantages for USDA working in partnership. The Expert Consultation concluded that there was a need for a global compilation of information on invasive species, and that the scope should be broad: agricultural, aquatic and natural systems, established, incipient and potential invasive species; support for exclusion, early detection and rapid response, and control and management technologies: and phases of invasion. The issue of long term sustainability for the ISC was raised and the consultation identified the need for a 5-10 year funding commitment to the project; the need to keep access fees for the ISC as low as possible; and preparation of business plans for project continuity for 5-10 years.

In 2005 CABI prepared for USDA a specific proposal to develop an International Consortium to develop the ISC. Based on previous experiences of building compendia, a project extending for three years was proposed, with an initial draft budget of not less than US\$3M. Following on from this, in 2006, the USDA hosted an international Inception Workshop in Washington D.C. at which potential international consortium partners were invited to participate and contribute to refine the draft project proposal. The most important outcome of this meeting was international recognition of the need for a comprehensive, scientifically-based database providing equitable access to base line information on invasive species. This recognition has led to a truly international Development Consortium of partners (Figure 1), which continues to grow.

Australia, Group Membership [Cooperative Research Centre for National Plant Biosecurity; Grains Research & Development Corporation; Horticulture Australia Limited; Invasive Animals Cooperative Research Centre]
Canada, Canadian Food Inspection Agency; Canadian Forestry Service; Canadian International Development Agency
CABI
Malaysia, Malaysian Agricultural Research and Development Institute

Mexico, National Health, Safety and Quality Service for Agri-Food
India, Ministry of Agriculture
Monsanto
Netherlands, Ministry of Agriculture, Nature and Food Quality
Switzerland, Swiss Agency for Development and Cooperation
Syngenta Crop Protection
UK, Department for Environment, Food and Rural Affairs; Department for International Development - Forum for Agricultural Research in Africa
USA, United States Agency for International Development; USDA, Agricultural Research Service; USDA, Animal & Plant Health Inspection Service; USDA, Foreign Agriculture Service; USDA, Forest Service; USDA, Invasive Species Co-ordination Program; United States Department of Commerce - National Oceanic and Atmospheric Administration

Fig. 1. Invasive Species Compendium Development Consortium (end 2009)

Commitments and Benefits of Consortium Membership

In the context of the ISC there is a cost to Membership in the ISC Consortium. The commitment requested from Consortium Members is a contribution of US\$175,000, usually paid in two installments, the first (required) of US\$95,000, the second (preferred) of US\$80,000. For developing countries the Contribution is reduced to US\$130,000, in installments of US\$70,000 and US\$60,000. Further commitment includes nominating a Member Champion who will attend meetings, contribute to the direction of the project, provide quality assurance advice and support the promotion and fundraising activities. Benefits to Consortium Members include: contributing to an international effort to compile a global knowledge base on invasive species rather than supporting independent action; a seat at the table to determine the ISC's strategic direction; leveraging multi-million dollars of development through modest investment; visibility as one of the ISC developers; participation in the planning for long term sustainability; and attendance at the annual Consortium Workshop.

What is the Invasive Species Compendium?

The ambition of the project is that the ISC will be the most extensive and authoritative compilation on the subject. It will cover recognition, biology, distribution, impact and management of invasives species, on a global basis. Invasive species in all taxa will be covered, including plants, fungi, bacteria, viruses, nematodes, molluscs and vertebrates. Their impact on natural ecosystems and biodiversity will be considered, and also on systems managed for agriculture, forestry, aquaculture, etc.

This information will be commissioned from thousands of expert contributors, from throughout the world, and from existing sources. The scientific content will be verified through peer review and CABI will ensure from quality control through rigorous editing. This ambition gives a real feel for the scale of the project and the need to plan carefully.

During 2007 the functional specification and species coverage of the ISC were developed with Consortium members, content partners and potential users who were asked to provide feedback on planning documents via the project 'wiki' (<http://invasivespecies.wiki.zoho.com>). Use of this Web 2.0 technology allows all stakeholders to track the feedback on an ongoing basis.

The project team has actively discussed cooperation with other invasive species initiatives and is guided by the GISIN Invasive Species Profile Schema which is being designed to facilitate information exchange. Collaboration with other initiatives have been formalized. In December 2007 a joint statement was made between the IUCN SSC Invasive Species Specialist Group (ISSG) and CABI announcing a collaboration 'to expand the amount of knowledge available on invasive species'.

The feedback from the Consortium members on the types of problems that users will want to seek answers put a high priority on building a robust and flexible content platform for the structured datasets.

Necessarily the core element of the ISC is the species 'datasheet', a highly structured template for tagging individual species information, designed through consultation with experts and Consortium members. The template is structured around 'chapter' headings: Identity; Distribution; Biology and Ecology; Impact; Management; and, Further Information. Fig 2 shows the information that commissioned authors' are requested to supply.

<p>1. IDENTITY SECTION Notes on Taxonomy and Nomenclature Summary of Invasiveness</p> <p>2. DISTRIBUTION SECTION Distribution – Further information History of Introduction/Spread Risk of introduction</p> <p>3. BIOLOGY AND ECOLOGY SECTION Description Similarities to Other Species/Conditions Notes on Habitat Notes On Crops/Other Plants Affected Biology and Ecology Genetics Reproductive biology Physiology and phenology Nutrition Associations Environmental requirements Movement and Dispersal – Summary Natural dispersal (non-biotic) Vector transmission (biotic) Accidental introduction Intentional introduction Notes on Natural Enemies</p> <p>4. IMPACT SECTION Impacts Economic impact Social impact Environmental impact Impact on habitats Impact on biodiversity</p>	<p>5. MANAGEMENT SECTION Productive Uses and Management Economic value Social benefit Environmental services Invasive Species management Detection and inspection methods Diagnosis Prevention SPS measures Early warning systems Rapid response Public awareness Eradication Containment/zoning Control Cultural control and sanitary measures Physical/mechanical control Movement control Biological control Chemical control Host resistance (incl. vaccination) IPM Control by utilization Monitoring and surveillance (incl. remote sensing) Mitigation Ecosystem restoration</p> <p>6. FURTHER INFORMATION Gaps in Knowledge/Research Needs Case Studies References</p>
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Fig. 2. Details of datasheet information requested.

This need to commission new species ‘datasheets’, to gather this information in a standardized way, and the processing and verification of each datasheet by peers, is obviously a time intensive process. Aiming to build a comprehensive database of invasive species means that to maintain the accuracy of current information, as well as filling in the gaps in comprehensiveness, is a long term commitment that requires financial planning and support. Initially we aim to cover the most important global invasive species, but the ambition is much greater.

Sustainability and access

Different sustainability models were discussed at the ISC Inception Workshop. The general requirement from the participants was for the ISC to be open to access by anyone, anywhere in the world. There was an understanding that the costs of ongoing maintenance would need guaranteed financial underwriting. USDA and CABI committed to continue investigating the different sustainability models. As potential new Consortium Members were approached after the Inception Workshop it became apparent that some agencies could only support the ISC if it was delivered in a truly openly accessible environment. This

challenged the existing members to consider the 'cost' of providing the ISC in accessible and open formats, including an offline version.

At the ISC Consortium Workshop in 2008, the annual cost of sustainability and ongoing development were estimated for: web, platform, search and general IT support; commissioning new invasive species datasheets; licensing relevant third party content; editorial management and support; project management; image research and management; and marketing and promotion. Activities that required significant different technical development are excluded and subject to market demand analysis and will require separate fundraising activities. It was subsequently agreed that for active ongoing development to meet the needs of the existing ISC Consortium Members an amount not less than US\$350k per annum is required. It was noted that the 'not less than' clause provides the essential framework for fundraising. The ISC Consortium has approved a further 5-years' of development, so the initial development budget identified in the very early planning stages, estimated at not less than US\$3M, now stands at not less than US\$4.5M. This level of funding covering initial set up phases and ongoing development and improvement, will ensure the ISC is authoritative and freely available to any desired user for a five-year period after being launched. During that time options for sustainability in the following 5-year period will be reviewed.

Conclusion

The business case for Membership of the ISC Development Consortium has two components. The first component is that understanding all aspects of invasive species, and their management and control could help to reduce their estimated economic damage of US\$1.4 trillion per annum (Pimental et al., 2001). To address invasive species worldwide requires that access to this knowledge is equitable between countries and continents; thus, barriers to access have to be minimized. The second component is that the Members of the ISC Development Consortium are looking to direct their staff to this resource because they know that: it will save search and sifting time; the scientific information has been verified; and, because of their involvement and investment, the ISC has been designed to meet their needs.

The business case for an openly accessible ISC, with no financial barriers to access, is that invasive species know no boundaries. Hence the Members of the ISC Consortium do not want 'Membership' to result in only Members having access; they demand and have committed to finance for an open access and open service.

The ISC has been in development since 2006, but its conception and scoping work goes back to 2002. We are still working on an alpha version as there is still significant development work to be completed, but it will be open for review to the Development Consortium in the second half of 2010. Keeping in mind the vision that the ISC will provide a comprehensive database of known invasive species in all taxa, except human pathogens, the realization of a truly accessible ISC depends on further financial support for its development and continuous sustainability. To fulfill this vision the Consortium fully supports fundraising as an activity and additionally understands the need for a communication strategy that covers marketing and public relations.

The development of the ISC as an openly accessible database has necessarily focused the Consortium on the long term sustainability of this model. There is universal acceptance that if it is not the user who pays for access then 'who pays' has to be addressed through a different mechanism. We believe the Consortium model for long term development and sustainability is working, but we are aware that the momentum must be maintained on keeping current Members active and recruiting new Members who support this philosophy.

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