The conservation knowledge commons: Putting biodiversity data and information to work for conservation

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ABSTRACT

Timely access to the best available data, information, and knowledge on biodiversity is an essential prerequisite for successful conservation. We consider *empirically responsible conservation* – or "evidence-based conservation" – to be essential for this success. We also consider the conservation community or conservation "domain" to be those organizations which are specifically dedicated to the conservation of biodiversity, through policy development, hands-on effort, or research.

Accessing the best available biodiversity data or ensuring wide dissemination of conservation knowledge are not simple tasks. Much of the data, information and knowledge on biodiversity that conservation practitioners and scientists require is fragmented, difficult to find, or simply inaccessible. Weak integration of conservation knowledge assets is considerably magnified in developing countries or countries in transition, where the consequences of limited access to data and barriers posed by the technological "digital divide" present enormous challenges to successful conservation efforts on the ground.

Unimpeded access to biodiversity data and information assets is also critical for effective policy formulation and decision making. The lack of comprehensive time series data on the status of biodiversity or of current, comprehensive data on land uses may result in weak understanding of the impact of climate change on biodiversity. Importantly, incomplete access to biodiversity data may also result in the undervaluation of biodiversity in development impact assessment.

This paper focuses on current issues of access to biodiversity data in the conservation community, and discusses ongoing efforts to address these challenges. While some barriers are technical in nature, most find their origins in institutional or organizational culture or approach. The work of the Conservation Commons will also be presented, along with lessons learned to date from this effort in developing a knowledge commons in the biodiversity conservation domain.

Keywords: *Biodiversity, conservation, open access, knowledge commons*

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OPEN ACCESS TO BIODIVERSITY DATA

Access to the best available data on biodiversity – for instance data on the status of endangered species or of critical habitats -- such as high conservation value forests, biodiversity hotspots, or protected areas – is essential for successful conservation, or for anyone wishing to ensure that development decision making is fully cognizant of potential impacts on biodiversity and the environment (Rodrigues, A. et al, 2008).

Yet obtaining biodiversity data is often fraught with complications. The conservation community is at times its own worst enemy in promoting successful conservation efforts, as much of the research data or best practice conservation organizations generate is simply not accessible. When it ***is*** available a variety of legal or institutional barriers, or a bewildering array of formats and standards, limit the integration of these assets into useful products.

The result is that decision making in the field of biodiversity conservation or environment frequently relies on expert opinion. Worse, decision makers are often influenced by lobbying, or “issue framing” which is not necessarily informed by objective analysis of the available data (Esty, D. and Rushing, R., 2007).

THE KNOWLEDGE COMMONS IN CONSERVATION AND BARRIERS TO ACCESS

Despite exponential expansion of the infrastructure of the World Wide Web over the past 15 years, barriers to data access persist. Effectively, this is an "*information gradient*" (or digital divide) that runs North to South and prevents most peoples in the South (as well as many in the North) from equitable, direct access to data and information on biodiversity. This gradient is both digital *and* analog (Ecochard, J.L., 2008).

Surprisingly, juxtaposed against the phenomenal growth of the internet, with its promise of global access to knowledge, the past decade has also witnessed the emergence of what some have called a "second enclosure" movement. Digital information and data in many contexts are increasingly treated as commodities subject to new and more restrictive proprietary controls (Lessig, L., 2006). Even organizations *that do not seek direct profit* from information (e.g., most conservation organizations) appear hesitant to make their data and information freely available (see Table 1 below). While there has been no comprehensive empirical study of this phenomenon, many knowledge workers in the conservation community cite issues of institutional “culture” (including both unconscious, reflexive, application of restrictive measures and conscious efforts to maintain proprietary control) and to a lesser degree legal and financial barriers.

Conservation organizations have been characterized as “friendly competitors” or even as rivals, and often behave in ways which seek to establish competitive advantage with funders (Chapman, M. 2004). There appear to be fears that organizations will somehow be taken advantage of (i.e., seen to have incompetently "given away the store") if it is perceived that full economic and institutional value has not been extracted from the creation of a particular biodiversity knowledge resource – for example a species data set from a rapid assessment. Interestingly, this perception in effect reflects fundamental institutional fears of criticism for *being seen to permit* “free-riding” on organizational or institutional investment, and in effect may represent a complication which could override the intentions of individual conservationists, or indeed of the organization’s mission. In addition, fiduciary boards of trustees and powerful donors are often *perceived* to be averse to such unfettered release of institutional knowledge assets (i.e. data and information).

In this increasingly “commodified” and “commercialized” information environment, market-based expectations and the assertion of "intellectual property rights" may present impedance to free, equitable and universal access to essential information and data necessary for biodiversity conservation. In many sectors, placing databases or information in the public domain has provided a solution (in the United States individual “data points” -- as constituting individual “facts” are already considered to be *in* the public domain – but databases as designed, value-added aggregations of data may be copyrightable). The notion of the "public domain" recognizes that there is broad social and/or economic value to placing information in a public *commons* for free, general use by all (including commercial uses) (Waters, D.J., 2007). Indeed, in the conservation domain much information and data can simply be placed in the public domain, and we believe that the international conservation community should support and encourage such action.

However, there are many instances of information that are not in the public domain that present more complex rights management dilemmas. Complexly composed data or information objects (involving information or data licensed from multiple sources) such as the IUCN Red List may similarly be inappropriate or unavailable for unconditional placement in the public domain, and more creative solutions must be found.

A way forward to address this issue is the notion of an "information commons", which defines a community of use under certain parameters, and guarantees free unhindered access to data, information and knowledge for that community for carefully defined uses within those parameters (Wilbanks, J. 2004). For example, use may be permitted for research, educational or conservation activities, but not for commercial, for-profit uses. Such a commons may be composed of public domain data and information as well as otherwise restricted information that is made openly available for specified uses. Producers of information may assign rights to such a commons (just as owners of real estate may grant development

"easements" on property to a conservancy) while maintaining traditional controls over their intellectual property rights in the larger international commercial market domain. This is sometimes described as a "conditional domain of use."

THE ETHICS OF ACCESSING DATA AND INFORMATION ON BIODIVERSITY

In addition to the array of institutional, legal, and other barriers in accessing the best available data and information in the conservation domain, there are also ethical issues associated with this phenomenon – most prominent of which is reflected in the persistence of the "digital divide" between north and south. The international community has recognized this issue, and has attempted to address it through a variety of international agreements.

Article 19 of the Universal declaration of Human Rights states: **"Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference *and to seek, receive and impart information and ideas through any media and regardless of frontiers."* [*emphasis added*]**. The former Secretary General of the United Nations, Kofi Annan, also affirmed that equitable access to information should be considered a basic human right (Annan, K. 1999).

Principle 10 of the Rio Declaration (1992, UNCED) proposes that "*environmental issues are best handled with participation of all concerned citizens, at the relevant level, and that at the national level each individual shall have appropriate access to information concerning the environment that is held by public authorities*". Moreover, Article 17 of the Convention on Biological Diversity (CBD) advises that "*parties shall facilitate the exchange of information, from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of developing countries*" (1992, UNCED).

With specific reference to the unique contribution of indigenous and local communities to the conservation of biodiversity, Article 8(j) of the Convention on Biological Diversity suggests that "*each party shall, subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity"*. Finally, Chapter 40 of Agenda 21 emphasizes that "*in sustainable development, everyone is a user and provider of information considered in the broad sense and that the need for information arises at all levels, from that of senior decision-makers at the national and international levels to the grass-roots and individual levels*".

RECENT ADVANCES IN IMPROVING ACCESS TO BIODIVERSITY DATA

Up until very recently the vast majority of data on biodiversity – specifically the over 3 billion individual records of species observations that are estimated to exist distributed among the world's scientific institutes, herbaria, natural history museums – existed as analogue records arbitrarily assembled in collections held far from the regions where the specimens were originally collected. On a global scale, much of this data collection was ad hoc rather than systematic – resulting in many overlaps, and more importantly many gaps in our understanding of species. These collections detailing life on this planet essentially represent the primary historical knowledge base for global biodiversity. Yet this incredible resource collected over the past two centuries, and of significant importance to the success of conservation efforts, is still hardly accessible.

Founded in early 2001, the Global Biodiversity Information Facility (GBIF) essentially convened the international community to resolve this issue through a unique partnership between governments, natural history institutions, and academia. Taking advantage of the exponential growth of the worldwide web and recent breakthroughs in "informatics", or the science of data and information processing, the mission of GBIF was to render accessible over the internet the world's legacy of data on species – most of which was collected from countries in the "south", yet housed in analogue files in institutions in the "north". In seven short years, GBIF has facilitated the creation of a distributed system, based on common data and metadata standards, which now includes over 150 million records on line (with ambitious plans to have a billion records up by the end of 2008).

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"GBIF's vision is to make scientific biodiversity data the common property of everyone, in service to science" (GBIF, 2008)

In addition to observational data, a vast amount of information and knowledge also exists with respect to many individual species and species assemblages. It is embedded in centuries of formal scientific publications held in the world's libraries. It exists in "grey literature" – not formally published – by both governmental and non-governmental organizations. It exists in maps, images and recorded sounds. And perhaps most importantly it exists in the experience-based knowledge of scientists, conservation practitioners and indigenous human cultures throughout the world (Moritz, T. 2004).

Similar to accessing records of species observations, however, the vast majority of these assets – representing a wealth of both scientific and conservation knowledge and experience – remains largely inaccessible. This situation persists despite an increasing number of taxon specific websites, such as Fishbase, Wikispecies, Ispecies, Species 2000, or the more recently launched Encyclopedia of Life, most of them amalgamating content for particular species.

PUBLISHING

A significant portion of the results of research and conservation effort is published daily in many thousands of scientific journals, arguably one of the most important vehicles available for disseminate of the best available science and knowledge on conservation. However, the majority of these journals – and particularly the most prestigious journals – are commercial operations with subscription costs well out of reach for the majority of developing country researchers and practitioners.

A recent initiative of the United Nations Environment Programme and Yale University – Online Access to Research on the Environment (OARE) – represents a step towards improving access to the best available environmental science and practice for developing country researchers. Yet the notion of making scientific data available only to a select body of institutions ignores the many individuals and groups in developing countries (and elsewhere) who contribute to building a global biodiversity knowledge base (innumerable volunteers in conservation, for instance, come to mind) (Agosti, D. 2007).

Plazi.org

Hundreds of millions of pages of information exist within the archives of the world's scientific journals on known species. Identifying and obtaining access to these references, however, is often a very tedious process. Plazi.org is a new Web based service that offers access to descriptions of species and an archive to store the publications as marked up documents. Based on TaxonX, an XML schema modeling the logic content of these publications, the Plazi Search and Retrieval Server allows powerful search functions to find species descriptions, or even simple mention of species, throughout the scientific literature.

The emphasis on a scientific publication being the final, discrete product of research is in the process of a dramatic shift to becoming important building-blocks of a global scientific knowledge system. The Berlin Declaration, which urges its members and their grant recipients to encourage, develop and advocate open publishing models, is exemplary of approaches leading to knowledge systems open to anyone (Berlin Declaration, 2003). Most recently, the US Congress's decision requesting the National Institutes of Health to ensure that all publications based on work sponsored by the NIH were open access is precedent setting. Current trends towards on-line, open access, and fully XML enabled scientific journals – as demonstrated by the Public Library of Science, BioMed Central, or recent commitments by Harvard University regarding open access to research results among others (Gjengedac, K. 2008), is beginning to take full advantage of the power of the web. At present, however, there are no peer reviewed open access journals that are specifically devoted to conservation biology or conservation science.

There are many outstanding issues, including or how to integrate or combine scientific data, standards, peer review, decisions regarding what content is relevant, and others. A core problem in access to the published scientific record, however, is the issue of copyright – particularly in light of recent high profile cases in the music industry or Google and the Google Book initiative. Copyright is a complex issue, governed by both international trade agreements and national law. The level of complexity increases when the line between

commercial use and consumption for science, education, or the betterment of humanity is increasingly blurred. Ignorance of what justifiably qualifies to be protected under copyright often results in the transferring of rights to publishers almost as a default setting. The result is significant barriers to accessing large volumes of the published scientific record, which are both counter-productive for conservation and fail to make best use of the Web.

COMMUNITIES OF PRACTICE

Publishing is clearly an important vehicle for improving the knowledge base for conservation. Yet the time lag between generating conservation results and publicizing those results to the world can undermine the urgent need which exists for tackling urgent environmental problems and rapid ecosystem change. The advent of Web 2.0 and second generation Internet-based services, such as social networking sites that promote online collaboration, strengthens the argument for unrestricted free access to scientific information. More importantly, the emerging 'semantic web' is data-driven and participatory (Lougee, W, 2007).

Given the huge challenges facing conservation today and the need for rapidly disseminating conservation results and best practice, "communities of practice" play an important role in expanding the knowledge base for conservation. The IUCN Commissions are essentially communities of practice, organized around key thematic areas of importance to conservation. The Society for Conservation Biology and similar learned societies also play this role, and make an important ongoing contribution to this knowledge base.

ConserveOnline is a neutral forum where conservation practitioners and communities of practice around the world can connect with each other to freely and openly share information, exchange ideas, and solve problems that help achieve their conservation goals. The goal of ConserveOnline is to support create a vibrant, international virtual community of conservation practitioners who learn from each other and share their expertise. Through ConserveOnline, anyone making conservation-related decisions can easily find answers to important questions and can share their own expertise and experiences with others.

www.conserveonline.org

In an increasingly connected world, however, communities of practice are moving on-line. Blogs, virtual discussion forums, and social networking sites have greatly accelerated the dissemination of ideas and knowledge in almost any sector. In general, the conservation community has been slow to take advantage of these recent advances in an organized fashion, although with the recent launch of initiatives such as ConserveOnline 3.0 this is beginning to change.

CREATING A GLOBAL BIODIVERSITY SPATIAL DATA INFRASTRUCTURE

The incidence of all biodiversity, of course, is place-based – occurring somewhere on the surface of the planet. Conservationists have long realized that by linking data on the distribution of, say, endangered species to other "spatial" data sets that can easily be plotted on a map – such as protected areas,

important ecosystems or, say, future mining concessions – both conservation strategy development and scientific analysis can be greatly improved (Wilson, K. et al, 2007).

Up until quite recently, conflating these data sets and generating maps was the purview of highly trained technicians. But mass market web-based applications such as Google Earth have, for the first time in history, allowed anyone with access to the internet to visualize (and increasingly manipulate) these data sets dynamically, in real time – without the need for sophisticated modeling or geospatial software.

Access to high-resolution satellite images of the Earth, such as through NASA's WorldWind program or Google Earth, or on-line mapping services such as MapQuest, has triggered an unprecedented surge in interest in a wide variety of geospatial applications. As the fundamental components of biodiversity, i.e. species and habitat – and the majority of the ongoing efforts to preserve them - are all "mapable", the notion of "geospatially enabling" data and information on biodiversity is becoming an increasingly important integrating platform for both producers and users of biodiversity data.

Conservation GeoPortal

By definition, biodiversity conservation work is largely place-based, occurring somewhere on the face of the planet. This has resulted in a wealth of maps and geographic information system (GIS) data that are scattered across thousands of organizations and individual scientists worldwide.

The **Conservation GeoPortal** was created to address this issue, providing a framework for cataloging this wealth of cartographic data in the conservation community. With the support of The Nature Conservancy, National Geographic, and the geographic software company ESRI, the GeoPortal is an open "community" resource cataloguing thousands of on-line maps and geographic databases.

www.conservationmaps.org

Knowing with precision, for instance, the location and extent of key areas of biodiversity is obviously important for ensuring that these areas or endangered species are not negatively impacted through development decisions. Place-based conservation efforts, moreover, can be more effectively targeted if a majority of conservation practitioners have similar access to key biodiversity data and information. Analogous to the Encyclopedia of Earth's approach to using taxonomy as the basic infrastructure for integrating the sum total of knowledge about individual species, a geographic or geospatial approach to organizing biodiversity data and information represents both a compelling and logical way forward to effectively managing and improving access to biodiversity data.

GBIF is rapidly moving towards geospatially enabling all on-line biodiversity data it supports. The Conservation GeoPortal provides a metadata window for cataloguing and searching map data held by individual conservation or scientific organizations. The World Database on Protected Areas has been available on line since 2005, and is rapidly improving in content and functionality. Efforts are also underway to geographically render important species data bases such as the IUCN Red List.

ORGANIZING AND INTEGRATING INFORMATION

Common standards for the collection and exchange of biodiversity represents the foundation which allows users to effectively leverage the data and information assets we already have, and stimulate the creation of new biodiversity data. It is important to streamline and significantly improve the way conservation data and information is created, integrated and disseminated through harmonizing (and adopting) existing efforts towards standards development and addressing the gaps that remain.

A number of recognized high-level standards currently exist in the conservation community, including the IUCN Management Categories for Protected Areas, the Red List Categories, and common vocabularies/ontologies for taxonomy developed by the Taxonomic Data Working Group (TDWG). Many of these standards have been adopted by a broad range of organizations, particularly within the conservation community. However adoption is by no means universal – and numerous gaps remain. Current efforts have often not adequately addressed issues of data exchange standards – resulting in many systems using these important assessment values which cannot easily interoperate. The best opportunities for more universal adoption (and development) of data and information standards across the community lie with funding bodies such as the private foundations (Moore, Macarthur, etc.) and with governmental entities such as the US National Science Foundation.

Priority focus areas for the development of new structured data standards include species conservation status, management effectiveness categories and ontologies for protected areas, priority conservation site descriptors and status, as well as common vocabularies for conservation action and best practice. The Conservation Measures Partnership (www.conservationmeasures.org) has developed *Open Standards for the Practice of Conservation*, version 2.0, which addresses some of these areas, but adoption remains patchy. This work will also build on open standards developed in other fields, leveraging existing innovations wherever possible for conservation. These standards include geospatial data standards (www.opengeospatial.org), global and regional species taxonomy standards, on-line referencing and archiving, among others.

BIODIVERSITY DATA AND THE PRIVATE SECTOR

Increasingly, private sector companies have begun to recognize the value proposition of integrating knowledge and information on biodiversity into their decision making processes. Many have made pledges regarding “no-go” areas (IUCN World Parks Congress, 2002) or mainstreaming the conservation of biodiversity into consideration for new developments, and further commitments to the principle of no net loss of biodiversity from industrial or commercial development (http://www.unglobalcompact.org/). Yet in order for these companies to fully meet these commitments a basic pre-requisite is ease of

access to the best available biodiversity data, information and knowledge generated from the scientific and conservation communities.

Many companies, particularly in the resource and commodities sectors such as forestry, mining, oil and gas, and agri-business, are understandably reaching out to the conservation domain to help fill this information gap. This is not philanthropy, nor should it be. Rather, the need for biodiversity data represents a very real business proposition, and access to these data should be based on transparent, open transactions between business interests and the conservation community.

Of course, the private sector is confronted by the same challenges in accessing the biodiversity data they need which are experienced in the conservation and scientific communities – poor accessibility, fragmented sources, and in many cases a lack of standards to facilitate integration and effective use. As a result, many (if not most) investment decisions are taken with an incomplete picture of potential impacts to biodiversity.

To address this issue, some companies are taking steps to build internal expertise (despite the fact this is often tangential to their business models) for gathering, integrating and interpreting biodiversity data in their operating structures. Alternatively, a number of partnership arrangements between some private sector companies and individual conservation organizations to improve access to biodiversity data have recently formed (http://proteus.unep-wcmc.org). These have only been partially successful, as no single conservation organization or scientific body has full access to all relevant biodiversity data sets.

Paradoxically, many private sector companies are also significant holders of biodiversity data themselves – from environmental impact statements to ongoing monitoring. In a number of critical areas of importance for biodiversity conservation, private sector companies have much better data then either the conservation or scientific communities. Internal disclosure restrictions, however, often prevent these companies from allowing access to their monitoring data for scientific purposes. Issues such as potential impacts to “competitiveness” are often cited, although it is arguable that release of non-sensitive data would have no impact on competitive standing, and would in fact support adherence to the corporate social responsibility standards which many companies are adopting.

ACCESS TO BIODIVERSITY DATA AND INFORMATION IN THE CONSERVATION COMMUNITY

Recognizing recent successes in mainstreaming data analysis on climate change into global policy making processes, conservation organizations are increasingly realizing that improved access to and use of biodiversity data can help drive effective decision making in support of conservation (TNC, 2001). Yet while there have been advances in some areas, open access to data generated in the conservation community is patchy at best.

Table 1 below, although by no means comprehensive, illustrates this tendency. In many cases it would appear that efforts to improve availability of data generated through research, implementation, or monitoring efforts are tentative at best. It would also appear that some conservation organizations have yet to take any visible steps to render these assets accessible. In fact, despite the explosion of the internet and exponential improvements to connectivity over the past decade, there have been relatively few tangible initiatives providing access to core biodiversity data generated within the conservation community – the release of the World Database on Protected Areas in 2002 perhaps being the most prominent of these.

The result in most cases is a lack of robust, time serried global data sets of biodiversity – and in particular of key species and habitats of critical importance to conservation efforts. This reality impedes the effectiveness of conservation effort, including informed decision making in other sectors which may impact on biodiversity.

Table 1: Access to data in the conservation community

Organization	**Dataset**	**Data Downloadable**	**Conditions**
Alliance for Zero Extinction	Global map of AZE sites & species	No (view data on-line)	N/A
BirdLife	Site unavailable	Could not be determined	N/A
FFI	None visible on-line	N/A	N/A
GBIF	Species records	Yes (spreadsheet, KML file where available)	Citation, non-commercial
GISP	Invasive species	No	N/A
IUCN	RedList	No (under development)	N/A
IUCN	Global Amphibian Assessment (RedList)	No (view records on-line)	N/A
IUCN	Invasive Species Specialist Group	No (view records on-line)*	N/A
IUCN	Salmonid Specialist Group	Yes	CC 2.0 license
NatureServe	Numerous datasets	Yes	Citation, non-commercial

TNC	Numerous datasets	No-view maps/records on-line (note – extensive review not undertaken)	N/A
WCMC	World Database on Protected Areas	Yes*	Citation, non-commercial
WCS	None visible on-line	N/A	N/A
WWF	Terrestrial Ecoregions & Global 200	Yes	Citation, non-commercial
WWF	Living Planet Report	No	N/A
* - denotes citation of Conservation Commons Principles			

What is less clear from the overview provided in Table 1 is why this situation persists – particularly if it is increasingly recognized that conservation efforts should be founded on the best available data on the status and trends of biodiversity, along with best practice methodologies for undertaking conservation efforts on the ground. Part of the problem relates to ongoing transaction costs (discussed below). A more fundamental constraint may be competition within the conservation community itself for funding and other resources, and the important role branding (particularly of knowledge or information products) plays in fundraising success.

Many prominent organizations such as the National Science Foundation, Harvard University's Faculty of Arts and Sciences, the European Commission, the Science Commons, and the National Academy of Sciences among others have called for open access to the results of all publicly funded research. Given that much of the funding utilized by the conservation community is derived from public sources, a similar commitment to open access within this domain would represent an important contribution to improving conservation outcomes.

TRANSACTION COSTS

While on-line biodiversity data and information assets effectively represent open access resources "freely" available for use by the conservation community or anyone, clearly there are costs associated with creating and maintaining the infrastructure for disseminating these resources. In many cases, grants or time-limited project funding are often used to develop a specific data or information resource. Creating sustainable business models to maintain and improve these datasets over time along with the infrastructure that supports them, however, represents an ongoing challenge for most conservation organizations.

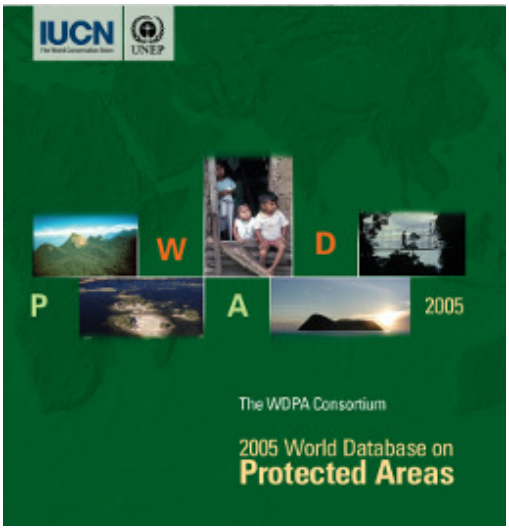
Yet in considering costs to the conservation, research and education communities of the constraints on access that we have been discussing above, it is essential to note that each time a conservationist, a researcher or a teacher is required – acting in good faith – to seek permission for use of some array of data

or of some information (text or image) for their work which contributes to the conservation goals we share, a cost is incurred. The aggregated costs to the global conservation community (or the deterrent effect of such anticipated costs) resulting from these barriers are difficult to estimate – *but must not be underestimated*. And moreover, as we suggest here, such costs are unnecessary.

Creative and innovative approaches to addressing the incremental costs of maintaining stable data and information repositories over time can be developed – particularly in partnership with donors and major grantees. A portion of project funding to defer long term maintenance costs should be included in every research or data collection initiative. Creating permanent funds as a means to provide stable revenues for biodiversity data repositories, effectively treating data and information about life on earth as a "global public good", should also be explored.

OVERCOMING BARRIERS TO ACCESS

In 1996, a number of prominent members of the international conservation community -- under the leadership of IUCN (The International Union for Conservation of Nature) – launched an initiative called the Biodiversity Conservation Information System (BCIS), with the goal of seeking more effective means of sharing data, information and knowledge. The BCIS group – with some substantial support from the Norwegian Aid Agency (NORAD) -- published materials on best practice for data management and conducted some experiments with the construction of metadata registries for partner organizations. The BCIS group also spent considerable effort in addressing the global community in a variety of venues – and ultimately sponsored the adoption of a resolution adopted by the World Conservation Congress in Amman Jordan – calling for IUCN to undertake serious union level efforts to plan strategically for information management (IUCN, 2000).



The BCIS group was also largely responsible for the composition of a visiting committee – constituted by IUCN's World Commission on Protected Areas – to review in August, 2001 the global "Protected Areas database" held at the World Conservation Monitoring Centre (UNEP WCMC). This process led ultimately to the first release to the global community of the full "World Database on Protected Areas" to the Durban World Parks Congress of 2002. BCIS also inspired development of the concept of a "biodiversity knowledge commons".

This group made presentations at the United Nations World Summit on Sustainable Development and the IUCN World Conservation Congress of 2000, where a resolution was adopted. Other sessions convened by the Commons group have included traditional knowledge and the Commons, private sector investment and open access with the International Finance Corporation, and meetings of the Society for Conservation Biology.

The Conservation Commons

The Conservation Commons, an initiative launched at the IUCN World Congress in November 2004, has coalesced around an agreed set of principles – defining a commonly held vision for open access, shared responsibilities, and ensuring effective use of biodiversity data and information. To date, almost 100 institutions (see Annex 1) have formally endorsed these principles. The core purpose of the Conservation Commons is to ensure open access and fair use of data, information, and knowledge on the conservation of biodiversity generated within the conservation community.

Principles:

Open Access
The Conservation Commons promotes free and open access to data, information and knowledge for conservation purposes.

Mutual Benefit
The Conservation Commons welcomes and encourages participants to both use resources and to contribute data, information and knowledge.

Rights and Responsibilities
Contributors to the Conservation Commons have full right to attribution for any uses of their data, information, or knowledge, and the right to ensure that the original integrity of their contribution to the Commons is preserved. 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.

www.conservationcommons.org

The Nature Conservancy, in particular, has made significant investments towards supporting tangible expressions of a knowledge commons within the conservation community - through initiatives such as ConserveOnline, the Conservation GeoPortal, and the Protected Areas Learning Network The American Museum of Natural History, moreover, released its complete legacy of scientific publications (>6,000 publications) for open access in January of 2006, and the development of the "Biodiversity Heritage Library" project – now involving 10 major natural history libraries in the US and UK and with funding under the Encyclopedia of Life project – is slated to digitize for open access the public domain holdings of all these libraries.

Despite these accomplishments, it seems clear that the response of the global community has been uneven and sporadic. Even those organizations which have provided primary support to this "commons" effort have often not taken comprehensive steps to share their non-sensitive data and information assets (which in the majority of cases would require little or no additional costs to the organization).

Adopting the Principles of the Conservation Commons Also represents an important step towards improving open access in the conservation community (see Annex 1). Tangible, concrete actions for putting these Principles into practice, however, are required if we want to ensure both the conservation and sustainable use of biodiversity on this planet.

CONCLUSIONS

Ethically, all but the most mercantile of knowledge workers and practitioners in the conservation community have a common mission: *the widest possible dissemination of knowledge for the benefit of biodiversity conservation*. Numerous approaches and tools presently exist to support open access in biodiversity conservation, including depositing of non-sensitive data and information directly into the public domain, contributing to efforts such as those described in this paper, or adopting the Principles of the Conservation Commons along with comprehensive strategies to put these Principles into practice. No organization can address the formidable challenges we face in conservation single handedly. Nothing short of a broad-based, collaborative movement within the conservation community can begin to tackle these challenges, and create the "virtual" community or knowledge "commons", where sharing much-needed data and information resources becomes the norm rather than the exception, required to sustain conservation success.

Environmental degradation and species loss continue to accelerate. Ecosystem stress and collapse is reaching such proportions that it will ultimately undermine any hard-earned gains that have been achieved towards sustainable development. The conservation community must not fail to use every effective means at our disposal to ensure open access to the best available knowledge, data, and best practice on the conservation of biodiversity.

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Annex 1: Organizations formally endorsing the Principles of the Conservation Commons

- American Museum of Natural History
- Alexander von Humboldt Inst. (Colombia)
- AntBase
- ARKive
- Belgian Biodiversity Platform
- Big Sky Conservation Institute
- Biodiversity Research and Training Forum
- BIONet International
- BirdLife International
- BP
- Centre for Genetic Resources
- Centre for Sustainable Watersheds
- Centre for Ornithology and Natural History (SACON-India)
- Chevron-Texaco
- CIFOR
- Coastal - Marine Environmental Science & Technology
- CONABIO – Mexico
- Conservation Biology Institute
- Conservation International
- CRIA (Brazil)*
- Digital Library of the Commons
- DIDG Information Systems
- Earth Conservation Toolbox
- EcoPort
- Environmental Education Center "Zapoveniks"
- Erawan Interactive Digital Publishing
- ESRI
- ETI BioInformatics
- Friends of Nature – Bolivia
- Flora & Fauna International
- Global Biodiversity Information Facility
- Global Invasive Species Database (GISD)
- Global Invasive Species Programme (GISP)
- Global Land Cover Facility, UMD
- Global Trans-boundary Protected Area Network
- GreenFacts
- INBio
- Information Center for the Environment, UC Davis
- INSnet, Internetwork for Sustainability
- Instituto de Biologia, UNAM (Mexico)
- Instituto Nacional de Biodiversidad
- Inter-American Biodiversity Information Network (IABIN)
- InterEnvironment
- International Center for Himalayan Biodiversity
- International Commission on Zoological Nomenclature
- Invasive Species Specialist Group (SSC)
- IUCN - The World Conservation Union
- Knowledge Management Online
- London Museum of Natural History
- Open Source International
- My Nature (Hungary)
- NASA
- National Biodiversity Institute – SANBI
- National Biological Information Infrastructure (NBII)
- National Geographic Society
- Nature Protection Trust – Seychelles
- NatureServe
- PALNet
- Philippine Society for the Protection of Animals
- RedHat
- Regional Centre for Development Cooperation (RCDC), Centre for Forestry and Governance (India)
- Réseau Africain pour la conservation de la Mangrove
- Rio Tinto
- Shell
- Society for Conservation GIS
- Social Insects Specialist Group of SSC
- The African Conservation Foundation
- The EcoInformatics Collaboratory
- The Nature Conservancy
- The Rainforest Alliance
- The Smithsonian Institution
- The Wildlife Society
- The World Conservation Union – Pakistan
- The Zoological Society of London
- TRAFFIC International
- TROPI-DRY – Forest Research Network
- Tropical Conservancy
- Tropical Rainforest Animals
- UNDP
- UNEP – WCMC
- UNESCO
- Wetland Friends of Nepal
- Wetlands of India
- Wild Bird Club of the Philippines
- Wildlife Conservation Society
- WildShare International
- World Commission on Protected Areas
- WWF Canada
- WWF Brazil
- WWF International