

**GBIF Plans 2007 – 2011**  
from prototype towards full operation



**GLOBAL BIODIVERSITY INFORMATION FACILITY**



... free and open access to biodiversity data

**GBIF Strategic and Operational Plans 2007-2011:  
From Prototype towards Full Operation**

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## Foreword

The major purpose of the GBIF Strategic and Operational Plans for 2007 - 2011 is to provide a roadmap that would enable GBIF to move toward full operational status by 2011. This document lays out our ambitions for GBIF, and indeed the Governing Board has agreed that we should strive to achieve these goals.

GBIF is unique in many respects. First, it is not a physical infrastructure, but a distributed and digital one that lives in the Internet. Secondly, it builds on the collective efforts and contributions of thousands of scientists in hundreds of institutes in tens of countries around the world. Thirdly, it serves many different user communities. These striking features distinguish GBIF from many other kinds of infrastructure.

The utility and importance of the rich data served through GBIF is being recognised by widely differing kinds of organisations in science and society. The Convention on Biological Diversity and other international conventions, land-use planners and the agricultural sector are all starting to ask for specific services that GBIF can deliver. As GBIF moves into a fully operational phase, these requests and others from other sectors will become more and more numerous.

The GBIF Strategic and Operational Plans for 2007-2011 will fundamentally continue the directions laid out in the Strategic Plan for 2001-2006 to

- enable scientific research that has never before been possible
- facilitate the use of scientific data in biodiversity policy- and decision-making, and
- make a whole world of biodiversity data that are currently exceedingly difficult to access freely and universally available via the Internet.

During the coming five year period, GBIF will become much more useful to its users by greatly improving the GBIF Data Portal system and the underlying web services, focusing in a major way on Participant Nodes and user communities, and emphasizing the improvement and description of data quality.

This document is intended to

- direct the work of GBIF (Secretariat, Participants and Nodes) and
- be a communication document to the broader scientific and user community interested in the future directions of GBIF for the next five years.

In honour of this new phase of GBIF, a new logo has been adopted (see cover), although the familiar "G" logo appears elsewhere in this document as a reminder of what has been accomplished during the first five years.

The several GBIF scientific advisory committees and our Participants have provided inputs and comments during the development of the Strategic and Operational Plans for 2007 - 2011. We in the Secretariat fully recognise the significance of these contributions and hope we have been able to consider and in a fair way balance different interests into coherent and sustainable plans.

Achieving the ambitions laid out in these plans will require a great deal of involvement and funding from GBIF's Participants and other partners and stakeholders. Significant external funds will have to be raised in order to come close to the goals and visions set out in these Plans. I hope all parties interested in GBIF will be aware of that and will actively work with us to fully realise the benefits of carrying out these Plans for GBIF's future.

*James L Edwards*  
Executive Secretary

## Executive summary

Many of the problems of the modern world transcend borders - as can their solutions, when diverse domains of science and data are connected in powerful and strategic ways. Thus GBIF's *prototype phase* has proven its worth as a conduit for knowledge and a multiplier of value in the urgent struggle to slow biodiversity loss and raise human knowledge about the range and variety of life on Earth. GBIF's early achievements have validated its mission to digitise and link the world's biodiversity databases: by making the data useful it can serve science, society and a sustainable future.

These *Strategic* and *Operational Plans* for 2007-2011 present a creative, comprehensive approach to *implementing an enhanced phase* in which GBIF will embody a dynamic worldwide community, able to respond to the needs of both scientific and applied users of biodiversity information.

The vision of the *Strategic Plan* is to extend GBIF's efforts to make biodiversity data available freely and universally through the Internet as the common property of everyone. GBIF will promote and support the digitisation and sharing of existing and new primary data and its application through practical tools.

The Plan foresees increasing the scope of some current activities and adding some new ones while prioritising among them all, building even broader working partnerships than has been done to date, and gaining even higher visibility in the scientific and other communities.

In partnership with the Convention on Biological Diversity and other biodiversity-related conventions, GBIF will identify at least three key areas in which GBIF-mediated data will serve convention initiatives.

The *Operational Plan* describes the tasks that need to be undertaken to move GBIF from a proof-of-concept, start-up organisation to fully operational status. These are grouped in major themes with clearly stated goals and milestones, key objectives of which are summarised below:

### Content

- Bring the *Electronic Catalogue of Names of Known Organisms* from its current 30% to 65% completion by 2008 and 95+% completion by 2011
- Promote the *digitisation and sharing*, via the Internet, of the stores of primary data records about species, prioritising data through consultation with users and scientists, and bringing the records available online to between 500 million and 1 billion by 2011
- Incorporate *new data types* throughout the period, and new tools that will facilitate "web-enabled taxonomy" by 2011

### Informatics

- *Improve the user-friendliness and capabilities* of the Data Portal system, both for humans and machines to use
- *Enable Internet searching for biodiversity data* across all levels of biological organisation, from molecules to ecosystems
- *Provide tools for improving data quality* and assessing its fitness for use early in the 5-year period

### Participation

- *Support the capabilities of Participant Nodes*, increasing their online presence from the current 40% to 100% by 2009
- *Enhance the capacity of people* to use and/or provide data by developing, with partners, an expanded program of training
- *Increase participation in GBIF* by 10% per year, and have all mega-diverse countries involved by 2011

*It is the right initiative with the right goals at the right time.*

GBIF Third Year Review, Preface

*In our view, if it did not exist, it would need to be created.*

GBIF Third Year Review, Executive Summary, p. ii

GBIF's dynamic and interactive *information architecture* will function as an ever-evolving open foundation on which anyone may build their own applications for biodiversity data. In this way it will push back the boundaries of discovery through new information technology techniques. The fully scalable platform can support science and decision-making at national, regional or global levels. Information will be encoded richly to support sophisticated "data mining".

Most of GBIF's services, and its links to molecular and ecological data, depend on scientific names. The work on extending the *Electronic Catalogue of Names of Known Organisms* from its current 30% to a 95% complete listing of life on Earth by 2011 is an essential part of moving toward full scale GBIF operation.

Valid and reliable data are fundamental for science as well as for planning and decision making. Therefore GBIF will develop and implement tools and procedures for *improving data quality*. Further activities as part of the Plan will include *improving the Data Portal system* and *expanding the depth and range of data types* to which it is a user-friendly gateway.

In addition, extended *outreach and training* efforts will help GBIF to function more efficiently as a worldwide network by supporting its participants, while also reaching out to new opportunities by raising awareness among potential data providers and users.

### Funding

The cost of enhancing GBIF to a more fully operational facilities with the outlined goals implies an increase of the GBIF Secretariat budget over the five-year period from approximately *3 million EUR in 2006 to 10 million EUR in 2011*. It should be noted that this is only a small percentage of the total investment worldwide in GBIF-related activities, because Participants will be making other investments that benefit themselves and GBIF.

The Plans have a fully developed budget annex to explain the necessary investments if the planned goals are to be achieved. The background information also provides examples of the costs of supporting similar organisations that hold or provide databases globally. Compared to these, GBIF has been under-resourced, a fact that the Third Year Review noted more than once.

### Campaigns

The Operational Plan outlines a new approach, called *campaigns*. A campaign is a project, or set of projects, that *brings together a range of collaborators* with a goal of developing a biodiversity informatics solution, increasing biodiversity data content and helping to organise providers and users into communities.

Together, GBIF and campaign partners will *set priorities, develop external funding models* and, through synergy, *achieve outcomes* that none could have achieved alone. Campaigns may include entrepreneurial organisations that benefit from GBIF-mediated data, information and communication technology (ICT) development partners, private foundations or governmental aid agencies. Identified *user communities may be related to global initiatives*, such as the Convention on Biological Diversity, the Global Strategy for Plant Conservation, the Global Pollination Project or the UN Millennium declaration.

### Public good and return on investment

Biological specimens, observations of nature, taxonomy and nomenclature are fundamentally important to science. These *species-level* data are *global public goods*: public funds have been invested in their collection over nearly three centuries, and many nations continue to gather new data. *The return on their investment can be multiplied* by bringing these data into the GBIF network.

*This revolutionary capability for sharing a treasure of unique data collected from across the entire planet will promote scientific collaboration and dramatically improve fundamental understanding of the state of the world's biodiversity. Science and society stand to gain much from the GBIF data. Data mining will turn up gems of insight and understanding that cannot be predicted but are likely to lead to fruitful new directions for both research and commercial applications. Such insights are vital to creating better futures for both people and nature.*

Report of the U.S. National Science Foundation Advisory Committee for GPRA Performance Assessment, 2005, p. 40

Species data are critical to developing an understanding of biodiversity that spans the full range of knowledge, standing as they do between molecules on the one hand and ecosystems on the other. Again, the return on investment already made in public-good molecular sequence databases and ecosystem observations can be multiplied by adding species data via an information architecture that allows people to combine all types of data in innovative ways. This is particularly true because the investors - in this case, GBIF Participants - combine not only their monetary resources but also their human capacities and openly share their data stores. Such a pooling of data, resources and expertise is mutually beneficial, achieving economies of scale and synergies that none could achieve alone. It is vitally important to remember that it takes active participation by all the parts of GBIF to create a networked future that will serve science, society and biodiversity itself.

GBIF has been built on this philosophy and will itself, with the implementation of the 2007-2011 Strategic Plan, be a significant global public good.

## Introduction

The Global Biodiversity Information Facility (GBIF) is an international organisation established in 2001 with the mission to make the world's biodiversity<sup>1</sup> data freely and universally available via the Internet. The establishment of GBIF was initially recommended by a megascience initiative of the Global Science Forum of the OECD<sup>2</sup>. However, from its inception GBIF has been global in its reach and inclusiveness, and is a global public good (see Box 1).

<sup>1</sup> All terms that may be unfamiliar to the general reader are defined in Appendix 2.

<sup>2</sup> All acronyms used in this document are fully spelled out in Appendix 2.

### BOX 1

#### GBIF as a Global Public Good

Public goods, as generally understood, have two important characteristics: (1) they are freely available to all, and (2) they are not diminished by use. By this definition alone, GBIF is a public good: (1) GBIF's fundamental principle is freely shared, accessible data, and (2) GBIF-mediated data can be used and reused by anyone- the very use of the data can often improve their quality. There is no single major "buyer" for GBIF-mediated data - in fact, the data can be used by researchers to generate new knowledge, by non-governmental agencies of one sort or another, by governments for decision-making, and by industry to generate profits and therefore tax revenues for governments.

A recent scientific paper by Arzberger et al.<sup>1</sup> has as its core principle that publicly funded research data should be openly available to the maximum extent possible because these data are a public good produced in the public interest. A set of very good examples of this are the databanks such as GenBank, PDB and FlyBase. They are supported by public funds, and are used for free by basic researchers to generate new knowledge as well as by the private sector to generate profits. Similarly, GBIF is a databank for the species level of biodiversity - serving up data from many sources that were generated in large part using public funds.

Also stating that factual data are central to the scientific research process and that data access and sharing issues are international in scope, Arzberger et al. then lay out eleven operating principles that should be included in explicit data access regimes. These are: Openness, Transparency, Responsibility, Professionalism, Interoperability, Quality, Efficiency, Flexibility, Property, Legality and Accountability. GBIF was the example chosen by these authors of an organisation that had developed an explicit data access regime - and they clearly point out that GBIF incorporates all eleven of the desirable operating principles.

There is increasing realisation that many of the important economic and social problems facing the world transcend national political boundaries. It is less widely recognized by the public that a broader approach to science and research may also provide significant economies of scale and synergistic interactions.<sup>2</sup> As pointed out by Arzberger et al., the key issue is that funding for data sharing infrastructures such as GBIF needs to be constructed on an ongoing basis, in order to maintain effective data management. As a global public good, GBIF will thrive if supported through implementation of a culture of data sharing and access (see Appendix 2) as well as financial contribution to coordination activities, by governments around the world.

<sup>1</sup> Arzberger, P., P. Schroeder, A. Beaulieu, G. Bowker, K. Casey, L. Laaksonen, D. Moorman, P. Uhlir and P. Wouters. 2004. *Promoting access to public research data for scientific, economic and social development*. Data Science Journal 3: 135 - 152.

<sup>2</sup> Dalrymple, D., 2002a. "International Agricultural Research as a Global Public Good: A Review of Literature, Issues, and the CGIAR Experience." In: Reeves, J., McNab, A., Rajaram, S. (Eds.), *Proceedings of the Warren E. Kronstad Symposium*. CIMMYT, Mexico, D.F., 59-72; and Dalrymple, D., 2002b. "Scientific Knowledge as a Global Public Good: Contributions to Innovation and Society (Examples from Agriculture)." Prepared for the *Symposium on the Role of Scientific and Technical Data and Information in the Public Domain*, 27 National Academy of Sciences, Washington, D. C., September 5-6, 2002.

The Global Biodiversity Information Facility (GBIF) is an international organisation established in 2001 with the mission to make the world's biodiversity<sup>1</sup> data freely and universally available via the Internet. The establishment of GBIF was initially recommended by a megascience initiative of the Global Science Forum of the OECD<sup>2</sup>. However, from its inception GBIF has been global in its reach and inclusiveness, and is a global public good (see Box 1). In its first five years, GBIF has achieved proof-of-concept of its mission. It currently has a prototype portal that connects nearly 100 million biodiversity data records that adhere to interoperable standards for data sharing. It has grown from 10 original members to 46 country members, 1 economy, and 31 international organisations as of this writing. It has proven useful to its members in many ways, not least by leveraging expenditures on biodiversity science, conservation, and information technology.

GBIF now needs to move into a phase of establishing itself as the globally preferred portal for biodiversity data. To do this it must develop more visibility and partnerships in scientific communities, take a more user-oriented approach, and enhance the information infrastructure it has begun to build. It must also ensure adequate resources, including funding and staffing, to make GBIF sustainable, as well as provide a framework that adds value to national efforts in biodiversity. This document sets the general direction for GBIF for 2007-2011, and will be implemented according to the Work Programmes that will be developed for those years. The Plans presented here are informed and guided by the GBIF Third-Year Review, which was an independent analysis of GBIF's accomplishments to date (see Box 2). These new GBIF Plans constitute a "living document" and the effectiveness of the Plans will need to be assessed midway through the timeframe covered, in 2009, to determine whether the outcomes are being achieved and if the milestones are realistic.

Throughout this document, the term "GBIF" when used alone means GBIF in the broadest sense: the Participants, the Nodes, the data providers, the information infrastructure, and the Secretariat. If only one of the parts is meant, that is stated (e.g. Participant Nodes, GBIF Secretariat).

This document is divided into the following sections:

- The Strategic Plan lays out the vision, mission and principles of GBIF. It also provides the key objectives and goals for 2007 - 2011, grouped together into four themes: Content, Informatics, Participation, and Governance and Funding.
- The Operational Plan outlines the activities and milestones needed to carry out the Strategic Plan. It identifies Participant activities associated with the goals, and the needed funding to achieve the goals in a series of modules.
- "GBIF 2001 - 2006" is a section that describes, for those readers less familiar with GBIF, the manner in which GBIF currently functions and the accomplishments it has achieved during its first five years.
- The Appendixes contain a logical frameworks analysis of the Operational Plan, as well as an investments summary and a timeline (Appendix 1) and a glossary and list of acronyms, with expansions (Appendix 2).

It is important to emphasise that these overall plans for GBIF will be complemented by the Participants' own plans about how they will utilise GBIF and implement it to help accomplish their own goals.

**BOX 2****The Third - Year Review of GBIF**

As of 2004, GBIF was in its third financial year, and the independent review process called for by the MoU was undertaken. Overseen by a partnership between CODATA and the international advisory group KPMG, the Steering Committee for the review included one representative of CODATA and two representatives from KPMG. Six highly respected individuals who were knowledgeable about the subject matter and intent of GBIF, but who were not involved in GBIF, were selected by the Steering Committee to serve as the Review Committee.

The Report of the Review Team (Steering Committee + Review Committee) was based on fact-finding by the KPMG representatives, the results of online questionnaires, and interviews with GBIF delegates, subcommittee members, officials of Participant countries, the Secretariat staff, representatives of other international organisations, and potential end users of GBIF data. It was presented to the Governing Board at its tenth meeting, April 2005.

**Content of the Review**

The major focus of the review was to analyse GBIF's effectiveness and to make recommendations regarding its future (e.g., should GBIF be continued beyond the initial five year period?). Four fundamental questions about the nature of GBIF had to be answered during those years. These questions, and the Third Year Review Team's answers to them, were:

- *Is a global distributed database feasible?* Yes, but the Data Portal interface and system need a lot of improvement. However, GBIF at present is greatly under-resourced for Portal development in relation to other database projects that deal with biological data.
- *Will data holders share biodiversity data through GBIF?* Yes, but there needs to be prioritisation of acquisition of future content in order to get a critical mass of data for identified users, and more attention must be paid to data quality issues.
- *Are the Participant Nodes a viable concept?* Yes, but the Nodes need much greater attention, and for many developing-country Nodes, capacity enhancement is much needed.
- *Can GBIF work with other international organisations to achieve its goals?* Yes, but special attention must be given to working with partners to complete the ECAT, and more end users need to be involved.

In pursuing answers to the questions, the Review Committee examined the quality and effectiveness of the following areas: Work Programme, Governance Structure, Legal Basis, Operations of the Secretariat and the Governing Board, Nodes, Voting Participation by Intergovernmental, Non-governmental and Other Organisations, Links to International Conventions, Links to Other International Organisations, IPR, Financial Mechanisms and Additional Funding.

**Major Conclusion of the Review**

Because GBIF is a megascience undertaking that will provide an essential informatics infrastructure for future biodiversity research and applications activities worldwide it should be fully supported and continue.

*In the third year, an independent review of [GBIF's] operations, financial mechanisms, legal basis, governance structure, and links to other organisations will be conducted to determine if any changes are needed. The lessons learned will be used to evaluate the effectiveness of the governance structure and to recommend any necessary changes.*

First GBIF MoU, Paragraph 11.2

## Strategic plan

### Introduction

GBIF exists within a creative tension at the interface of biology and information technology (IT). Biologists are the first to discover unexpected, new avenues for research on the basis of GBIF data; in turn this may then lead to novel findings and applications for science and society. IT experts, on the other hand, are challenged by the complexity of the GBIF information content. Dealing with the management, interoperability, and analysis of GBIF data in, for example, a Grid environment, is expected to result in IT applications usable by several sectors of society.

Thus, GBIF needs to partner both with public and scientific users to ensure that their immediate needs are being served, while also fostering new and innovative ways to use biodiversity data in curiosity-driven research. A balance between these differing expectations must be built into GBIF's work programmes and its resource allocation.

With respect to serving immediate scientific and public needs, GBIF has to strive to especially develop crucial partnerships with the partners that depend on GBIF-mediated data. This can be achieved through joint campaign strategies—involving the relevant user groups, data providers and funders—which will help to generate the funds needed to build the required applications on top of the data served through GBIF.

Original and innovative scientific development can be triggered by organising advanced training programmes and workshops, and through supporting scientific conferences dedicated to such approaches. The essence here is to train new generations of scientists in this area.

Getting spin-offs from IT is one of the best ways to keep GBIF operations at the top of information technological developments. Not only is this essential to deal with the complexity of biodiversity data, but it may also lead to new approaches towards dealing with complexity in other information sectors.

### Vision

GBIF will do for biodiversity data what the printing press did for the sharing of recorded information during the Renaissance – it will make scientific biodiversity data the common property of everyone, in service to science, the Convention on Biological Diversity among other international conventions, and the public good. GBIF is based upon primary scientific data—data that were recorded directly from nature—and upon a robust and comprehensive taxonomic system. These kinds of data can be used and reused in different analyses without diminishing their value. However, in this digital age, the use of biodiversity data are limited by the paucity of records that are in a digital form; most data are recorded only on paper in ink. For this reason, GBIF places a strong emphasis on the digitisation of natural history and other biological collections, as well as taxonomic names data and concepts. In addition, GBIF will provide tools that will, to unprecedented levels, enhance quality of these data, and describe its fitness for various uses.

By 2011, GBIF will embody a dynamic, worldwide community able to respond to the needs of scientific and applied users of biodiversity information by locating and exchanging relevant data through a robust web-based facility, providing analysis tools, and identifying potentially relevant sources of data and the means of making them accessible. Its well-developed, web services-based information architecture will be catalysing further IT developments by its Participants, partners and others. This shared community resource will thus be dynamic, interactive and ever-evolving, and will allow anyone to build applications that address and use GBIF-mediated data. It will be a fully scalable information architecture that can support science and decision-making at any appropriate scale: national, regional or global. GBIF will be playing a leading role in the development of data and metadata standards that enable linking together molecular, species and ecosystem data, as

well as digital libraries, images and other resources. This will make possible and facilitate 'mining' of data across multiple levels of biological organisation and thus open new avenues of scientific investigation. GBIF-developed tools will allow rapid generation and transfer of taxonomic data and the construction of species data-banks. GBIF will be assisting with capacity building in many parts of the world, and forming ever more partnerships to expand its contributions to science and society. Given limited resources and the twin urgencies of slowing biodiversity loss and increasing the store of human knowledge about biodiversity, it would be well if there were a global entity that could help coordinate the information-sharing activities of multiple players. GBIF is well-positioned to be this coordinating entity.

### **Mission**

GBIF comprises its Participants, their Nodes, data providers around the world, and a coordinating Secretariat that works with partner organisations of many types to accomplish the goals of all. It does this by

- Supporting and promoting the view that sharing biodiversity data, with clear rules and with full respect for the rights of the providers, has clear advantages for both users and providers.
- Reaching out to data providers and potential users of the data, providing them with opportunities to increase their capacity to share and utilise biodiversity data.
- Encouraging and facilitating the digitisation of data, including historical specimens, their label texts and associated materials, as well as observational data, so that these can be added to the digital store of available data;
- Encouraging and facilitating the digital capture, documentation and georeferencing of new specimens and observational records;
- Building an information architecture that offers web services to users and data providers, and makes biodiversity databases interoperable among themselves and across levels of biological organisation, as well as with digital literature;
- Helping its Participants meet their biodiversity information needs by providing the standards, knowledge transfer, technologies, and other assistance in gaining relevant capacity that help them access, link together and use data sources located anywhere in the world; and
- Balancing the need to make GBIF a user-driven deliverer of applied benefits in the short term with the need to innovate and build an information infrastructure of long-term utility that can allow science to operate in new ways.

### **Principles**

The founding GBIF Memorandum of Understanding<sup>1</sup> laid out the principles of GBIF, to which it still adheres. These are that GBIF will:

- be shared and distributed, while encouraging co-operation and coherence;
- be global in scale, though implemented nationally and regionally;
- be accessible by individuals anywhere in the world, offering potential benefits to all, while being funded primarily by those that have the greatest financial capabilities;
- promote standards and software tools designed to facilitate their adaptation into multiple languages, character sets and computer encodings;
- disseminate technological capacity by making widely available scientific and technical information; and
- make biodiversity data universally available, while fully acknowledging the contribution made by those gathering and furnishing these data.

Adherence to these principles is specifically intended to achieve benefits both for science and for society, and make GBIF a global public good.

<sup>1</sup> *First GBIF Memorandum of Understanding, Paragraph 3, Section 2. The whole document is available at*

<http://www.gbif.org/documents/firstmou>

### **Objectives and goals for 2007-2011**

GBIF will work in a user-focused way within four thematic areas: Content; Informatics; Participation; and Governance and Funding. Each will deliver one or more key objectives to ensure realistic progress towards the GBIF vision.

#### **Content**

GBIF will stimulate high impact science and exploit linkages among biodiversity data types at all levels of biological organisation and with data of other types through worldwide data sharing.

#### **Key objective**

- Complete a catalogue of known species names, and develop a range of species occurrence datasets with good taxonomic, temporal and geographical scope with demonstrable usefulness to, for example, the biodiversity-related conventions.

#### **Goals**

- A. Data integration and discovery is enabled for all groups of organisms by the electronic catalogue of names of known organisms
- B. The quality of the data served through the GBIF network is documented so its 'fitness for use' can be assessed and the quality of this data when errors are identified is being improved
- C. The amount and richness of the data served through the GBIF network are sufficient to meet the needs of major user groups, such as the CBD and scientists, and are sufficiently interoperable with genomic and ecological data to allow GBIF's users to develop more comprehensive approaches to the study of biodiversity

#### **Informatics**

GBIF will deliver innovative, practical and enabling informatics to achieve its vision of being the preferred gateway, worldwide, to a comprehensive, distributed array of biodiversity data that will serve many kinds of users, including scientists and the biodiversity-related conventions.

#### **Key objective**

- Enhance the GBIF technical network and its support services, so that they provide a high-performance, reliable, easy-to-navigate system for users to find data from which they can then derive biodiversity information products.

#### **Goals**

- A. Make the GBIF Data Portal system user-friendly and open to machine access, and thus a powerful tool for most popular uses and applications
- B. Consolidate the underlying enabling infrastructure and standardisation for global connectivity of biodiversity data and information using state-of-the-art IT tools and techniques
- C. Provide user-friendly tools for Nodes and data providers to support data sharing
- D. Support infrastructure for the GBIF information system moving from prototype to operational status, while also ensuring security and implementing appropriate backup

#### **Participation**

GBIF will help Participants build sustainable capacity for sharing data that meets their information needs, so that they receive the benefits outlined in the vision, and will establish a cohesive and inclusive network of alliances and partnerships, and through these identify and meet user needs.

**Key objectives**

- Provide all Participants with the knowledge and tools to share data, and help them develop their priorities and plans for establishing and maintaining their Nodes over the long term.
- Enable Participants to obtain science and applied use benefits from their own investments in data sharing.
- Engage with the biodiversity related conventions in at least three key areas where GBIF-mediated data will help deliver convention objectives at global and regional scales, and develop, test and implement solutions in partnership.

**Goals**

- A. The expertise and services that Nodes have are openly shared and constitute an integral component of GBIF activities
- B. Participants have access to adequate assistance, training and guidance to set up and maintain effective and efficient Nodes
- C. Country and organisational Nodes are empowered to effectively contribute to GBIF and obtain tangible benefits from it
- D. Data providers are comfortable about IPR issues and generation of value-added data and products by both non-commercial and commercial users
- E. New uses of biodiversity data to address scientific questions and provide solutions to outstanding issues in society are developed regularly and respond to the needs of a broad range of users
- F. GBIF ensures and promotes the active engagement of countries and scientific communities and helps provide the data needed for implementation of the biodiversity conventions

**Governance and funding**

GBIF governance will lead and manage the delivery of the key objectives and goals for content, informatics, and participation and as such needs to be able to move swiftly and flexibly to take advantage of opportunities that arise. A reasonable balance within GBIF's budget between the core funding provided by Participant contributions and external funding raised from donors in a campaign-style approach will achieve sufficient funds to be able to run the Secretariat efficiently and effectively in service to GBIF as a whole.

**Key objectives**

- Adopt a strong but flexible governance structure that balances input and advice from scientists with the needs of decision-makers, users and other stakeholders.
- Use a campaign approach to external funding to increase the content, functionality and value of GBIF activities to better serve all its users.

**Goals**

- A. Streamline the work of the Governing Board while ensuring that all Participants in GBIF have a voice in shaping the strategic direction of GBIF
- B. Widespread membership of Participants in the committees and working groups of GBIF
- C. An Executive Committee enabled by clear terms of reference to provide oversight of the implementation of the GBIF work plan by the Secretariat and ensure that the Governing Board is kept informed in a timely manner.
- D. An effective mechanism to enable GBIF to access advice from leading specialists to inform its strategic direction and work plans
- E. Conduct campaigns that bring together data users, data providers and funders who together design projects that synergistically serve everyone.

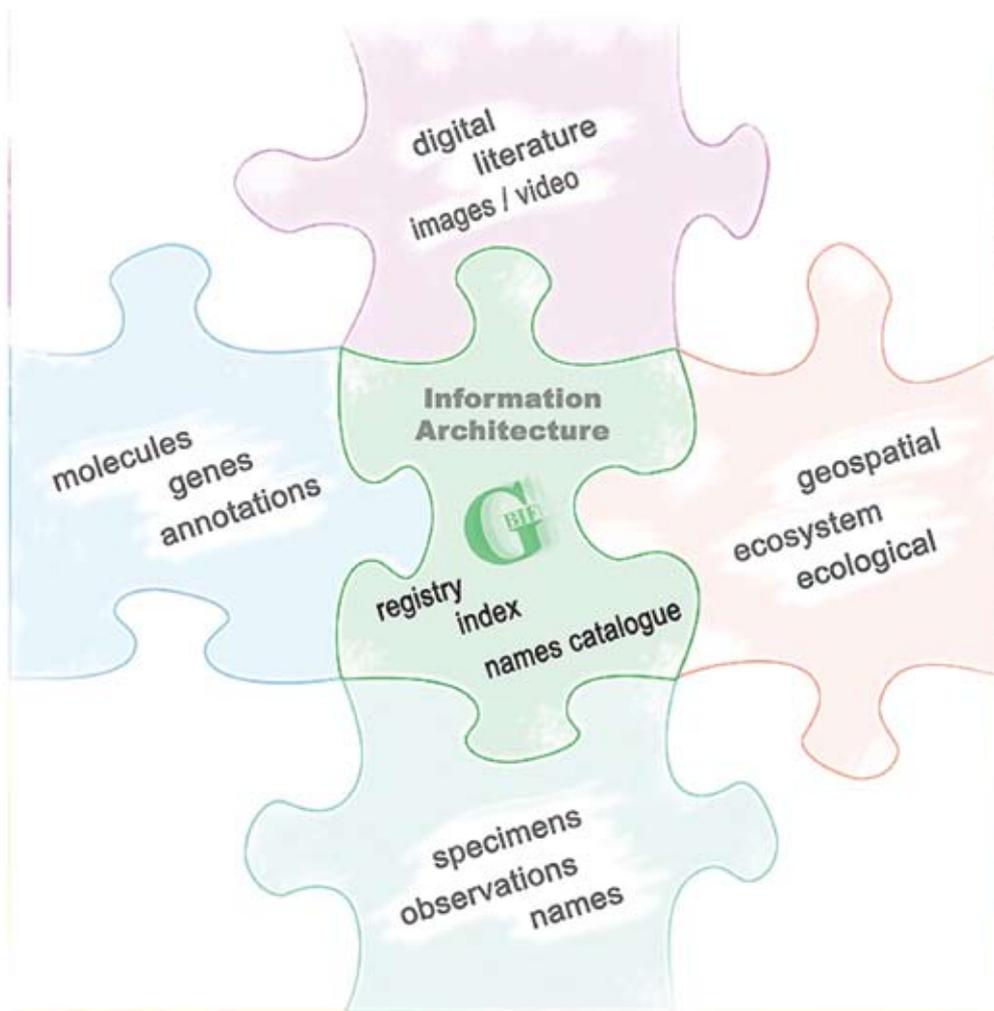
### **Conclusion**

It is necessary to integrate and analyse many different types of data from the socio-economic, physical and biological domains together to answer the challenges that face science and society. If this Strategic Plan is fully implemented, GBIF will facilitate the contribution of biodiversity data to these analyses by making it possible to simultaneously search databases at multiple levels of biological organisation molecular, species, ecosystem (see **Figure 1**). The electronic catalogue of names of known organisms that is one of GBIF's major areas of emphasis is the centerpiece of this interconnectivity and interoperability.

GBIF's focus on species-level data is essential to enable linking across the whole biological spectrum from molecular data to ecosystem information, as well as from primary data through to the published literature. GBIF's information architecture will provide pathways through this multidimensional landscape of data and information (see **Figure 1**) that will be accessible to everyone via the Internet. For example, these data can form a scientific foundation for the information needs of the Convention on Biological Diversity and other biodiversity-related conventions. They form a baseline for measuring rates of biodiversity loss thus helping with the 2010 initiative, as called for by the World Summit on Sustainable Development, as well as informing the Global Strategy for Plant Conservation, to mention but a few items. At the same time, the data shared via GBIF can be used to answer the questions of basic researchers, agriculturists, resource managers, national planning agencies, conservationists and others.

Rapid accomplishments and open outreach during its early years have given GBIF the visibility needed to proceed on a path toward brokering partnerships among the many projects that exist or are being started by nations, regional coalitions, or global organisations. Doing this will require key differences from the proof-of-concept operating procedure and funding levels in place under the first Strategic Plan (for 2003 - 2006). Implementing the Plan presented here requires increasing the scope of some current activities and adding some new activities while prioritising among them all, building even broader working partnerships than has been done to date, and gaining even higher visibility in the scientific and other communities. These goals cannot be achieved without sufficient resources.

This Plan calls upon GBIF Participants, Nodes, data providers and partners to accept responsibility for speeding the rate of biodiversity data acquisition and increasing the rate of biodiversity discovery by supporting the efforts that must be made to create an information architecture and build the data content that can greatly contribute to those goals. This means that Participants need to make within-country investments in their own institutions, through normal or extraordinary funding schemes. With additional staff, the Secretariat can coordinate these Plans' activities, but it is vitally important to remember that "we are all GBIF" - it takes active participation by all the players to create a networked future that will serve science, society and biodiversity itself.



**Figure 1.**

*GBIF's information architecture links together data from all levels of biodiversity and with other digital resources.*

*The key to modern biological information is the scientific names of organisms, and the electronic catalogue of the names that GBIF is building is fundamental to searching within and among the types of data indicated.*

*The linkages are completed by the registry and index that GBIF provides, because these are accessible to search engines from other domains.*

## Operational Plan

### Introduction

To realise the vision, carry out the mission and implement the strategy laid out above, GBIF must move from a proof-of-concept, start-up organisation to enhanced operational status. To do this, it must concentrate on three themes (Content, Informatics, Participation) and work within a Governance and Funding framework that enables the developments needed. These themes do not directly reflect the four programme areas under which GBIF operated during its first phase. Rather, all of the programmes would be involved in all of these cross-cutting themes. This section discusses the areas of concentrated activity at a high operational level. Finer detail is found in the biennial Work Programmes.

This Operational Plan has been informed by the Third-Year Review (see Box 2), which found that GBIF needs to

- move from start-up to mature operational status,
- prioritise and hone what it is doing in the science area,
- develop more visibility and partnerships in scientific communities, and
- ensure adequate resources, including funding and staffing, to make GBIF sustainable.

To address these recommendations of the Third-Year Review, GBIF needs:

- An easier, more intuitive way for users (both people and machines) to be able to search for data via GBIF Data Portal system. To gain this, the web services of fered, the Data Portal system and the user interfaces must be improved.
- Greatly enhanced data content. It is imperative to digitise and share sufficient specimen and observational data to provide the GBIF user community with the depth and richness of data necessary to document the current and historic distribution of species-level biodiversity. To accomplish this, GBIF must work with its Participants and with data providers around the world to develop priorities for digitising the needed data in the most efficient ways. Additional means to enhance data content include developing tools for web-enabled taxonomy, in order to speed the completion of the electronic catalogue of names of known organisms (the central importance of which cannot be overemphasised); developing a scheme for globally unique identifiers (GUIDs) that will advance linkages among the molecular, species and ecological levels of biodiversity as well as provide interoperability with digital literature resources; and working toward web-based taxonomy that will facilitate development of species banks.
- To work to improve the quality of the data served through the GBIF Data Portal network. To accomplish this, tools must be developed that will enable data providers to cleanse the data they share and adequately describe its fitness for use.
- To recognise the important role of the Participant Nodes in the GBIF network. This can be done by providing customisable portal-development toolkit (first released in early 2006) upgrades, additional training and by incorporating special expertise certain Nodes may possess into the whole network, thus decentralising GBIF operations when it is logical to do so.
- To serve user communities by helping to organise and focus their needs to develop “doable” projects. This can be accomplished by partnering with them, with scientists, data providers and funders to set priorities and lay out plans to develop campaigns (see further explanation below) based on the identified priorities.

## Campaigns

For the purposes of this Operational Plan, a "campaign" is a project, or set of projects, that

- Brings together a range of collaborators with a goal of
- developing a biodiversity informatics solution for some area,
- helping to organise provider - user communities,
- changing culture to take advantage of new technologies, or
- mobilising resources.
- Through synergy, would achieve outcomes that none of the partners could achieve alone.
- Has a taxonomic, geographic or thematic focus. A campaign will include participation from institutions and organisations that can provide relevant data, scientists and other researchers who wish to put these data to use, and institutions and agencies that may be prepared to fund the development of the solution. The final product would normally be a networked solution including on-line data sets, analytic tools, and end-user presentation via a web site. A campaign has a definite beginning and end—they are not meant to go on forever.

GBIF aims to support the development of campaigns with the following characteristics:

- Demonstrable scientific merit
- Rigorous quality control and open access for any data sets produced
- Use of biodiversity data to address significant scientific or policy issues
- Partnership (between GBIF Secretariat and other entities)
- External funding (primarily from sources outside GBIF's core budget)

GBIF would not necessarily be the sole driver for any campaign; this would be shared among the partners. However, GBIF is well-suited to be the umbrella under which such projects would be negotiated and developed according to GBIF standards and principles.

## Themes

### Content

All of the types of data associated with biodiversity at any level, from gene sequences to ecosystems (primary numerical data, descriptions, images, sounds, literature, etc. etc.)

**Priority:** Gain an understanding of wants and needs of various user groups and work toward sufficient content, both in quantity and quality, to meet these needs in partnership with both users and providers.

### Visions for 2011

- GBIF is the primary Web-wide source for all data and information about biodiversity through building the registries and indices that allow searching across interoperable sources of information from molecules to ecology.
- GBIF is the provider of a 95% complete electronic catalogue of names of known organisms, a freely available, fully integrated taxonomic checklist of all biota of the globe (in partnership with CoLp, nomenclators, other data providers).
- GBIF is gateway to
  - A threshold volume of species occurrence data,
  - Historical and newly generated data and information
  - The descriptive, morphological and phylogenetic areas of biological science
  - A high percentage of potential data and information providers register with GBIF because
  - GBIF assures data attribution to providers

- Provides data-capture, cleansing, filtering, documenting, and taxonomic tools
- The inclusion of data in the GBIF network is generally recognised as worthwhile activity by scientific funding bodies

#### **Goals, Outcomes and Milestones**

A. Data integration and discovery is enabled for all well-known groups of organisms and most of less well-known groups by the electronic catalogue of names of known organisms

- By 2008, 65% of known species concepts added; by 2011, 95% are complete
- MOCs and interchange methodology in place by end 2008, concerning digital library initiatives, sequence database holders and major ecological data networks
- Multiple tools for web-enabled taxonomy to assist biodiversity researchers to speed up their work in place by 2011, e.g. tools to ensure Code compliance in place by end 2007 in collaboration with the nomenclatural codes
- Agreements concerning and infrastructure for electronic assignment of GUIDs to publications of names and concepts in place by end 2011

B. The quality of the data served through the GBIF network is documented so its 'fitness for use' can be assessed and the quality of this data when errors are identified is being improved

- By 2007 a preliminary suite of standard fitness indicators to use against main GBIF content types is in place
- By the end of 2008, a suite of data cleaning tools that was initially commissioned and made available by GBIF in 2005 has been significantly enhanced and is being used by providers, users and GBIF itself to improve the quality of data and meta data.
- By 2010, measures of fitness for use are available for the majority of GBIF-served data.
- By 2007 data filtering tool-sets available to users.
- Each year training and education concerning data quality issues is provided for at least two important groups of data providers.

C. The amount and richness of the data served through the GBIF network are sufficient to meet the needs of major user groups, and are sufficiently interoperable with genomic and ecological data to allow GBIF's users to develop more comprehensive approaches to the study of biodiversity

- Each year an in-depth analysis and assessment of needs and of available high-quality data to meet those needs completed as part of a campaign
- Over a two to five year period for each campaign at least 75% of the target goals of the user groups are met
- Indexing of all data types (e.g. names, specimens, observations and literature) using GUIDs in place by end 2007
- Seed money awards each year result in increase of 1,500,000 historical species occurrence records
- By 2011, electronic data flow directly from the field to databases served through GBIF has increased by 50% over 2007 levels

#### **Participant Activities in this Area include, e.g.**

- Developing datasets of specimen and observation data, or of nomenclature and taxonomy, relevant to their needs and sharing these with GBIF

- Providing incentives to within-country collections institutions to digitise and share their data with GBIF
- Encouraging IT developments in the areas of rapid data capture and processing, etc.
- Promoting taxonomic capacity building in support of the GTI and other CBD initiatives, and GBIF

### Needed Investments in the Secretariat

#### Module I: Observational and Monitoring Data

Programme Officer (begins 2008) € 122,000

##### Tasks:

- Work with appropriate communities to identify common needs and opportunities
- Develop data models and standards for these data types

Project funding (begins 2008) € 120,000

#### Module II: Literature, Species Banks, and Web-Enabled Taxonomy

Programme Officer (begins 2008) € 122,000

##### Tasks:

- Work with groups that are preparing digital libraries, developing species data banks and instituting web-enabled taxonomy
- Ensure close linkages with these groups and participate in development of necessary standards and protocols

Project funding (begins 2008) € 120,000

Module III: Additional Seed Money (begins 2008) € 800,000

### Informatics

The information infrastructure (hardware, software, standards, services and interfaces) that enables the sharing and use of data and information.

**Priority:** Empower through web services the GBIF community to build applications on top of the growing pool of GBIF data, and integrate content via the GBIF Data Portal system to show in user-friendly manner what is available and what is possible.

### Visions for 2011

- The services of the GBIF Data Portal system are a universal foundation used throughout biodiversity informatics.
- The GBIF information infrastructure is a full-service mechanism for data and information integration.
- The Data Portal system and the information infrastructure work in a uniform fashion across many autonomous communities such as museum, observer, ecological, environmental, natural resource, agricultural and genetic resources.
- Data owners no longer have to consider how to make their data accessible connecting databases to the GBIF network is a matter of practice.
- National Nodes implement their portals in their own languages, thus providing the GBIF Data Portal system with multilingual capabilities
- GBIF has a regional and thematic support infrastructure and large numbers of regional or thematic portals are seamlessly and transparently accessing data from the GBIF network in seconds.
- A wide range of application packages are available to support analysis and manipulation of biodiversity data downloaded directly from the GBIF network, and because of these, publishing biodiversity data on the Internet is a popular activity.

### Goals, Outcomes and Milestones

- A. Make the GBIF Data Portal interface user-friendly for people and open to machine access, and therefore a powerful tool for most popular uses and applications
- Browsing GBIF data by geography, 2008
  - Browsing data by multiple taxonomies, 2009
  - Assess quantity and quality of data for particular groups and geographies, 2009
  - Customised portal for Participant Nodes, 2009
  - All GBIF data accessible through an open source toolkit to select, access and present data within any web portal, 2008
  - Distributed access to wide range of analytical tools, 2010
  - Integration of analytic tools through workflows, 2010
  - Partner with generic search engines such as Google, 2011
  - Polygon-based search, 2009
  - More complex spatial queries and spatial analysis capabilities (either locally or via web services), 2010
  - OGC WFS and WMS web feature service included in provider tools and portal, 2008
- B. Consolidate the underlying enabling infrastructure and standardisation for global connectivity of biodiversity data and information
- Deploy updated/new registry software, 2008
  - Standardise provider and resource metadata and categorise by taxonomy, theme, geography, usage, etc., 2008
  - Collection codens (e.g. Index Herbariorum codes) integrated with metadata, 2009
  - Partnerships formed with other registries (molecular, ecological, agricultural) for registry interoperability, 2010
  - TDWG standards allow all data objects to be identified using standard resolvable globally unique identifiers, 2007
  - GBIF has a web service and user interface allowing users to locate and view any data object with a standard globally unique identifier, 2007
  - Ensure that GBIF data providers and portals are fully enabled as web services, 2008
  - Schema repository in place, 2007
  - Ontologies being used for extensible data standards definition, 2009
  - In addition to using taxonomic names, taxon concept information used for integration when available, 2009
  - Process established within TDWG to identify data elements requiring controlled vocabularies and to develop these, 2008
  - Pilot projects on application of Grid for biodiversity data, working with relevant Grid projects such as BDWorld, MyGrid, D-Grid, SEEK
  - Migration from Web services to Grid services when/where feasible
- C. User-friendly tools for Nodes and data providers to support data sharing
- At least one supported package available for each data type such as specimen (2004), observation (2004), descriptive (2008), literature (2009), name/concept (2006), image (2007), character (2008), OGC (2007), etc.
  - Agree on metrics of data quality, 2007
  - Extensible library of validation tests available for each class of biodiversity data, 2007
  - All data assessed during indexing and reports automatically sent to data providers, 2007
  - Tools readily available and easily deployed to make corrections to provider data, 2009

- For at least 5 biodiversity software packages, integration with GBIF is "as simple as selecting a checkbox", 2008.
- LDAP service, 2010
- Certificate service, 2010
- Work with EDIT to develop tools for authoring electronic revisions and sharing name/concept information from them, 2010
- Support operation of tools and integration of revision data, 2011

D. Support infrastructure for GBIF information system moving from prototype to operational status

- Seamless registration of new providers, 2007
- Indexing of new data within one day, 2009
- Feedback services, 2008
- Mirror sites in all continents and thematic areas, 2009
- Central merging of regionally produced indexes, 2009
- Fast helpdesk response, 2007
- Frequently asked questions and knowledge base, 2008
- Download sites for software, 2007
- Usage policies in place, 2007
- Discussion and email integration, 2007
- Web site enhancements and increased wiki-based authoring, 2007

**Participant Activities in this Area include, e.g.**

- Developing community-specific extensions to data standards
- Building national, regional or thematic portals into GBIF-mediated data (including integrating data from other sources)
- Constructing GIS and other visualisation services that utilise GBIF-mediated data to serve Participants' own information needs
- Involving citizen-scientists in data collection activities

**Needed Investments in the Secretariat**

Module IV: Updating the Data Portal system

Portal Architect (begins 2007) € 122,000

Tasks:

- Work with DADI Programme Officer to plan, oversee and implement improvements in the Portal
- Establish contracts with developers around the world
- Deliver tools and interfaces that can be re-used in various portals

Additional Data Portal staff (begins 2010) € 122,000

Tasks:

- As complexity of the Portal system grows, take on tasks assigned by the Portal Architect and the DADI Programme Officer

Contracts, hardware, software, etc. € 400,000

Contracts for tools, software, etc. (begins 2008) € 200,000

Module V: Tools Development contracts, software, etc. (begins 2008) € 200,000

Module VI: Data Management, Data Manager (begins 2007) €122,000

Tasks:

- Work with data providers to index content and help them improve data quality
- Utilise data screening tools to flag instances of suspect data
- Make data cleaning toolkit available to end users

Contracts, hardware, software, etc. (begins 2009) €100,000

Module VII: Webmaster	
Webmaster (begins 2008)	€ 122,000
Tasks:	
<ul style="list-style-type: none"> <li>• Oversee development and updating of the Communications Portal</li> <li>• Assist other ICT staff with Data Portal development</li> <li>• Administer wikis, listserves, etc.</li> </ul>	
Contracts, hardware, software, etc. (begins 2009)	€ 100,000
Module VIII: User support, mirroring, hardware, software (begins 2007)	€ 600,000

### Participation

Promotion of the active involvement and benefits for scientists, students, conservationists, nature managers, planners and decision-makers as well as the private sector.

**Priority:** "We are all GBIF" - the data providers, the data users, the Participants and their Nodes - it is the Nodes that form the network through their interactions.

### Visions for 2011

- GBIF Participants come from all regions in the world and include megadiverse countries
- GBIF Participants are contributing actively to the GBIF vision through the work of their Nodes.
- GBIF is the primary infrastructure to address the biodiversity data needs of science, countries and biodiversity conventions.

### Goals, Outcomes and Milestones

- A. The expertise that Nodes have and the services they provide are openly shared and constitute an integral component of GBIF activities
  - Tools, services and expertise of Nodes available to the GBIF community by beginning of 2007 (prototype established in 2006)
  - By 2011, 4 -6 workshops held, with a different regional network involved in each and 1 inter-regional workshop that includes all thematic networks
  - As a result of mentoring, 2-3 Nodes become active per year
  - Comprehensive "Nodes Guide" in place by 2007
  - 3 - 6 Node-to-Node projects completed per year
  
- B. Participants have access to adequate assistance, training and guidance to set up and maintain effective and efficient Nodes.
  - 6 - 12 in-depth interactions with Nodes per year
  - 4 - 8 Nodes and potential Nodes moved to the next developmental step per year
  - "New Participant" package printed by mid-2007
  - 60 - 120 cases handled per year by Nodes Helpdesk
  - 10 - 20 Nodes move to the next developmental step1 per year
  - Annual training programme focused on identified needs and it is broadly advertised on Communications Portal and other media
  - At least 20 people/ training event/year trained and able to train others
  
- C. Country and organisational Nodes are empowered to effectively contribute to GBIF and obtain tangible benefits from it
  - Conceptual framework for incorporating organisational member contributions into GBIF [web] structure completed in 2006 and implemented in 2007
  - Web development to sustain Organisations' contributions in place by mid-2007 (prototype in place in 2006)
  - White paper on data provider communities, and how to work with them finalised by beginning 2008
  - By 2008, CEPDEC package developed (documentation of experiences; directories of resources, tools and contacts; roadmaps)

- D. GBIF ensures and promotes the active engagement of countries and scientific communities and helps in the implementation of the biodiversity conventions.
- GBIF has a 10% increase in participation per year.
  - All megadiverse countries become GBIF members by 2011.
  - Two to three new key international organizations contribute data, standards or services to GBIF per year
  - Rate of increase in amount of GBIF data rises from 5% to 10% per month
  - By 2011, campaigns and other scientific activities per year yield at least 10 to 15 papers that cite GBIF
  - By 2011, 40 to 50% of all potential providers of (high quality) data are part of the GBIF network
  - By 2010, GSPC Target 1 will have been achieved, largely through GBIF contribution
  - By 2011, GBIF web-enabled taxonomy tools will support goals of the GTI
  - MoCs with CITES, Ramsar and CMS Conventions in place by end 2008.
  - A minimum of 40 countries per year are regularly downloading data from the GBIF portal to use in fulfilling national obligations under the CBD, Ramsar, CITES and CMS conventions
  - GBIF is recognised and cited by these international fora as an important partner and collaborator.
  - Convention secretariats use GBIF data regularly to enhance their own databases.
- E. Data providers are comfortable about IPR issues and generation of value-added data by both non-commercial and commercial users
- Section developed in the GBIF portal that makes available user-friendly and relevant IPR information and materials by early 2007
  - Mechanisms that foster an open and constructive dialogue in place by early 2007.
  - Legal advisory group in place by early 2007
  - White paper addressing IPR issues associated specifically with data itself (not biological materials) by end 2007
  - Report from a second (first was held in 2004) GBIF workshop on IPR issues by end 2008
  - Data policy finalised, accepted and widely used by end 2007, and data providers are comfortable without “non-commercial use only” restrictions
- F. New uses of biodiversity data to address scientific questions and provide solutions to outstanding issues in society are developed regularly and respond to the needs of a broad range of users.
- By 2011, the number of “hits” on GBIF data is increasing by 5% to 10% per month
  - By 2011, the number of data downloading events is increasing by 5% to 10% per month
  - Three to four demo projects are developed per year
  - By 2011, references to GBIF in scientific and popular media occur monthly (on average)
  - People who are part of the GBIF network appear on radio, TV and webcasts; print and web articles are written about GBIF by others
  - Reports from yearly workshops provide potential users with ideas for analyses, and feedback from users indicates high levels of use and satisfaction with GBIF.

**Participant Activities in this Area include, e.g.**

- Establishing their Node or Nodes and sharing expert ise with other Participants
- Mobilising data by enabling access to biodiversity data-holding institutions and communities
- Providing technical support and expertise to data providers and users
- Contributing to the overall development of GBIF by participating in developing directions and priorities

- Helping to develop the GBIF work programme and the campaigns by providing capacities and seeking resources in cooperation with other GBIF Participants and partners
- Promote the culture change needed to make best use of the new resource that GBIF provides.

**Needed Investments in the Secretariat**

Module IX. Nodes, Nodes Programme Officer (begins 2007) € 122,000

Tasks:

- Travel extensively to help Nodes' development and implementation
- Seek funds from aid agencies to plan and implement Nodes in developing countries
- Hold workshops to develop best practices
- Identify ways to incorporate "non-standard" Nodes into the system
- Assist Nodes to reach out to and incorporate additional data providers

Second Nodes Programme Officer (begins 2008) € 122,000

Tasks:

- The tasks expected of the Nodes Programme Officers are so numerous and time-consuming that two individuals are the minimum to carry them out

Project Funding for improving Participant Nodes (begins 2008) € 650,000

Module X. Outreach

Second Outreach Programme Officer (begins 2008) € 122,000

Tasks:

- Improve interactions with the biodiversity-related conventions
- Identify campaign areas to consider for developmental fundraising
- Increase activities related to repatriation of data
- Recruit new Participants
- Develop ways to address IPR-related concerns

Module XI: Training

Training Coordinator (begins 2010) € 122,000

Tasks:

- Work with the Outreach Programme Officers to create and operate the training programme
- Oversee contracts with outside organisations to carry out training activities
- Develop online, Internet-based training resources

Module XII: Project funding for Outreach,

Training and Public Relations (begins 2007) € 800,000

**Governance and Funding**

GBIF governance will lead and manage the delivery of the key objectives and goals for content, informatics, and participation and as such needs to be able to move swiftly and flexibly to take advantage of opportunities that arise. A reasonable balance within GBIF's budget between the core funding provided by Participant contributions and external funding raised from donors in a campaign-style approach will achieve sufficient funds to be able to run the Secretariat efficiently and effectively in service to GBIF as a whole.

### Visions for 2011

- GBIF has an efficient and effective governance structure
- The views of both scientists and government representatives are heard in Governing Board meetings
- User communities are involved in setting priorities for the generation of content
- GBIF's products and tasks are scientific and serve both the private and public sectors.
- The campaign-style fundraising approach has captured the interest of the relevant user and provider communities, funders, and is succeeding in conducting large-scale projects.
- This type of approach to GBIF's interactions
- helps to speed up the provision of data to GBIF and
- improves GBIF's relationships with a broader set of communities, including both stakeholders and users.
- GBIF has a sustainable future.

### Goals, Outcomes and Milestones

- A. Streamlined, cost-effective governance procedure with a strengthened interim decision-making procedure.
  - New Rules of Procedure no later than 2008
  - No more than one Governing Board meeting each year.
  - Executive Committee empowered to function as oversight body between Governing Board meetings.
- B. GBIF focus is on science-governance dialog that is central to GBIF
  - Science Symposium with Ebbe Nielsen Prize Ceremony occurs on yearly basis, 2007 - 2011
  - At least 2 former Prize winners attend each Governing Board meeting or Science Planning meeting
  - Science discussion on agenda and recorded in minutes of each meeting, 2007-2011
  - Add reference to Science Council, and give some information about its role
- C. There is an effective mechanism in place to enable GBIF to access advice from leading specialists to inform its strategic direction and work plans
- D. Number of Voting Participants increased to share the funding load more widely
  - Participant numbers increased by 10% per year
  - Surveys determine awareness and understanding, yearly 2007 - 2011
- E. Contributions by Participants adequately support the activities of the GBIF Secretariat and the Work Programme
  - Participants agree to new scale of contribution by beginning of 2007
  - Increase services (e.g. training opportunities, etc.) to Voting Participant Nodes
- F. Special projects dramatically increase the content, functionality and value of GBIF activities
  - At least one funded campaign added to the GBIF portfolio each year, 2007-2011
  - Grants, aid funds and industry contributions received
  - Within Participant progress in digitisation producing measurable results (for example)

**Participant Activities in this Area include, e.g.**

- Participating in Governing Board and appropriate Committee meetings
- Contributing to the development and direction of GBIF activities
- Supporting own delegates to GBIF meetings
- Working with Secretariat staff to identify candidates for campaigns
- Facilitating campaign activities
- Encouraging Voting Participation in GBIF

**Needed Investments in the Secretariat**

Module XIII: Increased Governing Board expenses (begins 2007) € 96,000

Module XIV: Meeting and Travel Support Staff (begins 2008) € 122,000

Tasks:

- Handle the increasing number of meeting- and travel-related activities
- Set up workshops and meetings
- Work with travellers associated with Supplementary Fund activities, Governing Board, Committee and staff travel

Module XV: Campaigns

Campaign Development and Coordination Officer (begins 2007) € 122,000

Tasks:

- Work with the rest of GBIF to identify campaign candidates and potential partners in campaigns
- Develop the priority actions with relevant user groups and data providers
- Synthesise funding plans and write proposals

Campaign Development Funds (begins 2007) € 800,000

Module XVI: Recruitment costs and increased running expenses  
(begins 2007)

€ 180,000

## GBIF 2001-2006

The Strategic and Operational Plans were devised in a manner that takes into account the milieu within which GBIF operates. For those who may not be completely familiar with GBIF, this section provides explanations of this milieu, and how GBIF fits into it.

### **GBIF's Place, Role and Partnerships in the Information and Informatics Landscapes**

At the time GBIF was designed, as now, vast amounts of molecular and ecological data and literature were becoming available on the Internet. The designers of GBIF were convinced that full benefits from these data could be achieved only if species data and literature were also available. This is because genes occur within the context of species and species occur within the context of ecosystems. But, the needed species data have been collected over tens of decades, most of them prior to the advent of computers, and thus are not digital.

Therefore, GBIF was designed to focus on making species-level data (both specimens and names) available via the Internet by

- promoting digitisation of historical (legacy) and newly collected species data,
- developing the information architecture to facilitate interoperability among many distributed datasets, and
- extending this interoperability to data in the molecular and ecological realms, but to leave the development of those datasets to workers in those fields.

Thus, GBIF has a unique niche in the overall biological information landscape (see Figure 2). This niche is in the intersect of the three levels of biological information with regard to the information architecture and interoperability, just as species are at the intersect between molecules and ecology.

The data that GBIF works to make available are primary scientific data, meaning that they are recorded directly from nature. Such data can be used over and over again in different analyses and for different purposes. Just as in Figure 2, GBIF is shown in Figure 3 to occupy a unique niche among international organisations relevant to biodiversity. Not all such organisations are shown in the Figure, just a few examples so that the drawing is not too cluttered.

In the scientific arena, GBIF has many types of interactions. Representatives of GBIF's partners (there are many others) include

- CoLP to make scientific names data available,
- TDWG to develop standards for data and metadata, to enable interoperability,
- Digital library initiatives such as the Biodiversity Heritage Library to make sure that linkages are made between specimen and names data and digital literature, as well as the molecular and ecological communities to make those linkages (as discussed above),
- OBIS and other marine-oriented organisations so that their data are among those that can be obtained via GBIF, and
- National and international scientific initiatives such as NCEAS and NESCent in the U.S., EDIT in Europe and CRIA in Brazil so that the efforts of each benefit from the interaction with all.

In the international arena, GBIF-mediated data can serve, for instance,

- the CBD and other biodiversity-related conventions (GBIF Secretariat has an MoC with the CBD Secretariat, and has actively engaged in the implementation of the work programmes of e.g. the GTI),
- special initiatives of environment-related international organisations such as CAFF and UNEP and the biodiversity-related conventions, such as the 2010 initiative, the GSPC, the GISP and the CBMP, and

- GEOSS, which can benefit from GBIF's data that provide a historical record for establishing trends in biodiversity change, and from its experience in establishing distributed networks.

At the national level, GBIF-mediated data can serve, for instance,

- decision-makers
- national-level land-use planning agencies, and
- amateur scientists.
- Applications of GBIF-served data can also be made by, e.g.
- educational initiatives such as the GTI, coordinated by BioNET,
- focused regional information networks such as IABIN,
- on-the-ground conservation organisations.

The important thing to note in regard to GBIF's international relationships is that they are non-competitive partnerships in which GBIF's role does not duplicate that of any other organisation.

Organisational Participants bring to GBIF capacities, expertise and data that expand and complement the information provided via GBIF, such as:

- forums and developers' networks for database interoperability and services,
- quality, specialised information (images and other multimedia formats, conservation data, nomenclature, etc.)
- access to specialised data sources (marine organisms, seed banks, microorganisms, etc.)
- linkages to the molecular and ecological data realms.

Some of these data and developments are already being served from the prototype Data Portal; others will be integrated in the new GBIF Data Portal system, especially in the context of web-enabled taxonomy.

The mechanism that GBIF uses to make data readily available is its information infrastructure, an overview of which is shown in Figure 4. Access to and interoperability of datasets in any field, biodiversity included, is dependent on the use of standards for data and for metadata. Following its philosophy of non-duplication of effort, GBIF has adopted global internet standards that have proven so successful in recent years, such as

- HTTP to enable file transfers across the Internet,
- XML to facilitate different database applications to provide data that can be understood by any other application, and
- WFS to format the data such that they can be directly imported into GIS systems.

Within the area of biodiversity information itself, the data are for the most part substantially more complex than data in business, chemistry, physics, etc. Therefore, special standards and protocols are needed. Some of these were already under development before GBIF was established (i.e., ABCD and BioCASE, Dwc and DiGIR).

GBIF partners with the developers of these to improve their performance across the whole network, and to gradually unite them into a single protocol called TAPIR, as well as to develop a data standard that is adaptable for specific user requirements.

As GBIF works toward additional goals, such as linking with taxonomic keys and literature, other standards will be employed, such as

- TCS, to make it possible to "cross walk" among different taxonomic classifications,
- SDD, to enable moving data that are currently written out in paragraph form into databases, taxonomic keys, field guides and the like,

- TaXMLit, to enable literature records to be understood by database applications and other transfer protocols, and
- GUIDs, so that the network can report to the user who has provided the data they are about to use, as well as contribute to the efficiency of the system as a whole.

GBIF works with several partners in the development of such standards, especially TDWG, to achieve outcomes that none could achieve alone. Two parts of the information infrastructure that GBIF has built centrally (although replicated at mirror sites) are

- the UDDI registry, which enables searches to discover the existence of data, and
- the data index, which helps speed up internet searches.

Very importantly, these infrastructure elements can be addressed not solely by a central GBIF Data Portal, but also by a range of other portals that employ similar standards and protocols. In this way, the GBIF Data Portal is really a system of portals, a network open to anyone. Thus, the work that has gone in to the development of this information infrastructure has experienced the advantages of many partnerships but also provides benefits to not only the partners involved but to many others as well.

GBIF's activities to date have been in proof-of-concept mode. The Third Year Review Report, however, clearly indicates that it has proved that the concept is not only workable, but that it is "the right initiative, with the right goals, at the right time" and that it is now time to make GBIF sustainable in terms of staffing and resources. A comparison (see Box 3) of amounts of data served, and staffing and resource levels, between GBIF and other publicly funded database initiatives gives an indication of the resourcing levels needed.

Figure 5 shows the role of GBIF in biodiversity information networks. As indicated, GBIF works at the level of digitisation of data and providing those data to the Internet via its information infrastructure.

It also demonstrates, as was also noted in Figure 3, that the same data, depending on the types of analytical, synthetic and presentation tools that are employed, can be useful in

- scientific research,
- practical applications, and
- development of biodiversity-related policy.

GBIF's role is to make the data readily available; the particular information generated from those data is up to the user.

### **Lessons Learned from GBIF's First Five Years**

GBIF's designers observed the tremendous usefulness of digitally available biodiversity data to countries such as Costa Rica, as well as Mexico and Australia (see Box 4), and believed that steps should be taken on a global scale to ensure that all countries could secure the same benefits. However, the mechanism for doing this should be distributed, both in its information infrastructure and in the workload of digitising and serving the data. Thus was established the information architecture described above, and the network that provides the data.

That this concept can work has been demonstrated by the growth in data sharing shown in Figure 6 since the prototype GBIF Data Portal was launched, and by the network activity of both the Data and Communications Portals (see Table 1 and Figure 7). The potential for greatly increased data content is shown in Table 2, which indicates that by April 2006, GBIF should have been serving over 115,000,000 specimen and observation records.

Table 2 further shows that the amount of data available, both already digital and that could be digitised, is vast. Part of GBIF's work during the period of time covered by this Strategic Plan must be to promote and encourage the digitisation and sharing of these data, and many more that are not yet documented by the Participant Nodes. Figure 8 shows the significant upswing in data sharing that GBIF needs to accomplish the goals of this Strategic Plan. Further, Figure 9 shows the needed expansion of the electronic catalogue of the names of known organisms to 95% of all species by 2011.

GBIF has learned that increased attention must be paid to

- users and their information needs,
- the Participant Nodes and their needs for help and guidance,
- the Data Portal system (machine interfaces, enhanced user experiences, geographic search mechanisms, services to Participants),
- data quantity issues, aiming at comprehensive useful coverage for key groups of organisms,
- data quality issues, and
- training needs of both data providers and data users.

The original intent and focus for GBIF were sound and it should continue in the same vein. However, the Third Year Review (see Box 2) noted that as of 2005, GBIF had not yet begun to work especially well with the broadest possible communities, and that it needed to identify a mechanism to capture the interest of the relevant communities and work with them to implement larger-scale activities. Several e-conferences held to solicit advice have demonstrated that the community is willing to be involved if given the opportunity and means to do so.

GBIF is seen by many to need to play a leading role in facilitating the scientific and user communities to further the development of biodiversity informatics. Also, many user groups look to GBIF to help them, and GBIF is in fact already well known to some parts of the biodiversity research community. The seed money awards have set up good will in some parts of the community, and they are an important part of GBIF efforts and should be retained. However, priorities for them must continue to be set if GBIF is going to meet its goal of developing a useful body of data within a reasonable period of time.

The greatest risk to GBIF's success would occur if its ability to be flexible and adaptable (in, for instance, adopting new information technologies as they evolve) were placed in jeopardy by adherence to a rigid work programme laid out too far in advance. At the same time, creating a work programme on a yearly basis is time-consuming and does not allow for looking ahead. GBIF has now adopted a two-year time frame for the work programmes that appears to be working well.

It is important to manage expectations to avoid undue criticism and disappointment. GBIF can do this by

- working with our various user communities to set priorities, design projects and carry out joint activities to implement and fund them,
- focusing on the Participant Nodes, providing guidance, training, and facilitating inter-Node mentoring activities,
- growing the amount of data available through the GBIF Data Portal system, both in quantity and quality, and in richness in priority areas,
- increasing the number of Participants, both countries and organisations, and
- working toward a many fold increase in the number of people around the world who can use and analyse biodiversity data and information to answer their questions.

### **GBIF Uses and Users**

Although only a small percentage of primary biodiversity data are currently digitised, these data have already proven to be truly useful for conservation and management, as indicated by the scientific publications listed in Box 5. Although some of these papers were published before the GBIF data portal was available, they all use the kind of species-occurrence data that are mediated by GBIF. And, as the GBIF portal gains content, the pace and utility of such publications will increase dramatically.

The designers of GBIF included representatives from almost all of the potential user groups listed in Table 3. All were excited about the possibilities for their line of work if large amounts of species-occurrence data were available to them via the Internet.

It should also be noted that

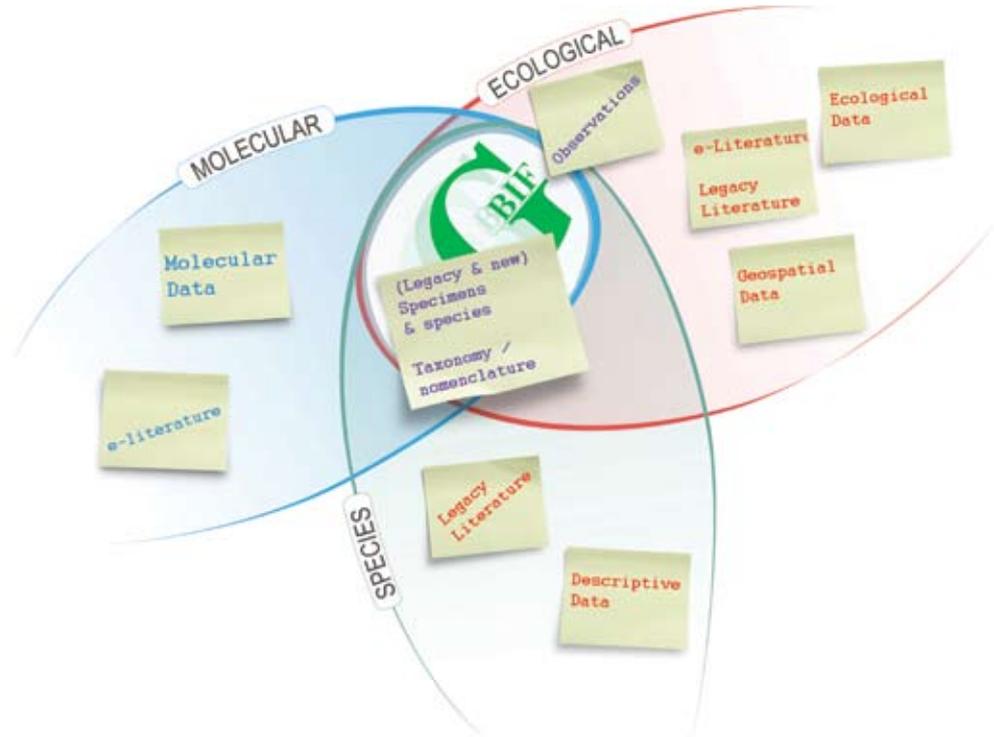
- Both the public and private sectors either are or could be included among members of almost all the user groups listed in Table 3. As GBIF develops its new activities, new and environmentally sustainable entrepreneurial activities will become possible, thus promoting economic and environmental welfare. Even as early as 2005, some Participant Nodes were working on making contacts with interested companies, although outreach will need to be continued to encourage innovative entrepreneurs to utilise GBIF data in new products and services.
- GBIF cannot guarantee to meet all of the relevant needs of all of these user groups immediately. However, this table will be used as an aid to prioritisation at various stages in the life of this Strategic Plan.

Though there is at present only a small percentage of all biodiversity data available digitally, nonetheless it has proven extremely useful in decision-making (See Box 4) and scientific research, both theoretical and applied (see Boxes 5, 6 and 7). And, there has been significant growth in data sharing just in GBIF's short history (See Figure 5). GBIF, through its focus on increasing data content and improving its IT capabilities, will increasingly contribute to science and innovation.

If the user groups indicated in Table 3 (and others) recognise the value of GBIF-mediated data and information and use it, they will generate a demand-side support system for GBIF activities. The risk associated with this assumption is that the users will be unable to 1) find the quantity and quality of data they expect, or 2) apply the appropriate analytical or modelling tools, and will thus ignore GBIF. To mitigate this risk, GBIF needs to 1) develop methodologies for improving and documenting both quantity and quality of data, and 2) provide increased training activities that will empower user groups.

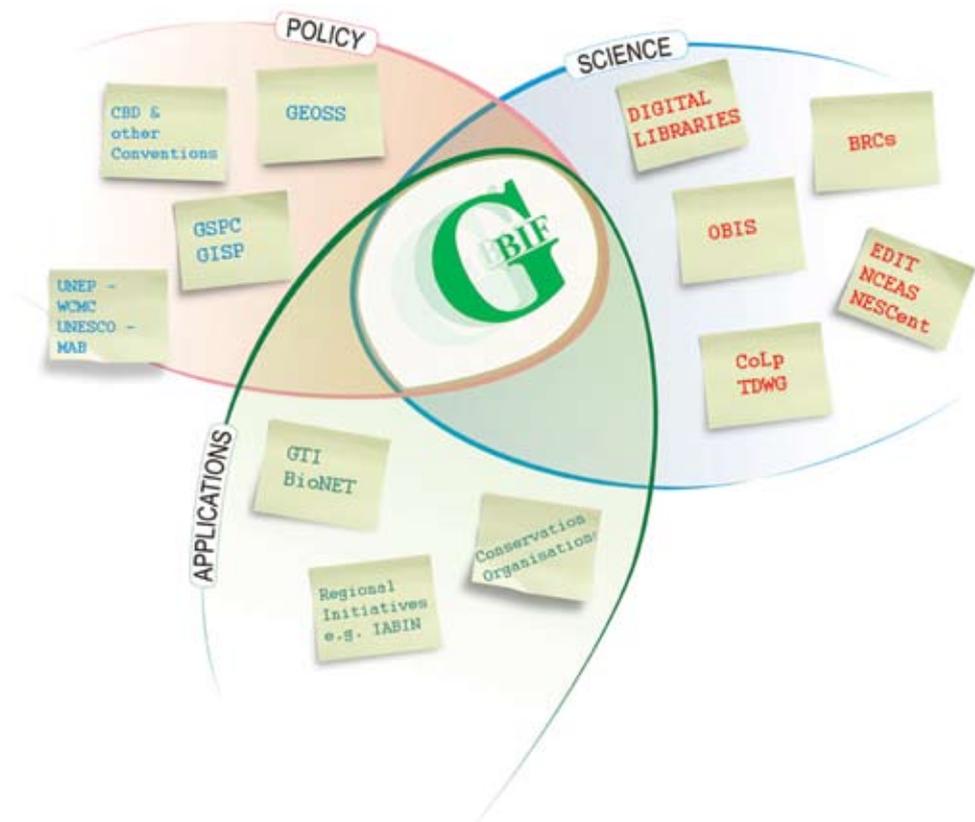
**Figure 2.**  
**GBIF's place in the biological information landscape.**

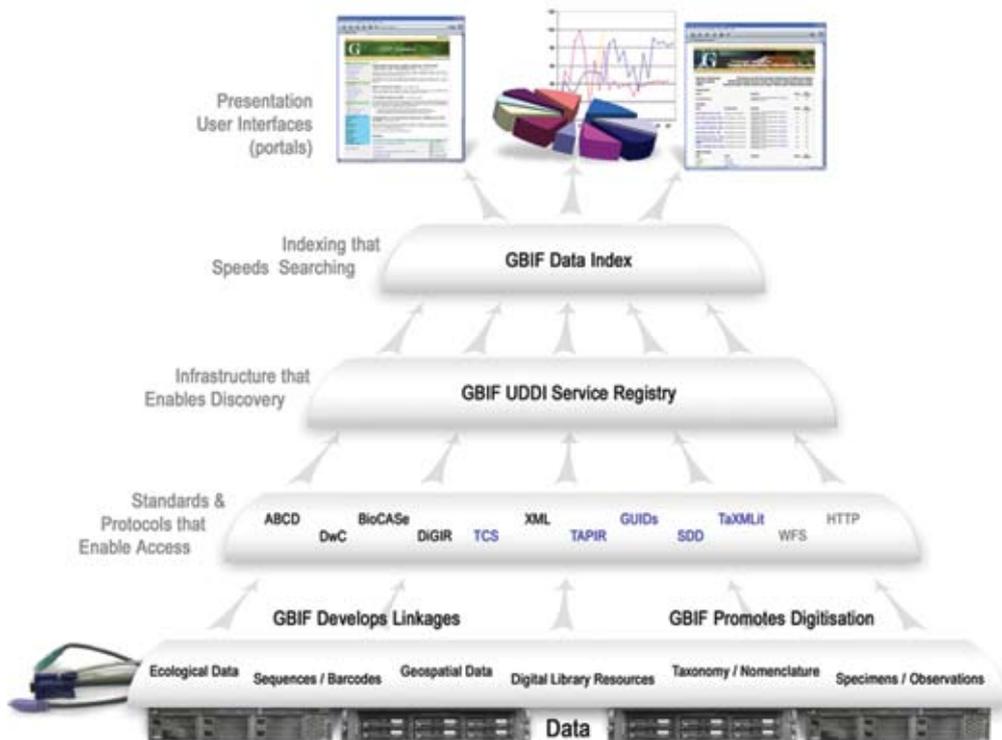
The data that GBIF makes available forms an essential link between the databases of gene sequences, protein structures, etc., such as GenBank, and those that hold environmental information at a larger scale. Scientific names (indicated by "taxonomy/nomenclature" in the sketch) are the key to unlocking all recorded information about species, whether it be data on their genes or their ecological interactions with one another. GBIF is working to make electronic searching across the full spectrum of biological data possible, as well as encouraging digitisation of data from specimens in natural history collections and from the legacy (historical) literature.



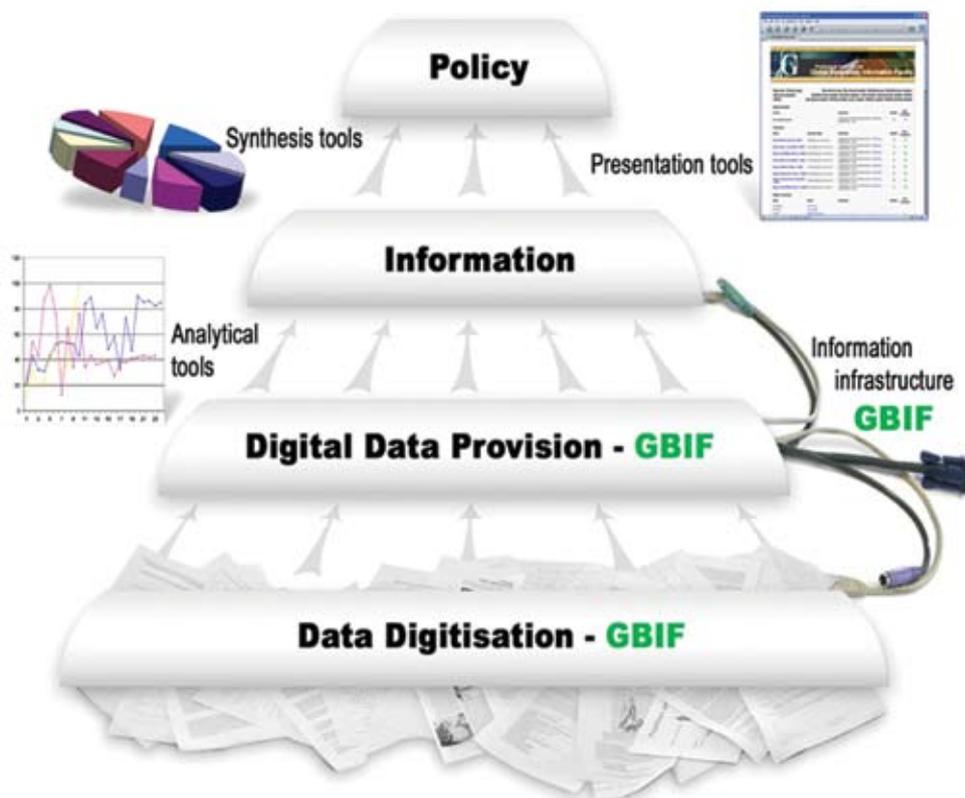
**Figure 3.**  
**GBIF's place among international organisations.**

GBIF makes primary scientific data available via the Internet for any person or organisation to analyse for their own purposes. In this, GBIF is unique among biodiversity-related organisations and conventions. The data provided by GBIF supports projects of the international conventions related to biodiversity such as the GSPC or the GISP, contributes to conservation and taxonomic training via the GTI, and can be accessed by the thematic portals of regional biodiversity information networks. GBIF works with other scientific initiatives such as the Biological Resource Centres, partners with TDWG to develop standards for biodiversity data and metadata, with CoLp and others to provide scientific names data and with OBIS to assure that marine biodiversity is accorded its rightful importance. The GBIF Secretariat plays a coordinating role to assure that there is no duplication of effort or expense.





**Figure 4.**  
**Overview of the GBIF information infrastructure.**  
 GBIF utilises protocols common to the entire Internet, such as HTTP, XML and WFS. It has also adopted standards and protocols for biodiversity data that were developed before GBIF came into existence, including the ABCD and Darwin Core (DwC) schemas and the BioCASE and DIGIR protocols. In addition, GBIF is playing a role in the development of additional standards indicated in blue, as well as leading the way toward adoption of globally unique identifiers (GUIDs) for biodiversity data objects. This will enable linking together genetic, species and ecological datasets. The GBIF UDDI Service Registry and Data Index are infrastructures that allow the GBIF Data Portal or any internet portal that uses these standards and protocols to access the data that GBIF makes available. All acronyms are explained in Appendix 2.



**Figure 5.**  
**GBIF's role in biodiversity information networks.**  
 GBIF focuses on encouraging the digitisation of vast amounts of invaluable data that is contained in natural history collections, libraries, and the memories of taxonomists and other scientists. It facilitates the sharing and use of digital data by building an information infrastructure (standards, protocols, a registry and index (see figure 4)) that makes those data openly and freely available to everyone. Anyone can access the data through GBIF's Data Portal or any other portal that accesses the same data and apply whatever analytical and synthetic tools they wish to those data for the purpose of informing policy decisions, as a basis for further research, or for any of many other possible uses.

**Box 3  
Comparison of resources available to five publicly funded data sharing initiatives.**

The initiatives shown are GenBank and other NCBI information activities (number of data records given is for GenBank, but staff and budget indicated are for all NCBI activities), the PDB, FlyBase, TAIR, and GBIF. Numbers given are current as of August 2005, except for TAIR which were current as of 2002. Budget figures are in USD.

Though the first three initiatives are mirrored (in the US, Europe and Japan), they are each actually a single, centralised database (albeit with incorporated links to other, related databases). The mirror sites of each use the same software and computer platform, and replicate the data holdings. Data providers of each resource submit their data to the central database or staff capture the data from the literature; users obtain data by querying a single Internet site.

In contrast, GBIF is addressing the difficult and complex task of making multiple databases interoperable among themselves and with many others, including the examples in the table. As of 29 August 2005, 549 databases from 135 providers, which utilise many different software applications and computer platforms, are included in the GBIF network. GBIF also has mirror sites that replicate its web services information infrastructure, but the data are distributed around the globe, remaining in the control and curation of the many data providers. Nonetheless, users obtain data from the entire network by querying a single Internet site.

	Number & Kind of Data Records serves	Number of Staff	Annual Budget
	~ 46,400,000 nucleotide sequences	~ 400 (~ 30 work on GenBank per se)	~ 50M
	31,535 structures	~ 30	~ 11 M
	272,702 55,093 genes 26540 models 113,398 sequences 77,671 mutants	36	~ 5 M
	708,000 400,000 sequences 200,000 mutants 4,000 markers 90,000 polymorphisms 14,000 publications	16	1.6 M
	80,500,000 specimens observations scientific names	13	3.5 M

**Box 4**  
**Successful use of digital biodiversity data in Mexico and Australia**

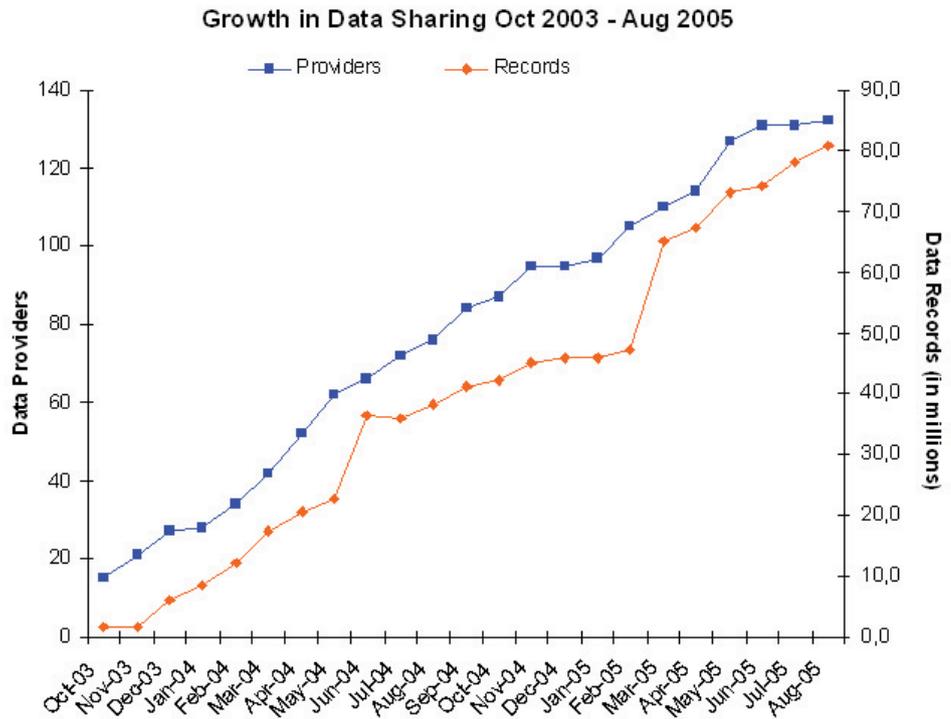
In Mexico, CONABIO receives between five and ten formal requests for information per week. About 50 per cent of these come from government agencies, mainly of the environment portfolio. The rest of the information requests come from scientists (about 40 per cent) and private companies (10 per cent). The government questions are often of the nature of "what protected species occur in a given place?" and are posed in relation to protected areas or zones where environmental impact assessments are being contested. In other examples, state or municipal governments require lists of their endangered or protected species. CONABIO's databases are also used to prioritize areas for conservation and for the Country Study and National Strategy of Biodiversity requested by the Convention on Biological Diversity, as well as in the regulation of planting of genetically modified crops and the prediction of probable routes of invasion by alien species.

In Australia, ERIN (part of the Department of the Environment) uses computing technology to provide access to information that is not held by ERIN but rather is drawn from distributed sources, which are maintained by many agencies and institutions. Use of environmental information is contributing to the development of environmental policies, assessment of environmental impact, and developments leading to sustainability. For example, information about plant and animal species has been integrated with climate models to predict the distribution of a range of species under a number of climate change scenarios developed from Global Climate Models. This information has then been integrated with other information about vegetation and soils for use in the development of species management plans. Data from the natural history collections of Australia, served through ABIF, are contributing to these many uses.



**Figure 6.**  
Growth in GBIF data sharing in the first two years of the prototype data portal.

The rate of increase in the number of providers and of data records during this 19-month period averaged approximately 5% per month. This rate must increase significantly in future (see Figure 6) if sufficient richness and depth of data, needed by users to answer their questions, is to be achieved. If the predictions of the Node Managers are correct (see Table 2), GBIF will soon experience an upturn in the data-sharing growth curve, although this will need to continue for a significant while.



**Table 1.**  
Network activity on the prototype Data Portal ([www.gbif.net](http://www.gbif.net)) and the Communications Portal ([www.gbif.org](http://www.gbif.org)) from their launches until the dates indicated.

These requests have come in from computers in over 130 countries.

	Prototype <a href="http://www.gbif.net">www.gbif.net</a> 04-07-2004 to 31-07-05		<a href="http://www.gbif.org">www.gbif.org</a> 04-01-2004 to 10-08-2005	
	Total	Average Week	Total	Average Week
Successful requests	11 million	193 thousand	15 million	181 thousand
Average successful requests per day	28 thousand	4 thousand	26 thousand	4 thousand
Successful requests for pages	9 million	165 thousand	714 thousand	8 thousand
Average successful requests for pages per day	24 thousand	3 thousand	1 thousand	2 hundred

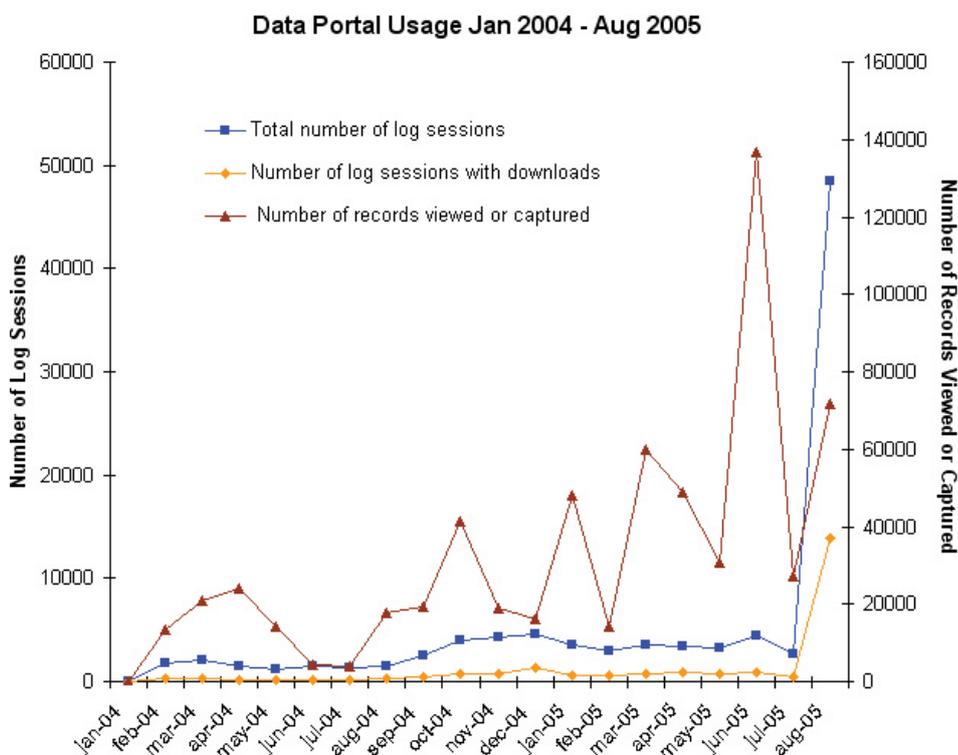


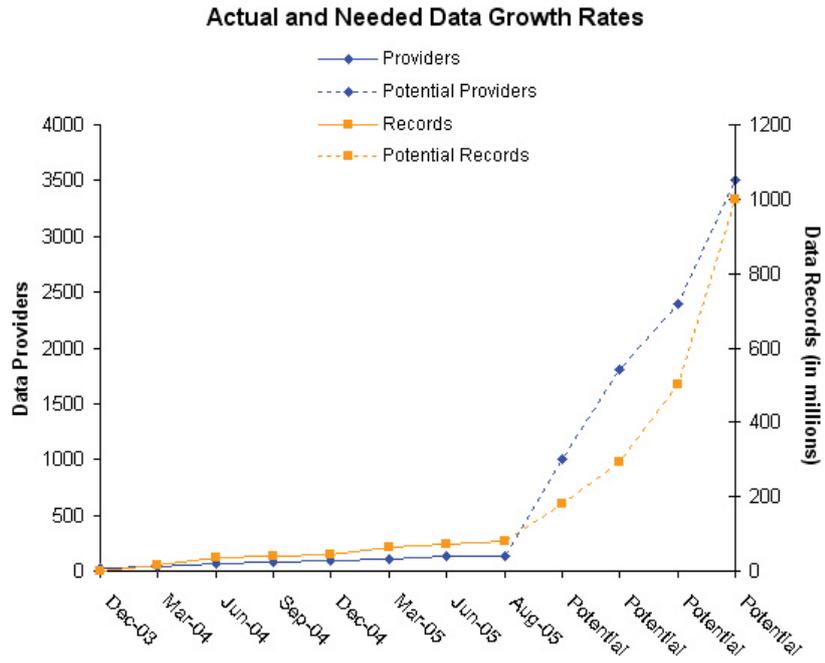
Figure 7. Data Portal usage as indicated by the numbers of log sessions and the numbers of records viewed or captured by users. The rate of use is uneven, but the log files of the data portal show a general upward trend in data usage. The term "download" in this figure means the count of records viewed on the screen by a user, as well as the number of records that users requested from data providers for analysis. It is not possible to distinguish between the two types of downloads. As the depth and richness of GBIF's data content grows, so will grow the usage of the data.

Status of GBIF data sharing as of 6 December 2005	
Number of data providers currently serving data through GBIF (as of 6 Dec 2005)	150
Number of records shared by these data providers (as of 6 Dec 2005)	81 million
<b>Potential data sharing (as estimated by 36 of 77 GBIF Node Managers reporting)</b>	
Estimated number of data providers that could share data through GBIF:	4200
Estimated total number of specimen holdings of these potential data providers	737 million
Estimated total number of observation holdings of these potential data providers	567 million
<b>Total records potentially available from the institutions reported by 36 Participants</b>	<b>1.3 billion</b>
Subset of these specimen holdings already existing in digital form	105 million
Subset of these observation holdings already existing in digital form	190 million
<b>Total of reported subsets of specimen and observation data that exist in digital form</b>	<b>295 million</b>
<b>Target GBIF growth for April 2006</b>	
Number of new data providers sharing data	500
Number of specimen and observation records expected to be shared	27 million
Number of additional records expected to be shared by current data providers	7 million
<b>Total records to be added by April 2006</b>	<b>34 million</b>
<b>TOTAL RECORDS SERVED THROUGH THE GBIF DATA PORTAL BY APRIL 2006</b>	<b>115 million</b>

Table 2. Status, potential and projection for growth of the number of GBIF data providers and shared data records. Note that these numbers are reported by only 36 out of 78 Participants, and so the numbers are low for the possible data providers and records even among GBIF Participants. Also note that there are quite a number of data-rich countries that have not yet joined GBIF, so the estimates of the data that could be shared are much higher than what is shown here.

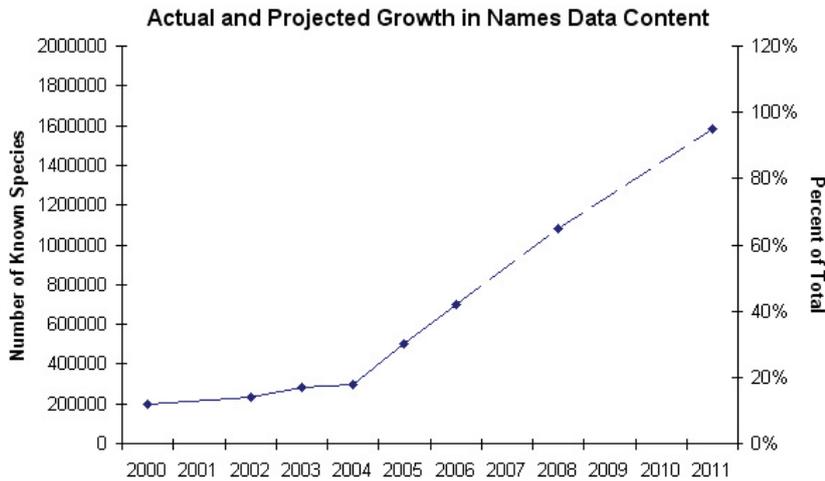
**Figure 8.**  
**Growth rate that is needed to achieve GBIF goals.**

The rate of increase in the number of providers and of data records has been relatively slow to date, and needs to take a significant jump upwards. Table 2 indicates that a rapid jump in data sharing should occur by April 2006, but it must continue for a significant period (indicated by "potential" on the graph legend).



**Figure 9.**  
**Growth rate planned for the electronic catalogue of names of species.**

The rate of increase in the number of species included in the electronic catalogue was relatively slow over the first five years of work by CoLp. The partnership that GBIF established with CoLp resulted in the significant upturn seen between 2004 and 2006. The targets for 2008 of 65% and for 2011 of 95% of all species are also indicated in the graph. These goals are expected based on projections by CoLp and by the addition of species from other contributors. The electronic catalogue is of fundamental importance to the ability of the GBIF information architecture to provide interoperability across all of biology (see Figures 1 and 9).



**Box 5****Current and potential users of GBIF data and its information infrastructure include other online resources**

These resources (each one is a global public good) may be accessed by users who do not know that they are calling on the GBIF information infrastructure because the interoperability afforded by GBIF is transparent to the user. Examples include other portals and value-adding service providers, e.g.:

**GenBank**

Utilises particularly the electronic catalogue of names and the ability to search for the localities at which a species that possesses a certain gene sequence occurs in nature.

CBOL - Uses the GBIF information infrastructure to provide access to voucher data for a particular barcode, specimen identity according to traditional means, and locality data for occurrence of the species.

**IPGRI**

Relies on the GBIF information infrastructure as a means to connect the various subsets of its data, held at a number of research centres around the world; builds on the GBIF information infrastructure to enhance its capabilities to better serve the agricultural research needs of society.

**ITIS**

Connects to the GBIF information infrastructure so that its users can readily access species occurrence data even though ITIS itself provides only name data.

**BeBIF Map Server**

Receives datasets from the GBIF data portal and returns results of the query on a map.

**CBIF Map Server**

Connects to the machine interface of GBIF index and offers geographic visualisation of the integrated GBIF data.

**Google Earth**

Offers a public API, which is used to achieve 3-D geographic visualisation of the integrated GBIF data.

**Box 6****Examples of publications that used analysis of species-occurrence data such as that available via GBIF**

- Argaez, J. A., Christen, J. A., Nakamura, M., Soberón, J. M. 2005. Prediction of potential areas of species distributions based on presence-only data. *Environmental and Ecological Statistics* 12:27-44.
- Argáez-Sosa, J., Christen, J. A., Nakamura, M. y Soberón, J. 2002. Prediction of high potential areas of habitat for monitored species. *Comunicaciones del CIMAT. Comunicación Técnica No. I-02-06/16-04-2002*, 1-20.
- Frank KT, Petrie B, Choi JS, Leggett WC. 2005. Trophic cascades in a formerly cod-dominated ecosystem. *Science* 308: 1621-1623.
- Golubov, J. M. Mandujano y J. Soberón. 2001. La posible invasión de *Cactoblastis cactorum* Berg en México. *Cactáceas y Suculentas Mexicanas* 46:90-92 .
- Guinotte JM, Bartley JD, Iqbal A, Fautin DG, Buddemeier RW. 2006. Modeling and understanding habitat distribution from organism occurrences and correlated environmental data. *Mar Ecol Prog Ser* (in press)
- Martínez-Meyer, E., A. T. Peterson, and A. G. Navarro-Sigüenza. 2004. Evolution of seasonal ecological niches in the Passerina buntings (Aves: Cardinalidae). *Proc. Royal Soc. Lond. B* 271:1151-1157.
- Martínez-Meyer, E., A.T. Peterson and W. Hargrove. 2004. Ecological niches as stable distributional constraints on mammal species, with implications for Pleistocene extinctions and climate change projections for biodiversity. *Global Ecol. Biogeogr.* 13: 305-314.
- Pearson, R. G. and T. P. Dawson. 2003. Predicting the impacts of climate change on the distribution of species: are bioclimate envelope models useful? *Global Ecol. Biogeogr.* 12:361-371.
- Pearson, R.G. and T. P. Dawson. 2005. Long-distance plant dispersal and habitat fragmentation: Identifying conservation targets for spatial landscape planning under climate change. *Biological Conservation* 123: 389-401.
- Peterson, A. T. and D. A. Vieglais. 2001. Predicting species invasions using ecological niche modeling: New approaches from bioinformatics attack a pressing problem. *BioScience* 51: 363-371.
- Peterson, A. T., J. Soberón, V. Sanchez-Cordero. 1999. Conservatism of ecological niches in evolutionary time. *Science* 285: 1265-1267.
- Peterson, A. T., M. Ortega-Huerta, J. Bartley, V. Sánchez-Cordero, J. Soberón, R. H. Buddemeier & D. R. B. Stockwell. 2002. Future Projections for Mexican Faunas under Global Climate Change Scenarios. *Nature* 416:626-629 .
- Peterson, A.T. and R. Holt. 2003. Niche differentiation in Mexican birds: using point occurrences to detect ecological innovation. *Ecology Letters* 6:774-782.
- Peterson, T., V. Sanchez-Cordero, J. Soberón, J. Bartley, J. y A. Navarro-Sigüenza. 2001. Effects of global climate change on geographic distributions of Mexican Cracidae. *Ecological Modelling* 144:21-30 .
- Rice, N.H., E. Martínez-Meyer and A. T. Peterson. Ecological niche differentiation in the *Aphelocoma* jays: a phylogenetic perspective. *Biological Journal of the Linnean Society* 80: 369-383.

- Segurado, P. and M. B. Araújo. 2004. An evaluation of methods for modelling species distributions. *J. Biogeogr.* 31: 1555-1568.
- Soberón, J. and A. T. Peterson. 2005. Interpretation of models of fundamental ecological niches and species' distributional areas. *Biodiversity Informatics* 2: 1-10.
- Soberón, J. and E. Huerta. 2002. The use of Databases to Assess the Risk of Gene Flow: The Case of México. En *LMOs and the Environment. Proceedings of an International Conference, November 27-30, 2001* (Ed.), Craig R. Roseland, Organization for Economic Cooperation and Development (OECD), Paris, France .
- Soberón, J., J. Golubov y J. Sarukhán. 2001. The importance of *Opuntia* in México and routes of invasion and impact of *Cactoblastis cactorum* (Lepidoptera: Pyralidae) *Florida Entomologist* 84:486- 492 .
- Soberón, J., J. Llorente-Bousquets and L. Oñate. 2000. The use of specimen-label databases for conservation purposes: an example using Mexican Papilionid and Pierid butterflies. *Biodiversity and Conservation* 9: 1441-1466 .
- Stein, B.R. and J. Wiecek. 2004. Mammals of the world: MaNIS as an example of data integration in a distributed network environment. *Biodiversity Informatics* 1:14-22.
- Thuiller, W., M. B. Araújo and S. Lavorel. 2004. Do we need land-cover data to model species distributions in Europe? *J Bio- geogr.* 31:353-361.

## **Box 7**

### **GBIF Demonstration Projects illustrate the many uses for GBIF-mediated data**

2003: UTU-BIOTA Demo Project (Finland and Peru)

This demo presents examples of the benefits of sharing and combining biodiversity data for different end users. Four (4) tours are available:

- Neotropical Species Distributions: Explore the reliability and consistency of data on species distributions.
- Access to multi-authored tree inventory plot data from the Western Amazon region.
- Is it possible to learn about large data sets through simple visualization? The tour examines one square km grid-based inventory data of vascular plant species in the sub-arctic Finnish Lapland.
- Distribution maps of collected insect specimens can be utilised in planning along with other regional information. Archipelago Sea in the SW Finland is used as an example.

2004: Biogeographic Analysis Tool (Australia)

- Web-based tool that helps users to understand patterns of species distributions
- Easy to use and highly visual system that produces flexible maps.
- Useful for conservation purposes.
- Documents several biogeographic patterns:
- Species Richness: How many species in a given area?
- Endemism: To what degree are the species present unique to an area?
- Taxonomic Diversity: How much taxonomic variation is represented by the species of an area?

2004: Species Loss Meter (Mexico and USA)

- Conservation tool that addresses compelling questions: Where are population losses occurring, and how much biodiversity is being lost?
- Uses species occurrence data, topographic surfaces, and primary habitat land use and land cover time-series.
- Based on primary habitat loss, species occurrence data is projected into scenarios of land cover change to produce "before and after" maps of distributional predictions.
- The tool generates geographic distribution maps of individual species through time as well as statistics about range loss and extinction rates.

2005: MAPA (Mapping and Analysis Portal Application)  
(Australia and USA)

This project will produce 2 GIS-based tools:

- Survey Gap Analysis Tool: to select locations for new survey efforts
- A data processing toolset made up of:
- Estimating biodiversity sampling effort using species accumulation curves
- Creating a matrix of ecological conditions for selected species occurrences given available environmental data layers for the region selected
- A measure of site-based biological dissimilarity (Bray-Curtis index)

2005: Enabling a Global Grid: Geospatial Data Sharing, Visualizations and Analysis (IUCNCanada -Pyxis)

This project demonstrates how a global grid can be used to enable analysis across multiple, disparate data sets and incorporate deterministic modelling tools like BAT (see above) or by incorporating biological and environmental data into dynamic spatial stimulation

- A single scientific platform that allows for persistent and rapid spatial data access and integration
- Means to store and access all spatial data records, including autoaggregation, decomposition and generalization.
- It is fully scalable from bits of a point feature to terabytes of satellite imagery, from whole continents down to a microbe.
- This method compliments and supports traditional encoding techniques and spatial applications.

**Table 3.**

**GBIF Uses and Users.**

*Both the public and private sectors either are or could be included among members of almost all the user groups listed.*

<b>User Group</b>	<b>Vision</b>	<b>In Place</b>	<b>Still Needed</b>
GBIF Participants	GBIF provides useful services that make it easier for them to meet their own strategic needs	Guidance on establishing data sharing at the Participant level; tools and standards, to allow data sharing and help desk for implementing them; training and capacity building.	National/Participant portal tools; targeted advice and capacity building, especially in developing country Participants
Researchers who use natural history or culture collections	GBIF-mediated specimen- and name-level data are used in systematic monographs, predictive models and other research activities; GBIF tools for web-enabled taxonomy facilitate rapid progress in monography, description of new species and collaborative research.	As of July 2005, 78+ million specimen and observational records; 580,000 names records; links to prototype tools	More, and better quality, data; tools for cleaning data and estimating data quality, easy to use analytical tools, machine-to-machine interface, demonstrations of data use
GBIF Data Providers	GBIF and its Participant Nodes acknowledged as sources of assistance and tools for specimen, observational and names data providers; data providers given recognition by users	Training workshops, easy-to-use tools for primary data sharing	Development of incentives for sharing data, such as tools to use in compilation and dissemination of data; more and easier-to-use tools for a wide range of data types; help manuals, etc.; resources and staffing to enable digitisation projects
Molecular research (e.g. DNA barcodes, phylogenetic analysis)	GBIF-mediated species-level data and information architecture enable seamless integration between gene or other sequence data and voucher specimen data, and from there to ecological context for gene evolution (for example)	Examples: partnership with GenBank/NCBI, BioMOBY	GUIDs
Agriculture	GBIF data of use in integrated pest management, measuring the impact of agriculture on biodiversity (and vice versa), locating wild relatives of crop plants, etc.	Discussions with e.g. FAO, IPGRI, CGIAR; Nordic Gene Bank and US National Germplasm System already Participants	Extensions of schemas and protocols

User Group	Vision	In Place	Still Needed
Resource Management (e.g. forestry, fisheries)	GBIF-mediated, easy to access scientific data contribute to good decision-making	Some data, but not enough; niche-modelling techniques (developed by others)	Tools development, awareness-raising, demo projects, training in niche modelling techniques
Geospatial / Ecological modelling community (e.g. Climate Change, Spread of Invasive Species, Emergent Diseases)	GBIF's robust data for niche-modelling and other kinds of analyses recognised in many fields	A few practitioners using GBIF data	Machine interfaces to GBIF data, technical training in modelling techniques, awareness among potential users of GBIF data, good metadata on the GBIF data that indicate degree of precision, etc., tools for data cleansing and assessment of fitness for use
International biodiversity-related conventions (e.g. CBD, Ramsar, CITES, CMS)	GBIF's primary data underpins the kinds of information provided by, for example, the CHM of the CBD or UNEP's WCMC	Strong partnership with CBD, dialogue with Ramsar and others	Time to demonstrate the synergism created by linking GBIF's specimen and taxonomic data to, for example, the CITES Appendices
National planning agencies or authorities	GBIF-mediated data used to compile lists of taxon occurrences in priority areas and underpin policy decisions at national and regional levels	Some data for every country in the world except San Marino and the Vatican	Much more data; machine interfaces to GBIF data; additionally, culture change toward incorporating primary data into their methods
Conservation	GBIF-mediated data reduce tensions in interactions between governments, NGOs and the public surrounding areas or organisms of concern	For example: Conservation Commons; monitoring networks; 2010 initiative; IUCN [SIS]; GSPC; IPI	Tools to enable more species-level and ecological data interoperability with GBIF occurrence data
General Public	Will use GBIF to seek answers to all sorts of questions about biodiversity	Working with TDWG and other partners to produce Data Portal capabilities to enable development of interfaces that can be individualised to fit needs of the user	More software-developer partners to develop such interfaces, inclusion of new kinds of information such as images, video, sounds, interactive keys

## **Appendix 1: Logical Framework Analysis of the Operational Plan**

### **Content**

All of the types of data associated with biodiversity at any level, from gene sequences to ecosystems (taxonomy, primary numerical data, descriptions, images, sounds, literature, etc. etc.)

**Priority:** Gain an understanding of wants and needs of various user groups and work toward sufficient content, both in quantity and quality, to meet these needs in partnership with both users and providers.

### **Current Situation Analysis**

When GBIF was initiated the efforts related to content were concentrated on primary species occurrence data based on specimen records from the world's natural history collections, and scientific names through the development of an electronic catalogue of the names of known organisms, the backbone of which is the Catalogue of Life partnership. Early on, the need to incorporate observational data became apparent. Now, it is clear that there are a number of additional classes of data that GBIF needs to consider, e.g. images, biodiversity monitoring data, literature records, taxonomic keys and descriptions, etc.

For GBIF to accomplish its goals of linking data and information from the entire range of biodiversity (molecular to ecological), much taxonomic content must be added. The distributed and integrative power of the internet and the modularity and portability of current software solutions available could be employed to significantly increase the rate at which this content grows.

The first MoU called for two more GBIF programmes: SpeciesBank and Digital Literature Resources. These were recommended in the OECD report at a time in which no one else was working toward these things. Now, several digital library initiatives are moving forward, and linking to these will form a large part of Digital Literature Resources. Further, "speciesbank" as a term has now been used by others to mean something different than what GBIF's designers intended. It is becoming apparent that GBIF's role is to provide standards, protocols, software tools and coordination to enable the development of "on the fly" information collation linked by species names, as well as to provide tools to help people compile information into species databanks. GBIF should also consider providing a registry of species databanks and tools for accessing them.

### **Visions for 2011**

- GBIF is the primary Web-wide source for all data and information about biodiversity through building the registries and indices that allow searching across interoperable sources of information from molecules to ecology.
- GBIF is the provider of a 95% complete electronic catalogue of names of known organisms, a freely available, fully integrated taxonomic checklist of all biota of the globe (in partnership with CoLp, nomenclators, other data providers).

This electronic catalogue facilitates the work of, for example, electronic librarians because it can provide not only currently accepted classification but also historical classification, with a "map" that shows the way between one classification and another. The same electronic catalogue is also the key to linking molecular sequence data through natural history and culture specimens to ecological data of various types (niche, ecosystem, remote sensing).

- Gateway to
- A threshold volume of species occurrence data, including a significant proportion of auditable voucher-specimen records, with broad taxonomic and geographical coverage
- Historical information (digital literature resources)
- Newly generated data and information
- Phylogenetic information
- The descriptive and morphological areas of biological science

- Desire to be part of GBIF is the stimulus for a very high percentage of potential data and information providers to register with GBIF because
  - GBIF assures data attribution of providers
  - GBIF-provided data-capture, cleansing and documenting tools are of great assistance to data providers
  - GBIF offers tools that allow data providers to filter or hide segments of their data they consider "sensitive" in order to allay concerns about misuse
  - GBIF offers taxonomic tools that form a powerful yet intuitive work bench for doing all tasks associated with compiling, transferring and using taxonomic data such as the building of species databanks, writing monographs and publishing them electronically, working collaboratively over the Internet, visualizing complex taxonomic problems in electronic interfaces etc. (that is, "web-enabled taxonomy")
  - The inclusion of data in the GBIF network is generally recognised as worthwhile activity by scientific funding bodies

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>A. Data integration and discovery is enabled for all well-known groups of organisms and most of less well-known groups by the electronic catalogue of names of known organisms</p>	<ol style="list-style-type: none"> <li>1. Work with existing and potential providers of names to build the electronic catalogue</li> <li>2. Utilise campaigns and seed money awards to supply name and concept data lacking from the catalogue</li> <li>3. Work with appropriate organisations to explore and develop methods for access to taxonomic data outside current electronic treatments, e.g. printed monographs and revisions (e.g. uBio, digital library initiatives), contact to databases (e. g. GenBank, IUCN) with use-generated species lists</li> <li>4. Utilise the collaborative and democratic powers of web-enabled taxonomy by: enabling contribution from taxonomists not affiliated with large research infrastructures, rapid development of on-line taxonomies and the development of methods for on-line checking of compliance of new names and combinations, leading to electronic registration of names</li> </ol>	<p>1-4. By 2008, 65% of known species concepts added; by 2011, 95% are complete</p> <ol style="list-style-type: none"> <li>1. 150,000 species added to the electronic catalogue of species names annually</li> <li>2. 70,000 species added to electronic catalogue of species names annually</li> <li>3. MOCs and interchange methodology in place by end 2008, concerning digital library initiatives, sequence database holders and major ecological data networks</li> <li>4a. Working with the nomenclatural codes, multiple tools for web-enabled taxonomy to assist biodiversity researchers to speed up their work in place by 2011, e.g. tools to ensure Code compliance in place by end 2007</li> <li>4b. Agreements concerning electronic assignment of GUIDs to specimen records, publication of names and digital literature in place by end 2011</li> </ol>	<ol style="list-style-type: none"> <li>1-2. Secretariat, Nodes, providers of names data and taxonomic concepts</li> <li>3. Secretariat, outsource development of tool and standards</li> <li>4a. Outsource tools development</li> <li>4b. Secretariat, Codes, digital library initiatives</li> </ol>

<b>Goal</b>	<b>Activities</b>	<b>Targets / Milestones / Indicators</b>	<b>Secretariat Staffing / Outsourcing</b>
<p>B. The quality of the data served through the GBIF network is documented so its 'fitness for use' can be assessed and the quality of this data when errors are identified is being improved.</p>	<ol style="list-style-type: none"> <li>1. Identify indicators of data fitness and devise ways to measure these indicators</li> <li>2. Advance the development and utilisation of data cleaning tools to increase data fitness</li> <li>3. Promote the uniform inclusion and utilisation of indicators of data fitness in shared data sets</li> <li>4. Make data filtering tools universally available to facilitate data users assessing the fitness of use of downloaded data sets</li> <li>5. Support training and outreach concerning data quality issues for at least two priority data provider groups per year</li> </ol>	<ol style="list-style-type: none"> <li>1. By 2007 a preliminary suite of standard fitness indicators to use against main GBIF content types is in place</li> <li>2. By the end of 2008 a suite of data cleaning tools has been developed and is being utilised to improve the GBIF data.</li> <li>3. By 2010 measures of fitness for use are available for the majority of GBIF data.</li> <li>4. By 2007 data filtering tool-sets available to users.</li> <li>5. Each year training and education concerning data quality issues is provided for at least two important groups of data providers.</li> </ol>	<p>1-3. Secretariat, external consultants and data providers</p> <p>4-5. Secretariat</p>

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>C. The amount and richness of the data served through the GBIF network are sufficient to meet the needs of major user groups, and are sufficiently interoperable with genomic and ecological data to allow GBIF's users to develop more comprehensive approaches to the study of biodiversity</p>	<ol style="list-style-type: none"> <li>1. Identify the digitisation priorities of major GBIF campaign partners, and increase the rate of digitisation based on identified priorities</li> <li>2. Increase the sharing through the GBIF network of observational and monitoring data for identified priorities</li> <li>3. Integrate genetic sequences, ecological datasets and more data types such as images, sound files, etc. with species occurrence data and digital literature resources</li> <li>4. Develop partnership and close working relationship with e.g. genomic, ecological, and digital library initiatives to ensure indexing via GBIF and use of GUIDs</li> <li>5. Increase the rate of digitisation of high quality, historical specimen-based data</li> <li>6. Facilitate electronic capture and metadata documentation of newly acquired occurrence data</li> </ol>	<ol style="list-style-type: none"> <li>1a. Each year complete an in-depth needs analysis and assessment for a major GBIF stakeholder</li> <li>1b. Over a two to five year period for each campaign at least 75% of the target goals of the user groups are met</li> <li>2. Over a two to five year period for each campaign at least 75% of the target goals of the user groups are met</li> <li>3. Indexing of all data types (e.g. names, specimens, observations, literature) using GUIDs in place by end 2007</li> <li>4. MOCs with key digital library initiatives, sequence database holders and major ecological data networks in place by end 2008</li> <li>5. Seed money awards each year result in increase of 1,500,000 historical species occurrence records</li> <li>6. By 2011, electronic data flow directly from the field to databases served through GBIF has increased by 50% over 2007 levels</li> </ol>	<ol style="list-style-type: none"> <li>1-2. Secretariat, GBIF campaign partners</li> <li>3-5. Secretariat</li> <li>6. Secretariat, data providers</li> </ol>

**Content Additional Funding**

## Module I. Observational and Monitoring Data

Programme Officer (begins 2008)	€ 122,000
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Project funding (begins 2008)	€ 120,00
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Observational and monitoring data have been underserved by GBIF. Funds are needed for a Programme Officer to work with these communities to bring the users and providers together, identify common needs and opportunities, and develop data models and standards for these data types. Observational and monitoring data are key data types for important user groups, including national, regional and local land managers and conservationists. Failure to develop better ways of managing observational and monitoring data will severely compromise its utility for many of these users, including the biodiversity conventions.

## Module II. Literature, Species Banks, and Web-Enabled Taxonomy

Programme Officer (begins 2008)	€ 122,000
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Project funding (begins 2008)	€ 120,000
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A Programme Officer is likewise needed to work with existing groups that are preparing digital libraries, developing species databanks, and instituting web-enabled taxonomy. GBIF needs to interface with these groups and ensure that their plans are congruent with ours. Literature references and species databanks are essential to allow the specimen and observational data currently served by GBIF to be linked to other data types. Ensuring close links to web-enabled taxonomy will help to speed up the completion of the ECAT, enable the progressive capture of new taxonomies, and make future updating of specimen and observational data much easier.

Module III. Additional Seed Money (begins 2008)	€ 800,000
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The campaign approach described above is a feasible way to work with user groups and data providers to identify priorities and develop funding schemes to digitise and make available those data that the users need most. However, there are three reasons for expanding seed money activity outside of the campaigns. First, some important data sets of great value will be too small or localised to be served appropriately by the campaign model, and can be funded via the seed-money approach. Second, previous experience has shown that it is not always possible to identify what future needs will be. For example, the next invasive pest species might well come from a taxonomic group for which the nomenclature is poorly developed and specimens and observations have not been digitised. Therefore, GBIF should have a mechanism for filling in the taxonomic and digitisation gaps. Third, the seed-money awards have been GBIF's most effective way to date for involving the data-provider community and helping them to self organise. Seed-money awards have been a great advertisement for GBIF and are a bottom-up approach to funding smaller-scale activities that could be the nucleus for future campaigns.

**Assumptions, Risks, Mitigation**

#	Assumption	Risk	Probability	Impact	Mitigation
C-1	The quality of data connected to the network is highly variable.	Even when errors are identified, it may take a significant amount of time before updates get incorporated	High	Medium	GBIF could improve on this by assisting data providers with data quality upgrades.
C-2	The number of types of content that need to be handled are growing steadily	This will present challenges in dealing with complexity, new partners, etc.	High	Low	If GBIF's information architecture evolves readily, however, it should be possible to integrate these in a reasonable amount of time.
C-3	Developments in the commercial arena of Digital Rights Management (DRM) of intellectual property rights (IPR) could affect the free flow of data.	Rate of growth of amount of data served through GBIF slowed.	Medium	High	To mitigate this, GBIF Secretariat will work with Participating countries to assure that scientific data and information remain open-access.
C-3	There are so many potential partners	May be difficult for GBIF to move quickly enough to capitalise on interactions	Low	Medium	Additional staffing would help meet the need

# Numbers in this column carry over to the Risk Analysis Overview Table, page 71

## Informatics

The information infrastructure (hardware, software, standards, services and interfaces) that enables the sharing and use of data and information.

**Priority:** Empower through web services the GBIF community to build applications on top of the growing pool of GBIF data, and integrate content through the GBIF Data Portal system to show in user-friendly manner what is available and what is possible.

### Current Situation Analysis

GBIF informatics started from scratch in the summer of 2002. During the first year, the Secretariat acquired its own computer park and the information architecture was designed. During the second year, the first toolkits for data providers, first central services, and training were deployed. During the third year the system was scaled up.

The first release of the GBIF Prototype Data Portal appeared early in 2004 and served as a proof of concept for the development of a global index of biodiversity data. This version of the portal offered only an HTML user interface to the data. By the end of August 2005, GBIF had 136 data providers in 31 countries, linking 550 collections/databases that together provided more than 80 million records of primary data. Rate of increase was about 3 million or 5% per month. There was a centralised helpdesk, registry, Data Portal and public web site. There were three data-provider implementations available for download.

The second release of the GBIF Data Portal implementation appeared at the end of 2005. It offers a suite of web services to support the development of other web portals and analytical applications. These services are based on open standards from TDWG and the Open Geospatial Consortium and support searches across hundreds of distributed data resources. The data accessible through the portal includes nomenclatural and taxonomic data sets, regional and legislative checklists, millions of taxon occurrence records, images and links to taxon pages. Clients can use provider metadata (e.g. country of origin, basis of record) and resource characteristics (e.g. availability, completeness and consistency of georeferencing) to select and filter data sets appropriately for their intended usage. The GBIF Data Portal also offers an HTML interface with browse, search and download functions to support most common tasks.

### Visions for 2011

- The services of the GBIF Data Portal system are a universal foundation used throughout biodiversity informatics.
- The GBIF information infrastructure is a full-service mechanism for data and information integration.
- The Data Portal system and the information infrastructure work in a uniform fashion across many autonomous communities such as museum, observer, ecological, environmental, natural resource, agricultural and genetic resources.
- Data owners no longer have to consider how to make their data accessible - connecting databases to the GBIF network is a matter of practice.
- GBIF has a regional and thematic support infrastructure and large numbers of regional or thematic portals are seamlessly and transparently accessing data from the GBIF network in seconds.
- A wide range of application packages are available to support analysis and manipulation of biodiversity data downloaded directly from the GBIF network, and because of these, publishing biodiversity data on the Internet is a popular activity.

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>A. Make the GBIF Data Portal system a user-friendly, powerful tool for most popular uses and applications</p>	<p>1. Develop user interfaces to support exploration of GBIF data</p> <p>2. Integrate GBIF data into other web portals</p> <p>3. Integrate GBIF data directly into GIS tools and GIS tools into GBIF portals</p>	<p>1a. Browsing GBIF data by geography, 2008</p> <p>1b. Browsing data by multiple taxonomies, 2009</p> <p>1c. Assess quantity and quality of data for particular groups and geographies, 2009</p> <p>1d. Customised portal for Participant Nodes, 2009</p> <p>2a. All GBIF data accessible through an open source toolkit to select, access and present data within any web portal, 2008</p> <p>2b. Distributed access to wide range of analytical tools, 2010</p> <p>2c. Integration of analytic tools through workflows, 2010</p> <p>2d. Partner with generic search engines such as Google, 2011</p> <p>3a. Polygon-based search, 2009</p> <p>3b. More complex spatial queries and spatial analysis capabilities (either locally or via web services), 2010</p> <p>3c. OGC WFS and WMS web feature service included in provider tools and portal, 2008</p>	<p>1a. Secretariat</p> <p>1b. Secretariat</p> <p>1c. Secretariat</p> <p>1d. Participant Nodes to work on deployment, Secretariat to coordinate</p> <p>2a. GBIF contractor to develop toolkit</p> <p>2b. External portals to provide analytical tools; Secretariat to enable them through web services</p> <p>2c. Secretariat, TDWG to build partnerships with bioMOBY and other tool developers</p> <p>2d. Secretariat to work with search engine companies</p> <p>3a. Secretariat, TDWG Geospatial Subgroup</p> <p>3b. GBIF partners and industry donors develop complex spatial query and analytical GIS capabilities</p> <p>3c. Contractor</p>

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>B. Consolidate the underlying enabling infrastructure and standardisation for global connectivity of biodiversity data and information</p>	<p>1. Redevelop the global registry of shared biodiversity data to include all levels of data from molecular to ecological</p> <p>2. Develop system of globally unique identifiers and encourage their use throughout biodiversity informatics</p> <p>3. Offer web service to data</p> <p>4. Harmonisation and semantic interoperability of data</p> <p>5. Explore Grid services</p>	<p>1a. Deploy updated/new registry software, 2008</p> <p>1b. Standardise provider and resource meta data and categorise by taxonomy, theme, geography, usage, etc., 2008</p> <p>1c. Collection codens (e.g. Index Herbariorum codes) integrated with metadata, 2009</p> <p>1d. Partnerships formed with other registries (molecular, ecological, agricultural) for registry interoperability, 2010</p> <p>2a. TDWG standards allow all data objects to be identified using standard resolvable globally unique identifiers, 2007</p> <p>2b. GBIF has a web service and user interface allowing users to locate and view any data object with a standard globally unique identifier, 2007</p> <p>3a. Ensure that GBIF data providers and portals are fully enabled as web services, 2008</p> <p>4a. Schema repository in place, 2007</p> <p>4b. Ontologies being used for extensible data standards definition, 2009</p> <p>4c. In addition to using taxonomic names, taxon concept information used for integration when available, 2009</p> <p>4d. Process established within TDWG to identify data elements requiring controlled vocabularies and to develop these, 2008</p> <p>5a. Pilot projects on application of Grid for biodiversity data, working with relevant Grid projects such as BDWorld, MyGrid, D-Grid, SEEK</p> <p>5b. Migration from Web services to Grid services when/where feasible</p>	<p>1a. Secretariat</p> <p>1b. Secretariat, TDWG</p> <p>1c. Secretariat, coden providers</p> <p>1d. Secretariat, partners</p> <p>2a. Secretariat</p> <p>2b. Secretariat</p> <p>3a. Secretariat</p> <p>4a. Secretariat</p> <p>4b. Secretariat</p> <p>4c. Secretariat</p> <p>4d. Secretariat</p> <p>5a. Secretariat, partners</p> <p>5b. Secretariat</p>

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>C. User-friendly tools for Nodes and data providers to support data sharing</p>	<ol style="list-style-type: none"> <li>1. Develop flexible extensible packages for data sharing with simple configuration to wrap any database structure and to serve data using any suitable biodiversity data schema</li> <li>2. Integrate data sharing packages directly into existing biodiversity data management software</li> <li>3. Support authenticated access to any resource to also support restrictive IPR policies of providers</li> <li>4. Support web taxonomy</li> <li>5. Automate validation of biodiversity data, including reporting to providers and users</li> </ol>	<ol style="list-style-type: none"> <li>1a. At least one supported package available for each data type such as specimen (2004), observation (2004), descriptive (2008), literature (2009), name/ concept (2006), image (2007), character (2008), OGC (2007), etc.</li> <li>2a. For at least 5 biodiversity software packages, integration with GBIF is "as simple as selecting a check-box", 2008.</li> <li>3a. LDAP service, 2010</li> <li>3b. Certificate service, 2010</li> <li>4a. Schema repository in place, 2007</li> <li>4b. Ontologies being used for extensible data standards definition, 2009</li> <li>4c. In addition to using taxonomic names, taxon concept information used for integration when available, 2009</li> <li>4d. Process established within TDWG to identify data elements requiring controlled vocabularies and to develop these, 2008</li> <li>5a. Work with EDIT to develop tools for authoring electronic revisions and sharing name/concept information from them, 2010</li> <li>5b. Support operation of tools and integration of revision data, 2011</li> <li>5a. Agree on metrics of data quality, 2007</li> <li>5b. Extensible library of validation tests available for each class of biodiversity data, 2007</li> <li>5c. All data assessed during indexing and reports automatically sent to data providers, 2007</li> <li>5d. Tools readily available and easily deployed to make corrections to provider data, 2009</li> </ol>	<ol style="list-style-type: none"> <li>1a. Open source projects and contractors to package; Secretariat to test and support</li> <li>2a. Secretariat to work with providers of biodiversity software</li> <li>3a. Secretariat</li> <li>3b. Contractor</li> <li>4a. Secretariat</li> <li>4b. Secretariat</li> <li>5a. Nodes Committee</li> <li>5b. Secretariat Help desk</li> <li>5c. Programmer support for data validation tools</li> </ol>

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>D. Support in. frastructure for GBIF information system moving from prototype to operational status</p>	<p>1. Operate registration and indexing and support the data providers</p> <p>2. Distribute operations for high availability</p> <p>3. Helpdesk for end users and data providers</p> <p>4. Enhance the collaboration infrastructure</p>	<p>1a. Seamless registration of new providers, 2007</p> <p>1b. Indexing of new data within one day, 2009</p> <p>1c. Feedback services, 2008</p> <p>2a. Mirror sites in all continents and thematic areas, 2009</p> <p>2b. Central merging of regionally produced indexes, 2009</p> <p>3a. Fast helpdesk response, 2007</p> <p>3b. Frequently asked questions and knowledge base, 2008</p> <p>3c. Download sites for software, 2007</p> <p>3d. Usage policies in place, 2007</p> <p>4a. Discussion and email integration, 2007</p> <p>4b. Web site enhancements and increased Wiki-based authoring, 2007</p> <p>4c. From simple document management in CIRCA to knowledge management on LiveLink, 2007</p>	<p>1a. Regional support centres do indexing</p> <p>1b. Secretariat supports regional centres</p> <p>1c. Secretariat</p> <p>2a. Regional support centres to operate mirror sites</p> <p>2b. Secretariat to merge regional indexes and distribute them to Nodes</p> <p>3a. Regional support centres do the help desk in their languages and time zones; Secretariat to support regions</p> <p>3b. All helpdesk operators</p> <p>3c. Secretariat</p> <p>3d. Secretariat</p> <p>4a,b. Committee members, expert groups, and contractors to contribute content</p> <p>4c. Secretariat</p>

**Informatics Additional Funding**

## Module V. Updating the Data Portal

Portal Architect (begins 2007)	€ 122,000
Additional Data Portal staff (begins 2010)	€ 122,000
Contracts, hardware, software, etc.	€ 400,000

As noted by many observers, the Prototype Data Portal is in need of a major overhaul and update. The Portal Architect will work with the DADI Programme Officer to plan, oversee, and implement these improvements. This individual will be responsible for developing contracts with relevant developers around the world, selected by competitive bidding processes. The person will also be responsible for distributing and interchanging portal functionality throughout the GBIF Data Portal system. As the portal system grows in size and complexity, an additional staff member will be needed to manage it.

## Module V.

Tools Development contracts, software, etc. (begins 2008)	€ 200,000
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The Deputy Director for Informatics, DADI Programme Officer, and Portal Architect will be responsible for overseeing the development of a wide range of user-friendly software tools, including data provider software. Major areas of focus will include the integration of community-developed tools for web taxonomy, images, character descriptions and literature into the GBIF architecture, as well as developing tools to aid the interface of portal-supplied data with geographic information systems (GIS).

## Module VI. Data Management

Data Manager (begins 2007)	€ 122,000
Contracts, hardware, software, etc. (begins 2009)	€ 100,000

The Data Manager will be charged with working with data providers to index their content in a rapid fashion, and in particular to develop and deploy tools to improve the quality of data. This individual will apply a common set of data screening tools, developed under the 2005-2006 Work Programme, to all data being served to the portal, in order to flag instances of suspect data entries (e.g. species name is not in the correct field or geo-referenced coordinates appear to be outside the indicated collecting locality). The Data Manager will also make the data-cleaning toolkit available to end users, so that they can gauge the goodness-of-fit of particular data sets to their particular needs. Additional funds are provided starting in 2009 to update and expand the data-cleaning toolkit.

## Module VII. Webmaster

Webmaster (starts 2008)	€ 122,000
Hardware, software, etc. (starts 2009)	€ 100,000

The Webmaster will oversee the further development and updating of the GBIF Communications Portal, and assist other ICT staff with Data Portal development. The individual will also be in charge of other communications resources, such as wikis, listservs, etc.

## Module VIII. User Support, Mirroring,

and Additional Hardware and Software (starts 2007)	€ 600,000
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As the data portal system and the Secretariat grow, the number of mirror sites and their capabilities need to be increased and be partially funded by GBIF. User help-desk functions will also need growing resources and IT solutions. Finally, there will be additional needs for ICT hardware and software, including additional servers and hard disks, more powerful backup mechanisms, new software (including licenses and annual maintenance fees), etc.

**Assumptions, Risks, Mitigation**

#	Assumption	Risk	Probability	Impact	Mitigation
I-1	Limited portal capabilities would cause GBIF to fail in its mission and in serving users.	Lack of staff and resources affects GBIF's ability to make progress in developing web services, Data Portal, etc.	Medium	High	Dedicated and outsourced staffing adequate to address the many IT challenges.
I-2	The GBIF network comprises a wide variety of sources which use different categories and terminologies to organise their data.	At present, it is impossible for the Data Portal implementation to provide full integration among data sources	High	Medium	However, developing and agreeing on a shared ontology would alleviate this problem, although this is an enormous task that could take many years to complete.
I-3	There is fragmentation in the community and among data types	This fragmentation continues because standards for data and metadata are not developed	Medium	Medium	Managing expectations to keep them at a realistic level, and actively contributing to all relevant standards-development activities.

# Numbers in this column carry over to the Risk Analysis Overview Table, page 71

### **Participation**

Promotion of the active involvement and benefits for scientists, students, conservationists, nature managers, planners and decision-makers as well as the private sector.

**Priority:** "We are all GBIF" - the data providers, the data users, the Participants and their Nodes - it is the Nodes that form the network through their interactions.

### **Current Situation Analysis**

GBIF shows a very uneven geographical distribution in its country participation, which can be explained by 1) unevenness in scientific capacity among the world's countries, and 2) as being the logical result and expression of the negotiation process that gave life to GBIF. It is therefore no surprise that a quick look at the current status of participation will show bias in regional representation. Even though it has a global agenda, GBIF is perceived by many as a mostly OECD-led initiative that lacks actual global participation. To date, GBIF has been able to achieve the goals established by the Governing Board for increasing membership. However, most developing countries and countries with economies in transition are joining as Associate Participants, thus having a different status within the organisation (or as the 3rd Year Review indicates they can be seen or considered as "free riders"). Organisational Associate Participants have grown in number to 31, but there are still relevant data initiatives that have yet to get involved in GBIF. Training activities have been used to promote GBIF and thus attract non-members from within the regions where the courses were given.

Participant Nodes are crucial to making it a megascience endeavour, by contributing

- access to the biodiversity data communities and therefore to mobilising data,
- technical support and expertise for other Nodes and for the scientific community,
- input to the overall GBIF development, and
- to the culture change required to make use of the new resource that GBIF provides.

However, the work of Nodes during the first five years has been on an invent-as-you-go basis. The Nodes are very heterogeneous in terms of aims, affiliation, priorities and resources, as they represent both countries and organisations. However, Nodes are expected to provide benefits to:

- biodiversity information users by acting as information hubs
- environment agencies by providing a good basis for decision making (quality data, accessible data, in usable ways)
- open the way to better biodiversity science and education
- deal with issues with biodiversity implications (sustainability, natural services, agriculture, disasters, water, etc.)
- help users make better-informed decisions (by supplying, for example, case studies, pilots, demos).

It is also clear that there are needs among Participant Nodes and data providers for items such as computers, software and Internet connectivity as well as training in their use. GBIF does not itself have the funding to be able to provide this basic infrastructure, but we can partner with governmental aid agencies or foundations to provide these items. This is the purpose of GBIF's Capacity Enhancement Plan for Developing Countries (CEPDEC).

### Data providers

As of mid 2005, the existing GBIF Nodes estimated (see Table 2 in main text) that there are as many as 4000+ potential data providers within current Participants (this is undoubtedly a gross underestimate), but at present only 131 are sharing data from 541 collections databases. The Nodes need to work to recruit and network the potential data providers shown in Table 2 (main text) and yet others.

### Scientists and other technical users

The Review indicated that "PR" within the scientific community (providers of data and information), rather than with the general public, is much more important for the present and immediate future. This is because building the infrastructure can not be accomplished overnight, and the data and information generated by the scientific community is essential to GBIF success. Phase II of GBIF, when it has user-friendly interfaces and easily obtained and used analytical tools that can access large amounts of natural history specimen and observation data (products), will then be much more marketable to the public, to educational, private sector and other users.

### Public

In GBIF's early years, the press uptake has been unsatisfactory to those who have worked so hard to make GBIF a reality. However, the Third Year Review indicated that public press efforts were premature until user-friendly products were available from GBIF.

### Training

The GBIF MoU underscores the need for involvement and broad participation of its members in training activities. Under its objectives the MoU states that GBIF Participants "contribute to training and capacity development for promoting global access to biodiversity data" (Paragraph 3, Objective 3e). GBIF has recognised the need to have two separate kinds of training activities and has developed plans for developing partnerships to implement them:

1. Technical training for Nodes aims at bringing them all to a common level of skills so that they can efficiently promote mobilising data in their realms. With such skills the Nodes can enable data providers to more effectively share biodiversity data freely and openly. During 2003 and 2004 a total of 8 training courses of this kind were given around the world in English, French and Spanish by the Secretariat. More than 150 individuals were trained in GBIF information architecture technologies, and they came from 40 countries and 13 organisations. In addition, some Participants also ran training workshops themselves. During these events, opportunity was also taken to reach out to potential new Participants.
2. Training for data users highlights the importance of utilizing biodiversity data for science, planning, conservation and decision-making. The first GBIF Data Modelling Workshop was held in 2005. It was oversubscribed, showing the need for such training opportunities. A total of 25 participants were trained in building predictive models utilizing ecological niche modelling.

### Visions for 2011

- GBIF has the active participation and engagement of all megadiverse countries and of countries in all regions in the world; all relevant data initiatives are involved in GBIF.
- International biodiversity conventions see GBIF as an important tool to help them implement their work programs particularly at the national level.
- All GBIF Participants are contributing actively to the GBIF vision through the work of their Nodes and are getting tangible benefits from the GBIF network.

- Nodes produce many services and have significant expertise that can be used to improve the overall efficiency of GBIF.
- CEPDEC and similar partnerships with aid agencies and foundations are helping to reduce the digital divide by enhancing the biodiversity informatics capabilities in a wide variety of participating developing countries to better use and share data.
- There have been radical increases in numbers of data providers and numbers of digitised collections.
- Researchers and the public regard GBIF as the primary place to go on the Web for species information and connections to other kinds of biodiversity data and information.
- GBIF data policies are fully understood and accepted; scientists do not fear sharing their data.
- Scientists and other users recognise that they can use GBIF as well as contribute to it.
- GBIF training is broadened to include the use of additional analytical tools, some of which have been developed during GBIF demonstration projects.
- GBIF data-use training is more and more in demand, and there are more and more people skilled in these analytical methods.

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
A. The expertise that Nodes have and the services they provide are openly shared and constitute an integral component of GBIF activities	<ol style="list-style-type: none"> <li>1. Set up a tools, expertise and services repository</li> <li>2. Seek the cooperation and involvement of regional networks</li> <li>3. Continue mentoring program</li> <li>4. Produce "The Nodes Guide"</li> <li>5. Coordinate and encourage Node-to-Node activities</li> </ol>	<ol style="list-style-type: none"> <li>1. Tools, services and expertise of Nodes available to the GBIF community by beginning of 2007 (prototype established in 2006)</li> <li>2a. 4 -6 workshops, with a different regional network involved in each</li> <li>2b. 1 inter-regional workshop that includes all thematic networks</li> <li>3. As a result of mentoring, 2-3 Nodes become active per year</li> <li>4. Comprehensive version in place by 2007</li> <li>5. 3 - 6 projects completed per year</li> </ol>	1-5. Open source projects and contractors to package; Secretariat to test and support
B. Participants have access to adequate assistance, training and guidance to set up and maintain effective and efficient Nodes.	<ol style="list-style-type: none"> <li>1. Assist directly: visits, GBIF sessions, help to write / prepare plans and proposals so that Nodes are helped to overcome barriers</li> <li>2. Support the set up of focused and efficient Nodes</li> <li>3. Prepare "New member-package"</li> <li>4. Provide "help desk"</li> <li>5. Conduct workshops for Node Managers on new tools, standards and protocols as they become available</li> <li>6. Conduct training needs assessments and create a training programme</li> <li>7. Continue TAPIR provider training (min. 2 per year) for data providers, in partnership with Nodes and with special emphasis on regional approaches</li> </ol>	<ol style="list-style-type: none"> <li>1. 6 - 12 in-depth interactions per year</li> <li>2. 4 - 8 Nodes and potential Nodes moved to the next developmental step per year</li> <li>3. Materials printed by mid-2007</li> <li>4. 60 - 120 cases handled per year</li> <li>5. 10 - 20 Nodes move to the next developmental step per year</li> <li>6. Annual training programme focused on identified needs and it is broadly advertised on Communications Portal and other media</li> <li>7. At least 20 people/ training event/ year trained and able to train others</li> </ol>	1-7. Secretariat to work with providers of biodiversity software
C. Country and organisational Nodes are empowered to effectively contribute to GBIF and obtain tangible benefits from it	<ol style="list-style-type: none"> <li>1. Devise conceptual framework for incorporating organisational member contributions into GBIF [web] structure</li> <li>2. Integrate contributions from organisational Nodes into the GBIF sites</li> <li>3. Identify strategies for fruitful interactions between Nodes and data providers (may involve task group meeting/s)</li> <li>4. Develop model for CEPDEC (capacity enhancement program for developing countries)</li> </ol>	<ol style="list-style-type: none"> <li>1. Plan completed in 2006, implemented in 2007</li> <li>2. Web development to sustain Organisations' contributions in place by mid-2007 (prototype in place)</li> <li>3. Identify strategies for fruitful interactions between Nodes and data providers (may involve task group meeting/s)</li> <li>4. Develop model for CEPDEC (capacity enhancement program for developing countries)</li> </ol>	1-4. Secretariat

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>D. GBIF ensures and promotes the active engagement of countries and scientific communities and helps in the implementation of the biodiversity conventions.</p>	<ol style="list-style-type: none"> <li>1. Attend key international events and conferences to promote GBIF and particularly reach out to biodiversity-rich countries and relevant international organisations and attract them to join GBIF</li> <li>2. Encourage scientific community to upload their data to GBIF and to use GBIF data in their research</li> <li>3. Establish partnerships that promote sharing of data to countries of origin</li> <li>4. Enhance collaboration with the CBD</li> <li>5. Develop MoCs with CITES, Ramsar and CMS Conventions and encourage them to link their databases to the GBIF data network.</li> </ol>	<ol style="list-style-type: none"> <li>1a. Identify recruitment champions</li> <li>1b. GBIF has a 10% increase in participation per year.</li> <li>1c. All megadiverse countries become GBIF members by 2011.</li> <li>1d. Two to three new key international organisations contribute data, standards or services to GBIF per year</li> <li>2a. Rate of increase in amount of GBIF data rises from 5% to 10% per month</li> <li>2b. By 2011, campaigns and other scientific activities per year yield at least 10 to 15 papers that cite GBIF</li> <li>3. By 2011, 40 to 50% of all potential providers of (high quality) data are part of the GBIF network</li> <li>4a. By 2010, GSPC Target 1 will have been achieved, largely through GBIF contribution</li> <li>4b. By 2011, GBIF web-enabled taxonomy tools will support goals of the GTI</li> <li>5a. MoCs in place by end 2008.</li> <li>5b. A minimum of 40 countries per year are regularly downloading data from the GBIF portal to use in fulfilling national obligations under the CBD, Ramsar, CITES and CMS conventions</li> <li>5c. GBIF is recognised and cited by these international fora as an important partner and collaborator.</li> <li>5d. Convention secretariats use GBIF data regularly to enhance their own databases.</li> </ol>	<ol style="list-style-type: none"> <li>1. Secretariat, Science Committee, Science Subcommittees, Governing Board members</li> <li>2. Scientists</li> <li>3. Secretariat, also Science Committee, Science Subcommittees, Governing Board</li> <li>4a. Secretariat, partners</li> <li>4b. Secretariat, TDWG, tools developers</li> <li>5. Secretariats of GBIF, CITES, CMS and Ramsar and Participants</li> </ol>

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
<p>E. Data providers are comfortable about IPR issues and generation of value-added data by both non-commercial and commercial users</p>	<ol style="list-style-type: none"> <li>1. Familiarise participants and providers with IPR issues</li> <li>2. Establish an ad hoc and pro bono legal experts' advisory group on IPR issues</li> <li>3. Hold second workshop to further address issues related to commercial use of GBIF-mediated data</li> <li>4. Devise a consensus data policy that includes disclaimers, data use and data sharing agreements, and citation mechanisms for GBIF and as models for data providers and Nodes</li> </ol>	<ol style="list-style-type: none"> <li>1a. Section developed in the GBIF portal that makes available user-friendly and relevant IPR information and materials by early 2007</li> <li>1b. Mechanisms that foster an open and constructive dialogue in place by early 2007.</li> <li>2a. Legal advisory group in place by early 2007</li> <li>2b. White paper addressing IPR issues associated specifically with data itself (not biological materials) by end 2007</li> <li>3a. Workshop report by end 2008</li> <li>3b. Providers remove "non-commercial use only" restrictions</li> <li>4. Data policy finalised, accepted and widely used by end 2007</li> </ol>	<ol style="list-style-type: none"> <li>1. Secretariat</li> <li>2a. Secretariat</li> <li>2b. Legal advisory group</li> <li>3. Workshop participants, Secretariat</li> <li>4. Secretariat</li> </ol>
<p>F. New uses of biodiversity data to address scientific questions and provide solutions to outstanding issues in society are developed regularly and respond to the needs of a broad range of users.</p>	<ol style="list-style-type: none"> <li>1. Increase the visibility and use of data</li> <li>2. Make available attractive, useful, and user-friendly examples of data uses.</li> <li>3. Promote the development of demand-driven, problem-solving and innovative demo projects</li> <li>4. Promote visibility of GBIF products via media of various sorts</li> <li>5. Conduct at least 1 workshop per year to explore new uses and analytical methods</li> </ol>	<ol style="list-style-type: none"> <li>1a. By 2011, the number of data hits is increasing by 5% to 10% per month</li> <li>1b. By 2011, the number of data downloading events is increasing by 5% to 10% per month</li> <li>1c. By 2011, references to GBIF in scientific and popular media occur monthly (on average)</li> <li>2. Feedback from users indicates high levels of use and satisfaction with GBIF data.</li> <li>3. Three to four demo projects are developed per year</li> <li>4. People who are part of the GBIF network appear on radio, TV and webcasts; print and web articles are written about GBIF by others</li> <li>5. Report from each workshop provides potential users with ideas for analyses</li> </ol>	<ol style="list-style-type: none"> <li>1, 4. Professional PR staff or consultants; also Governing Board, Science Committee, Science Subcommittees, Secretariat</li> <li>2. Outsource development, make available on Communications Portal</li> <li>3. Secretariat, demo project developers</li> <li>5. Workshop participants, Secretariat, with partners to organise events</li> </ol>

**Participation Additional Funding**

## Module IX. Nodes

<u>Nodes Programme Officer (starts 2007)</u>	<u>€ 122,000</u>
<u>Second Nodes Programme Officer (starts 2008)</u>	<u>€ 122,000</u>
<u>Project funding for improving Participant Nodes (starts 2008)</u>	<u>€ 650,000</u>

The current Nodes Liaison Officer position is paid by funds provided on a one-time basis by the Danish Natural Science Research Council, and the position needs to be made permanent. It is also clear that the Nodes' needs justify having two individuals in this area. Activities to be undertaken by the two Nodes officers will include extensive travel to various Nodes to help with their development and implementation, seeking funds from developmental aid agencies to plan for and implement Nodes in developing countries, holding workshops to share best practices regarding Nodes, identifying ways to incorporate "non-standard" Nodes into the system (e.g. Participant Nodes that are serving different data types, such as molecular or ecological data, or information about the various Codes of nomenclature), and identifying ways to help Nodes to reach out to and incorporate additional data providers and user groups. The needed project funding will allow increased mentoring among existing Nodes, training and other capacity building activities for new Nodes, the development of new tools to aid the Nodes in linking to and extracting data from the GBIF portal in new ways (e.g. country-specific or thematic views of the data), and the development of regional networks of Nodes.

## Module X. Outreach

<u>Second Outreach Programme Officer (starts 2008)</u>	<u>€ 122,000</u>
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An additional Outreach Programme Officer is needed to complement the existing work of the Outreach and Capacity Building Programme Officer. Together, these two individuals will focus on identifying campaign areas to consider for developmental fundraising (including the Capacity Enhancement Plan for Developing Countries, or CEPDEC), improving interactions with the biodiversity-related conventions and other user groups, increasing activities related to repatriation of data, recruiting new Participants, especially the world's mega-diverse countries, and developing ways to address IPR-related concerns.

## Module XI. Training

<u>Training Coordinator (starts 2010)</u>	<u>€ 122,000</u>
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The Training Coordinator works with the Outreach and Capacity Building Programme Officer to create and operate the training programme and will oversee a transparent selection process for letting contracts to outside organisations to carry out training workshops on GBIF's behalf. The person will also develop and implement on-line, Internet-based training resources.

## Module XII.

<u>Project Funding for Outreach, Training and Public Relations (starts 2007)</u>	<u>€800,000</u>
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Additional project funds are needed to fund more (and larger) demonstration projects that show the value of GBIF data for various user groups, the repatriation of data to countries of origin, a pro bono legal advisory group, and discussion fora and regional workshops to examine IPR issues.

Project funding is also needed to pay for a wide range of essential workshops on topics such as regional approaches to digitisation, repatriation of data, use of GBIF-supplied software tools (e.g. TAPIR), Node Manager training, how to use modelling and other data-mining and analysis tools, and the development of value-added approaches to GBIF-supplied data, as well as on-line, Internet-based training resources. In addition, once the Data Portal implementation has been re-engineered and more demonstration products are available, it will be necessary to not only seek press attention to the Portal system and its products but also to conduct publicity campaigns. It will probably be possible to outsource these activities. In addition, the cost of workshops for Participants, press activities at meetings, and production of materials must be covered.

**Assumptions, Risks, Mitigation**

#	Assumption	Risk	Probability	Impact	Mitigation
P-1	The benefits of being a Voting Participant in GBIF are not adequately perceived.	Resistance by Associate and non-Participants to becoming Voting Participants.	Medium	High	GBIF can mitigate this by funding more, and more useful, demonstration projects and by providing training and other benefits to Voting Participants as well as substantially increasing the amount and quality of available data.
P-2	Demonstration projects are helpful in improving the perception of GBIF as worthwhile to join and support.	Demonstration projects result in insufficiently interactive and intuitive or user-friendly products	Low	High	Carefully choose demo projects that will utilise GBIF data and take full advantage of its information architecture.
P-3	Some Participants fail to establish a Node	This is "dead weight" for GBIF, and progress is hampered.	Medium	Medium	GBIF can mitigate this by providing guidance and advice on how to set up a Node, as outlined in this Plan.
P-4	Nodes may fail to meet expectations	Nodes being shut down or downsized, or do not function as needed by the GBIF network.	Medium	High	Increase attention to the Nodes as outlined in this Plan, helping them to provide services to their Participants that are perceived as valuable, and to stay on track with overall GBIF goals.
P-5	The sociological component of the Nodes mission is to form networks of data providers.	Nodes fail to recruit and form such networks.	Low	High	Participants can mitigate this through adopting policies that require data-sharing, and the NODES committee can develop "best practices" to help Nodes with this function.

# Numbers in this column carry over to the Risk Analysis Overview Table, page 71

#	Assumption	Risk	Prob-ability	Impact	Mitigation
P-6	CEPDEC funding necessary for capacity enhance-ment in develop-ing countries.	Inability to find funding.	Low	Medium	Careful prepara-tion of propos-als, building of strong cases for funding; adding staff to work on campaigns.
P-7	In order to provide level of training needed, GBIF must form partnerships with others.	GBIF loses recognition for providing training.	Low	Medium	Maintain close contact is with training partners and assuring that training materials are clearly labelled GBIF.
P-8	The Data Portal system needs to have user-fri-endly, intuitive interfaces, large amounts of data, and good demo project results to attract users.	Broad-scale publicity be-fore these are available leads to disillusionment and distrust.	Low	High	Publicise successful developments when they are "ready for prime time."

# Numbers in this column carry over to the Risk Analysis Overview Table, page 71

### Risk Analysis Overview Table

The table below summarises the potential hazards facing GBIF's three Areas of Concentration as set out in this Strategic Plan. The items in this summary table are coded according as they are in the Assumptions, Risks, Mitigation tables for each area of concentration, above.

The impact of each hazard should it occur (low, medium, high) is plotted from left to right on the table. The probability of a hazard occurring (low, medium, high) is plotted from top to bottom of the table. If a risk is in the centre one of the nine boxes, it would have medium probability and medium impact (for example, I-3 and P-3 as shown). A risk in the lower left-hand box would have high probability but low impact (e.g. C-2), and so on. Use of this table allows identification of the most risks with highest impact and probability, and thus determines the focus of management activities.

		Impact		
		Low	Medium	High
Probability	Low		C-4 P-6 P-7	P-2 P-5 P-8
	Medium		I-3 P-3	C-3 I-1 P-1 P-4
	High	C-2	C-1 I-2	

The table indicates that most of the risks identified in the Strategic Plan are in the medium and high impact most are in the low and medium probability ranges. Focus of mitigating activities will be on the risks placed in the four cells to the bottom and right of the table, particularly on the High-impact, Medium-probability risks.

### **Governance and Funding**

In order to carry out its important work and ambitious plan, GBIF needs an efficient and effective governance structure. It is also important that the views of both scientists and government representatives be heard in Governing Board meetings. Further, user communities need be involved in setting priorities for the generation and improvement of data content. Efficiency is needed to avoid wasting money, and effectiveness is needed to guide the use of those funds.

GBIF's products and tasks are scientific and serve both the private and public sectors, which implies that society's responsibility to fund it is inevitable. The Basic Financial Contributions by Voting Participants are crucial to its existence. Also in the financial mix is the Supplementary Fund, which can accept donations from Participants and from other sources as well, and income obtained from foundations, research councils, aid agencies and the like.

GBIF is adding the campaign approach for raising funding for large scale projects carried out in partnership with various constituencies. This mechanism to capture the interest of the relevant user and provider communities and work with them to implement larger-scale activities will require that GBIF organise partnerships and activities within the scientific and other communities. There are many voices, from Participants, the Review Team, and individuals in the scientific and user communities, calling on GBIF to undertake such larger-scale organisational efforts. However, it must be recognised that organising the community takes time, personnel and money before the funders make their contribution.

GBIF has adopted a campaign style of approach to work with various interested communities and partners to achieve time-bounded, larger scale goals. The GBIF budget should have initiating funds for one or two campaigns a year for the first three years of this Strategic Plan. Such funds would be used as matching funds to the contributions of other partners, to hire the expertise that will be needed to write grant proposals and to manage large-scale projects.

#### **Adding this new type of approach to GBIF's interactions will**

- help to prioritise activities and achieve common goals,
- speed up the provision of data to GBIF, as well as strengthen our ties to our user communities,
- highlight GBIF as an organisation that wants to help our user communities, provide examples of why forming partnerships with GBIF is a good idea, and
- improve GBIF's relationships with a broader set of communities, including both stakeholders and users.

Such an approach, in which GBIF focuses on user needs while at the same time adhering to scientific merit as a fundamental principle in setting priorities, is indispensable to enable GBIF to achieve a sustainable future.

Goal	Activities	Targets / Milestones / Indicators	Secretariat Staffing / Outsourcing
A. Streamlined, cost-effective governance procedure with a strengthened interim decision-making procedure.	<ol style="list-style-type: none"> <li>1. Continue to update the Rules of Procedure</li> <li>2. Reduce number of Governing Board meetings.</li> </ol>	<ol style="list-style-type: none"> <li>1. New Rules of Procedure no later than 2008</li> <li>2a. No more than one Governing Board meeting each year.</li> <li>2b. Executive Committee empowered to function as oversight body between Governing Board meetings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Governing Board</li> </ol>
B. GBIF focus is on science-governance dialog that is central to GBIF	<ol style="list-style-type: none"> <li>1. Maintain the mix by holding Science Symposium and Ebbe Nielsen Prize Ceremony in conjunction with Governing Board meetings.</li> <li>2. Encourage Participants to include both scientists and bureaucrats in delegations</li> <li>3. Ensure that a science discussion is included in the agenda of Governing Board meetings</li> </ol>	<ol style="list-style-type: none"> <li>1. Science Symposium with Ebbe Nielsen Prize Ceremony occur on yearly basis, 2007 - 2011</li> <li>2. At least 2 former Prize winners attend each Governing Board meeting or Science Planning meeting</li> <li>3. Science discussion on agenda and recorded in minutes of each meeting, 2007-2011</li> </ol>	<ol style="list-style-type: none"> <li>1. Science Committee and Secretariat organise</li> <li>2. Participant delegations</li> <li>3. Governing Board Chair, Executive Secretary</li> </ol>
C. Scientists and other user communities fully involved in setting GBIF priorities	<ol style="list-style-type: none"> <li>1. Seek excellence in the GBIF advisory structure</li> <li>2. Hold planning sessions (e.g. Science and Technology Advisory Groups, Science Subcommittees meetings) to which relevant communities are invited (other interested persons may attend at own expense) for designing the Work Programme and identifying campaign opportunities.</li> </ol>	<ol style="list-style-type: none"> <li>1. 5 high-profile scientists and others attend each planning session, 2007 - 2011</li> <li>2. White paper on result of planning session received after each, 2007 - 2011</li> </ol>	<ol style="list-style-type: none"> <li>1. Science Committee recommends; Secretariat handles details</li> <li>2. Travel Co-ordinator handles venue, organisation, travel details, etc. (also handles all other Secretariat travel)</li> </ol>

<b>Goal</b>	<b>Activities</b>	<b>Targets / Milestones / Indicators</b>	<b>Secretariat Staffing / Outsourcing</b>
D. Number of Voting Participants increased to share the funding load more widely	<ol style="list-style-type: none"> <li>1. Recruit new Participants at major international meetings, targeting potential voting participants with high GDP</li> <li>2. Publicise benefits of Voting Participation</li> </ol>	<ol style="list-style-type: none"> <li>1. Participant numbers increased by 10% per year</li> <li>2. Surveys determine awareness and understanding, yearly 2007 - 2011</li> </ol>	<ol style="list-style-type: none"> <li>1. Governing Board, Secretariat</li> <li>2. Secretariat</li> </ol>
E. Contributions by Participants adequately support the activities of the Secretariat and the Work Programme	<ol style="list-style-type: none"> <li>1. Using strong business plan endorsed by Governing Board, leverage more funding from extant participants</li> <li>2. Develop incentives for becoming Voting Participant</li> </ol>	<ol style="list-style-type: none"> <li>1. Participants agree to new scale of contribution by beginning of 2007</li> <li>2. Increase services (e.g. training opportunities, etc.) to Voting Participant Nodes</li> </ol>	<ol style="list-style-type: none"> <li>1. Governing Board</li> <li>2. Secretariat</li> </ol>
F. Special projects dramatically increase the content, functionality and value of GBIF activities	<ol style="list-style-type: none"> <li>1. Work with stakeholders (users, partners, funders) to design and implement campaigns such as CEPDEC</li> <li>2. Encourage Participant-specific projects</li> </ol>	<ol style="list-style-type: none"> <li>1a. At least one funded campaign added to the GBIF portfolio each year, 2007-2011</li> <li>1b. Grants, aid funds and industry contributions received</li> <li>2. Within Participant progress in digitisation producing measurable results (for example)</li> </ol>	<ol style="list-style-type: none"> <li>1. Secretariat, representatives of other stakeholders</li> <li>2. Participants, their Nodes, partners</li> </ol>

## **Additional Resources for Governance and Funding**

### **Module XIII.**

Increased Governing Board expenses (starts 2007) €96,000

The funding for Governing Board expenses was drastically cut in 2006, in order to keep funding for the Work Programme steady. The increase proposed for 2007 simply returns this spending to its earlier level, which will provide adequate funding for the Chair's expenses, the meetings of the Nodes Committee and the Science Committee (including its Subcommittees), and the yearly Science Symposium. In addition, we need to budget for growth in the Nodes Committee (each new Participant has an automatic seat on that Committee), the yearly Science Planning Meetings, and the periodic meetings of the Science Council.

### **Module XIV.**

Meeting and Travel Support Staff (starts 2008) € 122,000

A support staff member is needed to handle the increasing number of meeting- and travel-related activities, including setting up of workshops, Supplementary-Fund travel, Governing Board and Committee meetings, staff travel, etc.

### **Module XV. Campaigns**

Campaign Development and Coordination Officer (starts 2007) € 122,000

Campaign Development Funds (starts 2007) € 800,000

A Campaign developer and coordinator is needed to get the campaign process started. This individual will need to have good management and project development skills. S/he will work with the rest of the staff to identify potential campaign topics, develop priority actions with the relevant user groups and data providers, synthesise a funding plan, and be actively involved in writing proposals in collaboration with the various stakeholders.

For the campaign approach to work successfully, the Campaign Coordinator will need to have development funds at his/her disposal to pay for the various stages of development of the projects and also to use as matching funds on proposals.

### **Module XVI.**

Recruitment Costs and Increased Running Expenses (starts 2007) € 235,000

All the new staff identified in this strategic plan will need to be recruited internationally. In addition, the contracts of all of the current GBIF staff members will run out in the next few years, so recruitment will be needed for their replacements, too. The new staff members will also bring increased running costs to the Secretariat for such items as travel, medical and travel insurance, and supplies not provided by the Secretariat Host. Finally, it is foreseen that the University of Copenhagen will be unable to provide free space for all the new staff proposed, and therefore this figure includes €55,000 for rental of extra office space in buildings adjacent to the Secretariat.

### Investments summary

The table below summarises the current annual spending for the various areas of activity, and the additional annual spending (as of 2011) needed to implement this Strategic Plan. All figures are in thousands of Euros.

\* Includes required cost-of-living, step increases for staff and inflationary increases in running expenses for current staff and the cost of the Ebbe Nielsen Prize across the years 2007 - 2011.

Areas of Activity	Current expenditures (2006 €€)	Increases in current operations (2011 €€) *	New Modules	Total budget needed (2011 €€)
Content	992	105	1284	2381
Informatics	997	184	1886	3067
Participation	536	77	1936	2549
Governance	115	5	218	338
Sustainable Finance	415	89	1157	1661
<b>TOTAL</b>	<b>3055</b>	<b>460</b>	<b>6481</b>	<b>9996</b>

The second column (Current expenditures) shows the 2006 GBIF budget, converted into Euros at the current exchange rate.

The third column (Increases needed for current operations) is based on the following assumptions:

- Salaries are increased according to the GBIF Staff Rules, and incorporate cost-of-living and step increases.
- Work Programme costs and Expenses of the Governing Board are kept level, with no increases over the five-year period.
- Running expenditures for the Secretariat and the travel-related costs of the Ebbe Nielsen Prize are increased at the average inflationary rate for Denmark (2.5% per year).

The fourth column incorporates the costs of the proposed new modules, as outlined in the previous section and in the Annex.

The fifth column is simply the sum of the previous figures, to give the total budget needed to fully implement the Strategic Plan.

The following table indicates when each module begins. All staff are expected to be hired in January of the indicated year, unless another month is listed.

**Timeline**

Module	2007	2008	2009	2010	2011
I. Observation and monitoring data					
II. Literature, species bank, web tax.		June			
III. Add. Seed Money					
IV. Updating Data Portal system					
V. Tools development					
VI. Data management	June				
VII. Webmaster		Sept.			
VIII. User support, mirroring, hardware/software					
IX. Nodes					
X. Outreach					
XI. Training		June			
XII. Project funding outreach, training and public relations					
XIII. Governing Board expenses					
XIV. Meeting & travel support					
XV. Campaigns	June				
XVI. Recruitment/running exp./rent					

## Appendix 2: Glossary and Acronym Expansion

<b>ABCD Schema</b>	<p>The <i>Access to Biological Collection Data</i> (ABCD) Schema is the product of a joint TDWG and CODATA initiative to develop a standard for distributed data retrieval from collection data bases. The schema seeks to cover data exchange for all kingdoms and for both specimen and observation records. <a href="http://bgbm3.bgbm.fu-berlin.de/TDWG/CODATA/Schema/default.htm">http://bgbm3.bgbm.fu-berlin.de/TDWG/CODATA/Schema/default.htm</a></p>
<b>BDWorld</b>	<p>Biodiversity World <a href="http://www.bdworld.org/">http://www.bdworld.org/</a></p>
<b>Berlin Taxonomic Information Model</b>	<p>The <i>Berlin Taxonomic Information Model</i> is a database model for handling the complexity of taxonomic names, in particular botanical names. <a href="http://www.bgbm.org/biodivinf/docs/bgbm-model/">http://www.bgbm.org/biodivinf/docs/bgbm-model/</a></p>
<b>BioCAsE</b>	<p>The <i>Biological Collection Access Service Protocol</i> is derived from the DiGIR protocol and supports web-based searches for XML data. It has been used in particular for data exchange using the ABCD schema. <a href="http://www.biocase.org/">http://www.biocase.org/</a></p>
<b>Biodiversity</b>	<p><i>Biodiversity</i>, the short form of "Biological diversity," means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity, Art. 2, paragraph 1).</p>
<b>Biodiversity data</b>	<p><i>Biodiversity data</i> refers to scientific data, primarily about biological species and about specimens or observations of individual organisms.</p>
<b>Biodiversity Database Interoperability</b>	<p>The <i>Biodiversity Database Interoperability</i> segment of the GBIF information architecture manages the portal's access to web services on other machines and handles the complexities of issuing a data requests to multiple providers which may be using heterogeneous protocols and data standards to present their data.</p>
<b>Biologia Centrali-Americana Project</b>	<p>The <i>Biologia Centrali-Americana (BCA)</i> Project has goals which include the delivery of a digitised version of the 58 biological volumes of the <i>Biologia Centrali-Americana</i> (a fundamental resource on the Neotropical flora and fauna). <a href="http://www.sil.si.edu/BCAProject">http://www.sil.si.edu/BCAProject</a></p>
<b>BioMOBY</b>	<p>BioMOBY is an international research project involving biological data hosts, biological data service providers, and coders whose aim is to explore various methodologies for biological data representation, distribution, and discovery. <a href="http://www.biomoby.org">http://www.biomoby.org</a></p>
<b>BioNET International</b>	<p>BioNET-INTERNATIONAL is dedicated to supporting sustainable development by helping developing countries to overcome the taxonomic impediment by becoming self-reliant in taxonomy. <a href="http://www.bionet-intl.org/">http://www.bionet-intl.org/</a></p>
<b>CAFF</b>	<p><i>Council on Arctic Fauna and Flora</i></p>
<b>CBD</b>	<p><i>Convention on Biological Diversity</i>. The Convention's member countries regularly share ideas on best practices and policies for the conservation and sustainable use of biodiversity with an ecosystem approach. <a href="http://www.biodiv.org/default.shtml">http://www.biodiv.org/default.shtml</a></p>
<b>CBMP</b>	<p><i>Circumpolar Biodiversity Monitoring Program</i>, an initiative of the <i>Council on Arctic Fauna and Flora</i></p>
<b>CBOL</b>	<p><i>Consortium for the Barcode of Life</i> is an international initiative devoted to developing DNA barcoding as an accurate and reliable tool for scientific research on the taxonomy of plant and animal species. <a href="http://barcoding.si.edu/index_detail.htm">http://barcoding.si.edu/index_detail.htm</a></p>
<b>CEPDEC</b>	<p><i>Capacity Enhancement Plan for Developing Countries</i> of GBIF under Strategic Plan 2007 - 2011</p>

<b>CGIAR</b>	<i>Consultative Group on International Agricultural Research</i> . <a href="http://www.cgiar.org/">http://www.cgiar.org/</a>
<b>CHM</b>	<i>Clearing House Mechanism</i> of the Convention on Biological Diversity promotes the sharing of information and technologies for working with biodiversity. <a href="http://www.biodiv.org/chm/default.aspx">http://www.biodiv.org/chm/default.aspx</a>
<b>CITES</b>	<i>Convention on International Trade in Endangered Species of Fauna and Flora</i> aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. <a href="http://www.cites.org/">http://www.cites.org/</a>
<b>CMS</b>	<i>Convention on the Conservation of Migratory Species</i> aims to conserve terrestrial, marine and avian migratory species throughout their range. <a href="http://www.cms.int/">http://www.cms.int/</a>
<b>CODATA</b>	<i>The Committee on Data for Science and Technology (CODATA)</i> is one of the bodies working on the development of the ABCD Schema. <a href="http://www.codata.org/">http://www.codata.org/</a>
<b>Collection coden</b>	An acronym or other abbreviation that identifies a particular collection, for example "GH" for Gray Herbarium of Harvard University
<b>CoLp</b>	The <i>Catalogue of Life partnership</i> includes <i>Species 2000</i> and <i>ITIS</i> and is a grouping of organisations with the common goal of producing a unified catalogue of the names of all organisms.
<b>CRIA</b>	The <i>Centro de Referência em Informação Ambiental</i> (Reference Center on Environmental Information) is a not-for-profit, non-government organization. Its aim is to contribute towards a more sustainable use of Brazil's biodiversity through the dissemination of high quality information and education. <a href="http://www.cria.org.br/">http://www.cria.org.br/</a>
<b>Data Provider</b>	A Data Provider is any computer within the GBIF Network that offers data services to the rest of the network. This term is also used to refer to the persons, institutions or organisations that share data.
<b>Data Provider Toolkit</b>	The <i>Data Provider Toolkit</i> will be developed by the GBIF Secretariat as a set of reusable components which may assist in the development of Data Providers.
<b>D-Grid</b>	Initiative zur Förderung eines Grid-basierten e-Science-Frameworks in Deutschland <a href="http://www.d-grid.de/">http://www.d-grid.de/</a>
<b>DiGIR</b>	The <i>Distributed Generic Information Retrieval</i> (DiGIR) protocol is a development activity of the TDWG Access to Biological Collection Data (ABCD) subgroup. It is intended to support retrieval of structured data from multiple, heterogeneous databases. Both requests and replies are modeled as XML queries. It is currently being used to exchange data in the DwC format, but several groups are investigating use of DiGIR with the ABCD Schema. <a href="http://digir.sourceforge.net/">http://digir.sourceforge.net/</a>
<b>DNA</b>	<i>Deoxyribonucleic Acid</i> a long linear polymer found in the nucleus of a cell and formed from nucleotides and shaped like a double helix; associated with the transmission of genetic information
<b>DRM</b>	<i>Digital Rights Management</i> is an umbrella term referring to any of several technical methods used to control or restrict the use of digital media content on electronic devices with such technologies installed.
<b>DwC</b>	The <i>Darwin Core</i> is a profile describing the minimum set of standards for search and retrieval of natural history collections and observation databases. It includes only core data elements which are likely to be available for the vast majority of specimen and observation records. <a href="http://tsadev.speciesanalyst.net/DarwinCore/darwin_core.asp">http://tsadev.speciesanalyst.net/DarwinCore/darwin_core.asp</a>

<b>EDIT</b>	<i>European Distributed Institute of Taxonomy</i> is an EC project to harness the power of the many taxonomic institutions in Europe by networking them to work synergistically
<b>FAO</b>	<i>Food and Agriculture Organisation</i> of the United Nations leads international efforts to defeat hunger. <a href="http://www.fao.org/UNFAO/about/index_en.html">http://www.fao.org/UNFAO/about/index_en.html</a>
<b>Feedback</b>	The <i>GBIF Network</i> allows users of its <i>data services</i> to provide feedback to the data providers. This function is implemented as the <i>User Feedback Service</i> , a <i>web service</i> offering an interface to pass a text message to the provider of any data item. This message is transmitted to the relevant Data Provider administrator as an e-mail.
<b>GBIF</b>	The <i>Global Biodiversity Information Facility</i> is an international organisation with the goal of making the world's biodiversity data freely and universally available. Its members include a wide range of countries and international organisations, and the GBIF Secretariat is based in Copenhagen, Denmark. <a href="http://www.gbif.org/">http://www.gbif.org/</a>
<b>GBIF Communications Portal</b>	The <i>GBIF Communications Portal</i> is a community resource that provides news, articles, events, documents and other linkages of use to the GBIF community. <a href="http://www.gbif.org/">http://www.gbif.org/</a>
<b>GBIF Data Portal</b>	The <i>GBIF Data Portal system</i> provides a number of key services to the rest of the <i>GBIF Network</i> to support access to the data distributed through the network. These services include the management of the Registry, the Index, access to the electronic catalogue of names of species, and a set of search tools. The <i>GBIF Data Portal</i> is not itself a <i>Data Provider</i> but serves as an integration point for all data in the network. <a href="http://www.gbif.net/">http://www.gbif.net/</a> See also: <a href="http://wiki.gbif.org/dadiwiki/wikka.php?wakka=HomePage">http://wiki.gbif.org/dadiwiki/wikka.php?wakka=HomePage</a>
<b>GBIF Network</b>	The <i>GBIF Network</i> is the entire network of computers and networks which comes together to provide the common pool of biodiversity data which <i>GBIF</i> presents.
<b>GBIF Participant</b>	A country or international organisation or economy that signs the MoU and agrees to carry out the activities indicated therein.
<b>GenBank</b>	<i>GenBank</i> is the NIH genetic sequence database, an annotated collection of all publicly available DNA sequences. <a href="http://www.psc.edu/general/software/packages/genbank/genbank.html">http://www.psc.edu/general/software/packages/genbank/genbank.html</a>
<b>Geographic service data</b>	In the future <i>GBIF</i> will require access to an increasing number of external data services in areas related to biodiversity. One of the key areas will be <i>geographic service data</i> , providing information such as gazetteers or mapping services.
<b>GIS</b>	<i>Geographic Information Systems (GIS)</i> are computer systems and software which allow the combination of multiple data layers, each providing information about some characteristics of a geographic area. Such systems provide tools for mapping and analysing the data.
<b>GISIN</b>	<i>Global Invasive Species Information Network</i> <a href="http://www.gisinet.org">http://www.gisinet.org</a>
<b>GISP</b>	<i>Global Invasive Species Programme</i> was established in 1997 to address global threats caused by Invasive Alien Species (IAS), and to provide support to the implementation of Article 8(h) of the CBD.
<b>GPP</b>	<i>Global Pollination Project</i> (full title: Conservation and Management of Pollinators for Sustainable Agriculture, Through an Ecosystem Approach) of UNEP/GEF, executed by FAO.
<b>Grid</b>	<i>Grid</i> computing seeks to create new application models which can exploit large-scale pools of computing resources. <a href="http://www.gridforum.org/">http://www.gridforum.org/</a>

<b>GSPC</b>	<p><i>Global Strategy for Plant Conservation</i> is a program of the CBD with the objective of halting the current and continuing loss of plant diversity. <a href="http://www.biodiv.org/programmes/cross-cutting/plant/default.asp">http://www.biodiv.org/programmes/cross-cutting/plant/default.asp</a></p>
<b>GTI</b>	<p><i>Global Taxonomy Initiative</i> is a program of the CBD with the objective of addressing the lack of taxonomic information and expertise available in many parts of the world. <a href="http://www.biodiv.org/programmes/cross-cutting/taxonomy/">http://www.biodiv.org/programmes/cross-cutting/taxonomy/</a></p>
<b>GUID</b>	<p>A <i>Globally Unique Identifier</i> is a numeric or text identifier which is guaranteed to be unique even at the global level used to improve connections between related data items even when served by different data providers.</p>
<b>HTML</b>	<p><i>HyperText Markup Language</i> is the formatting language used to format most human-readable data on the Internet. <a href="http://www.w3.org/MarkUp/">http://www.w3.org/MarkUp/</a></p>
<b>HTTP</b>	<p><i>Hyper Text Transfer Protocol</i> is a stable Internet specification/standard used globally. <a href="http://www.w3.org/Protocols/">http://www.w3.org/Protocols/</a></p>
<b>IABIN</b>	<p><i>Inter-American Biodiversity Information Network</i> is a regional initiative and is a Participant in GBIF. <a href="http://www.iabin.net/english/index.shtml">http://www.iabin.net/english/index.shtml</a></p>
<b>ICT</b>	<p><i>Information and Communications Technologies</i></p>
<b>Index</b>	<p>The <i>Index</i> is a component of the <i>GBIF information architecture</i>. It uses the service <i>metadata</i> held in the <i>Registry</i> to access all <i>data services</i> connected to the <i>GBIF Network</i> and to generate a central index for accessing <i>biodiversity data</i>.</p>
<b>Informatics</b>	<p>The use of <i>ICT</i> to make data and information automatically available via the Internet.</p>
<b>Interoperability</b>	<p>The ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together. With respect to software, the term <i>interoperability</i> is also used to describe the capability of different programs to read and write the same file formats and utilise the same protocols.</p>
<b>IPGRI</b>	<p><i>International Plant Genetic Resources Institute</i> is the world's largest non-profit agricultural research and training organisation devoted solely to the study and promotion of agricultural biodiversity. <a href="http://www.ipgri.cgiar.org/index.htm">http://www.ipgri.cgiar.org/index.htm</a></p>
<b>IPi</b>	<p><i>International Initiative for the Conservation and Sustainable Use of Pollinators</i> is an issue within the Agricultural Biodiversity Work Programme of the CBD. <a href="http://www.biodiv.org/programmes/areas/agro/pollinators.aspx">http://www.biodiv.org/programmes/areas/agro/pollinators.aspx</a></p>
<b>IPR</b>	<p><i>Intellectual Property Rights</i> - In law, particularly in common law jurisdictions, intellectual property or <i>IP</i> refers to a legal entitlement which sometimes attaches to the expressed form of an idea, or to some other intangible subject matter.</p>
<b>ITC</b>	<p><i>Information Technology and Communications</i></p>
<b>IT</b>	<p><i>Information Technology</i>.</p>
<b>ITIS</b>	<p><i>The Integrated Taxonomic Information System (ITIS)</i> is a collaborative development between the United States of America, Canada and Mexico to develop catalogues of species names. <a href="http://www.itis.usda.gov/">http://www.itis.usda.gov/</a>, <a href="http://www.agr.gc.ca/itis">http://www.agr.gc.ca/itis</a> and <a href="http://siit.conabio.gob.mx.">http://siit.conabio.gob.mx.</a></p>
<b>IUCN</b>	<p>The World Conservation Union, formerly known as the <i>International Union for the Conservation of Nature</i> <a href="http://www.iucn.org/">http://www.iucn.org/</a></p>

<b>KPMG</b>	KPMG is a global network of professional services firms providing Audit, Tax and Advisory services.
<b>LDAP</b>	<i>LDAP (Lightweight Directory Access Protocol)</i> is a model and protocol for storing and retrieving hierarchically-arranged information. It is designed to run directly over TCP/IP.
<b>MAB</b>	UNESCO's Programme on <i>Man and the Biosphere</i> develops the basis, within the natural and the social sciences, for the sustainable use and conservation of biological diversity, and for the improvement of the relationship between people and their environment globally. <a href="http://www.unesco.org/mab/about.htm">http://www.unesco.org/mab/about.htm</a>
<b>Metadata</b>	Metadata are data records that provide descriptive information about other data. In the context of GBIF, metadata provides information about the suppliers of biodiversity data and about the origins and purpose of those data.
<b>Mirror site</b>	A mirror site is a replica of a central site, established to protect data from hardware failure, allow faster downloads, and to balance demand load. <a href="http://en.wikipedia.org/wiki/Mirror_site">http://en.wikipedia.org/wiki/Mirror_site</a>
<b>MoC</b>	<i>Memorandum of Cooperation</i>
<b>MoU</b>	<i>Memorandum of Understanding</i>
<b>MyGrid</b>	The myGrid project aims to exploit the growing interest in Grid technology, with an emphasis on the Information Grid, and provide middleware layers that make it appropriate for the immediate needs of bioinformatics. It is a UK e-Science project funded by the EPSRC involving five UK universities, the European Bioinformatics Institute and many industrial collaborators. <a href="http://www.mygrid.org.uk/index.php?&amp;MMN_position=1:1&amp;MMN_position=1:1">http://www.mygrid.org.uk/index.php?&amp;MMN_position=1:1&amp;MMN_position=1:1</a>
<b>Name data</b>	Name data refers to structured data providing information about taxonomic names and their relationships.
<b>NCBI</b>	The U.S. <i>National Center for Biotechnology Information</i> , part of the National Library of Medicine, in turn part of the National Institutes of Health. <a href="http://www.ncbi.nlm.nih.gov/">http://www.ncbi.nlm.nih.gov/</a>
<b>NCEAS</b>	The U.S. <i>National Center for Ecological Analysis and Synthesis</i> <a href="http://www.nceas.ucsb.edu">http://www.nceas.ucsb.edu</a>
<b>NESCent</b>	The U.S. <i>National Evolutionary Synthesis Center</i> <a href="http://www.nescent.org/main/">http://www.nescent.org/main/</a>
<b>NODES</b>	The GBIF committee comprising the managers of all Participant Nodes
<b>Nomenclator</b>	A nomenclator is a listing of the scientific names of a group of organisms, such as Nomenclator Zoologicus ( <a href="http://uio.mbl.edu/NomenclatorZoologicus/">http://uio.mbl.edu/NomenclatorZoologicus/</a> ) or Nomenclator Ipomoeae ( <a href="http://www.fau.edu/divdept/biology/people/daustin/nomen-1.htm">http://www.fau.edu/divdept/biology/people/daustin/nomen-1.htm</a> )
<b>OBIS</b>	<i>Ocean Biogeographic Information System</i> , a component of the Census of Marine Life (CoML), provides an important component of GBIF data - those from the marine realm. <a href="http://www.iobis.org/Welcome.htm">http://www.iobis.org/Welcome.htm</a>
<b>OECD</b>	<i>Organisation for Economic Cooperation and Development</i> <a href="http://www.oecd.org">http://www.oecd.org</a>
<b>OGC</b>	<i>Open Geospatial Consortium</i> . The Open Geospatial Consortium, Inc. (OGC) is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services. <a href="http://www.opengeospatial.org/">http://www.opengeospatial.org/</a>

<b>Ontology</b>	A formal ontology is a controlled vocabulary expressed in an ontology representation language. This language has a grammar for using vocabulary terms to express something meaningful within a specified domain of interest. However, the term is also used to refer to several different things: glossaries, data dictionaries, thesauri. <a href="http://www.metamodel.com/article.php?story=20030115211223271">http://www.metamodel.com/article.php?story=20030115211223271</a>
<b>Participant</b>	A country, economy, intergovernmental or international organisation or an entity designated by them, that has signed the GBIF MOU and has expressed its intention to observe the provisions therein.
<b>Participant Node</b>	A mechanism by which a <i>Participant</i> coordinates and supports its GBIF data-sharing activities. A <i>Participant Node</i> includes both physical infrastructure and human resources. Typically a <i>Participant Node</i> encourages and supports the activities of the <i>Participant's</i> data providers to both contribute and use GBIF-served data, provides information technology (IT) infrastructure and expertise for GBIF activities, and functions as an information gateway among <i>Participants</i> , other partners, and the <i>Secretariat</i> .
<b>Participant Node Toolkit</b>	The Participant Node Toolkit will be developed by the Secretariat as a set of reusable components which may assist <i>GBIF</i> participant countries and organisations to develop their <i>Participant Nodes</i> .
<b>Portal</b>	Portal is used as a general term to refer to a web site that offers a single access point for users to retrieve content from a wide variety of sources.
<b>Portal Toolkit</b>	The Portal Toolkit is a toolkit offered by the <i>GBIF Secretariat</i> to assist <i>Participant Nodes</i> to develop their own <i>Support Services</i> components. It is based on the Zope web server and supports content syndication. <a href="http://circa.gbif.net/Members/irc/gbif/ict/library?l=/download_gbif_tools">http://circa.gbif.net/Members/irc/gbif/ict/library?l=/download_gbif_tools</a>
<b>Ramsar Convention</b>	The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. <a href="http://www.ramsar.org/">http://www.ramsar.org/</a>
<b>Registry</b>	The Registry is a component of the <i>GBIF information architecture</i> , which may also be redeployed within <i>Participant Nodes</i> . It is responsible for maintaining metadata about <i>Data Providers</i> and web services.
<b>SDD</b>	The <i>TDWG Structured Descriptive Data</i> subgroup has the task of developing an interoperability standard for descriptive data providing information about character states for different organisms. <a href="http://www.tdwg.org/sddhome.html">http://www.tdwg.org/sddhome.html</a>
<b>SEEK</b>	<i>Science Environment for Ecological Knowledge</i> is a five year initiative designed to create cyberinfrastructure for ecological, environmental, and biodiversity research. <a href="http://seek.ecoinformatics.org/">http://seek.ecoinformatics.org/</a>
<b>SIS</b>	<i>Species Information Service</i> , a world-wide species information resource on the status and distribution of species threatened with extinction. <a href="http://www.iucn.org/themes/ssc/programs/sisindex.htm">http://www.iucn.org/themes/ssc/programs/sisindex.htm</a>
<b>Species 2000</b>	<i>Species 2000</i> is an international organisation with the goal of enumerating all known species of plants, animals, fungi and microbes on Earth as the baseline dataset for studies of global biodiversity. <a href="http://www.sp2000.org/">http://www.sp2000.org/</a>
<b>Species Analyst</b>	The Species Analyst is a research project developing standards and software tools for access to the world's natural history collection and observation databases. The Species Analyst is based at the University of Kansas Natural History Museum and Biodiversity Research Center. <a href="http://tsadev.speciesanalyst.net/">http://tsadev.speciesanalyst.net/</a>

<b>Specimen / observation data</b>	Throughout this document <i>specimen/observation data</i> refers to data describing individual specimens or observations of organisms identified by taxon.
<b>Data (or metadata) standard</b>	Technical <i>standards</i> define a set of properties that a product or service should have. Standards are laid down by an organisation, such as TDWG and GBIF, that brings together representatives of producers and users of the type of product or service to establish the standard(s) in question.
<b>Structured data</b>	Throughout this document <i>structured data</i> refers to any data for which the structure and permitted content have been clearly defined.
<b>TAPIR</b>	<i>TDWG Access Protocol for Information Retrieval</i> is the "next generation" protocol which combines the capabilities of BioCAsE and DiGIR
<b>TaXMLit</b>	<i>Taxonomic XML literature</i> protocol developed by the Biologia Centrali-Americana project to enable exchange of digital literature.
<b>TCP/IP</b>	<i>Transmission Control Protocol/Internet Protocol</i> is the main transport protocol used within the Internet to allow any two machines to communicate.
<b>TCS</b>	Taxon Concept Schema developed by TDWG with support from GBIF and SEEK to enable the efficient handling of names and taxonomic data within the GBIF information architecture. <a href="http://tdwg.napier.ac.uk/TCS_1.0/docs/publications.html">http://tdwg.napier.ac.uk/TCS_1.0/docs/publications.html</a>
<b>TDWG</b>	The <i>Taxonomic Database Working Group (TDWG)</i> is an international body established to define standards for use in biological data projects. <a href="http://www.tdwg.org/">http://www.tdwg.org/</a>
<b>Thesaurus</b>	A <i>thesaurus</i> is a networked collection of controlled vocabulary terms. <a href="http://www.metamodel.com/article.php?story=20030115211223271">http://www.metamodel.com/article.php?story=20030115211223271</a>
<b>uBIO</b>	<i>Universal Biological Indexer and Organiser</i> is an initiative within the science library community to partner with other international efforts such as GBIF to create and utilize a comprehensive and collaborative catalogue of known names of all living (and once-living) organisms. <a href="http://www.ubio.org/">http://www.ubio.org/</a>
<b>UDDI</b>	<i>Universal Description, Discovery and Integration (UDDI)</i> is a registry technology and protocol available for use in creating web-based registries of <i>web service</i> implementations. <a href="http://www.uddi.com/">http://www.uddi.com/</a>
<b>UNEP</b>	<i>United Nations Environment Programme</i> established to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations. <a href="http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=43">http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=43</a>
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organisation encourages international peace and universal respect by promoting collaboration among nations. <a href="http://www.unesco.org">http://www.unesco.org</a>
<b>Unstructured data</b>	<i>Unstructured data</i> refers to any data for which the structure and permitted content are not clearly defined. Such data may in fact be formatted according to a definite structure, but this structure is unknown to the system processing the data.
<b>WCMC</b>	<i>UNEP World Conservation Monitoring Center</i> provides information for policy and action to conserve the living world. <a href="http://www.unep-wcmc.org/">http://www.unep-wcmc.org/</a>

<b>Web</b>	The World Wide <i>Web</i> ("WWW", "W3", or simply "Web") is an information space in which the items of interest, referred to as resources, are identified by global identifiers called Uniform Resource Identifiers (URIs). The term is often mistakenly used as a synonym for the Internet, but the Web is actually a service that operates over the Internet. <a href="http://en.wikipedia.org/wiki/World_Wide_Web">http://en.wikipedia.org/wiki/World_Wide_Web</a>
<b>Web Service</b>	A <i>web service</i> is any computing service which is published and accessible across the Internet and offers a standardised <i>XML</i> interface allowing users to invoke its function. Most of the web services discussed in this document provide access to biodiversity data.
<b>Web-enabled Taxonomy</b>	Any implementation of Internet technology that assists and enhances the development of the classification, nomenclature and taxonomy of groups of organisms
<b>WFS</b>	A <i>Web Feature Service</i> allows a client to perform data manipulation operations on a set of geographic features
<b>WMS</b>	A <i>Web Mapping Service</i> allows a client to generate a map online in real time
<b>XML</b>	The <i>eXtensible Markup Language (XML)</i> is a simple document format developed from SGML to support electronic publishing. It provides a flexible model particularly for structuring textual data. The <i>XML</i> language is supplemented by technologies such as <i>XML Schema</i> , <i>XPath</i> and <i>XQuery</i> to produce a powerful model for processing electronic data. <a href="http://www.w3.org/XML/">http://www.w3.org/XML/</a>



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