GUIDELINES FOR ENVIRONMENTAL INFORMATION MANAGEMENT IN WORLD BANK/ INTER AMERICAN DEVELOPMENT BANK PROJECTS, LATIN AMERICA AND THE CARIBBEAN

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FOREWORD

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AKNOWLEDGEMENTS

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ACRONYMS

BDP: Biological Data Profile of the Content Standard for Digital Geospatial Metadata. http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/biometadata/biodatap.pdf

BR: Biological Record concept of SiB Colombia. See section 1 for more information.

CE: Curatorial Extension of Darwin Core. http://wiki.tdwg.org/twiki/bin/view/DarwinCore/CuratorialExtension

Conabio: Comisión nacional para el conocimiento y uso de la biodiversidad. (National Commission for knowledge and use of biodiversity of Mexico). www.conabio.gob.mx

CSDGM: Content Standard for Digital Geospatial Metadata of FGDC, in accordance to ISO 19115. http://biogeodb.stri.si.edu/bioinformatics/IABIN/

CSDGM –BDP: Content Standard for Digital Geospatial Metadata with Biological Data Profile of FGDC.

DwC: Darwin Core Standard. http://wiki.tdwg.org/twiki/bin/view/DarwinCore/DarwinCoreDraftStandard

EME: Environmental Measurements Extension of Darwin Core http://wiki.tdwg.org/twiki/bin/view/DarwinCore/EnvironmentMeasurementsExtension

ETN: IABIN Ecosystems Thematic Network. http://biogeodb.stri.si.edu/bioinformatics/IABIN/

FGDC: Federal Geographic Data Committee, USA. www.fgdc.org

GBIF: Global Biodiversity Information Facility. www.gbif.org (administrative). www.gbif.net (data).

GE: Geospatial Extension of Darwin Core. http://wiki.tdwg.org/twiki/bin/view/DarwinCore/GeospatialExtension

GN: Geospatial Network. It is under development in the IABIN Thematic Networks framework. http://geospatial.iabin.net/

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GUID: Global Unique Identifier

I3N: IABIN Invasives Information Network.

IABIN: Inter American Biodiversity Information Network. www.iabin.net

IE: Interactions Extension of Darwin Core http://wiki.tdwg.org/twiki/bin/view/DarwinCore/InteractionExtension

IDB: Inter-American Developmet Bank. www.iadb.org

ICBN: International Code of Botanical Nomenclature. Saint Louis version: http://www.bgbm.org/iapt/nomenclature/code/SaintLouis/0000St.Luistitle.htm

ICNCP: International Code of Nomenclature of Cultivated Plants. http://www.ishs.org/sci/icracpco.htm

ICZN: International Code of Zoological Nomenclature. http://www.nhm.ac.uk/hosted_sites/iczn/

IETF: The Internet Engineering Task Force. http://www.ietf.org/index.html

INBio: Instituto Nacional de Biodiversidad (National Biodiversity Institute of Costa Rica). www.inbio.ac.cr

ISO: International Organization for Standardization. www.iso.org

LAC: Latin America and the Caribbean region.

NBII: National Biodiversity Information Infrastructure of the United States of America. www.nbii.gov

PATN: IABIN Protected Areas Thematic Network http://protectedareas.iabin.net/

PE: Pollination Extension of Darwin Core http://wiki.tdwg.org/twiki/bin/view/DarwinCore/PollinationExtension

PTN: IABIN Pollinators Thematic Network. http://pollinators.iabin.net/

RFC: Request For Comments Initiative of the IETF. English Webpages: http://www.ietf.org/rfc.html Spanish translations: http://www.rfc-es.org/

SiB: Sistema de Información sobre Biodiversidad de Colombia. (Biodiversity Information System of Colombia). www.siac.net.co/sib

SINIA: Sistema Nacional de Información Ambiental de Chile. www.sinia.cl

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Sistema Nacional de Información Ambiental de Nicaragua. www.sinia.net.ni

SSTN: IABIN Species and Specimens Thematic Network http://species.iabin.net/ (administrative). http://ara.inbio.ac.cr/SSTN-IABIN/welcome.htm;jsessionid=F8EAF69186B749DABD260809D0FEE934 (data).

STRI: Smithsonian Tropical Research Institute. www.stri.org

TDWG: Biodiversity Information Standards (initiative). www.tdwg.org

WB: The World Bank. www.worldbank.org

WKT: Well Known Text. http://en.wikipedia.org/wiki/Well-known_text

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INTRODUCTION

The World Bank (WB) and the Inter-American Development Bank (IDB) are responsible of the development of many environmental projects in Latin America and the Caribbean. Resources from both institutions have been allocated widely to countries and initiatives to procure a better understanding of our environment, and to contribute in its preservation, with the final purpose of guaranteeing a better quality of life for our region.

All those projects generate, manage and distribute information. However, that information is highly heterogeneous, as same as widely distributed in space and time. At least three consequences result from that fact:

- The majority of the information produced is not available for other parties than its generators, in the best situation. Raw biodiversity data usually are not stored nor distributed beyond the publication of results, independently if they are scientific articles, field guides, information products or decision making systems, among others.
- Normally, the available information cannot be used by people or initiatives different from the ones that produced it, nor is it possible to use that information for purposes different to the ones it was obtained for. The reason why it happens is that the scarce available information may not be collected or distributed with the acknowledgement of its usefulness; hence, it is not properly documented[1]. In other words, available information does not follow standards[2], so it is not combinable or interoperable.
- The will of sharing the information is not clearly declared by generators/projects developers before starting a project or the information production. The rules to guarantee appropriate recognition of intellectual property --and credits-- if the information is accessed or used, usually are not established either.

In that sense, it is a fundamental need of WB/IDB to assure that all the information that has been and will be produced by the environmental projects under its management will be appropriately documented and standardized, with the scope that it should be used by different involved parties efficiently. It will help the environmental community to reduce duplication of efforts, and make a better use of resources.

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[1] To **document**, in the dictionary definition, is to support by references (Adapted From: WordNet 2.0 Copyright 2003 by Princeton University. All rights reserved. www.wordreference.com). In the Biodiversity Informatics field, something is documented if its context is detailed enough by means of *metadata* (see Metadata documentation below) and if its structure is validated by the use of *standards*.

[2] A **standard** in this context is a commonly and widely agreed pattern, model or reference to do something. A biodiversity information standard in the world context may refer to documents, software tools and protocols that aim to guarantee the best quality (fitness of use) of biodiversity information for the largest number of users.

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But there are advances in the World to contribute to this enormous task. Research by international initiatives and institutions, such as Biodiversity Information Standards (TDWG[3]) and Dublin Core Metadata Initiative[4] has started to solve the necessary agreements to make interoperability happen. The Inter American Biodiversity Information Network –IABIN- and the Global Biodiversity Information Facility –GBIF- have been implementing and promoting biodiversity information standards and protocols, in order to facilitate information sharing in the regional and global environments. And these efforts have been complemented by developments at the national level in Latin America, like the Biodiversity Information System of Colombia (SiB, according its Spanish original name), Conabio in Mexico, INBio in Costa Rica, or the SINIA of Chile and Nicaragua[5].

Nevertheless, those efforts entail an appropriate spreading and capacity building strategy. Implementation of well documented processes and standards for information management requires not only the knowledge about them, but the will and the wish to use them. In some atmospheres, it may represent only the conformity to superior instructions, but in most situations, it may correspond to a change of mentality. Afterward, the present Guidelines document is expected to serve as the first part of the above mentioned strategy, specifically regarding biodiversity data for LAC projects. Even when the standards and protocols mentioned here are of international relevance; and knowing that there are other training initiatives running in parallel, it is important to recognize that the LAC situation is different from other regions. Furthermore, there is at least one regional initiative (IABIN) with the capacity and the will to make biodiversity information publicly available and useful in the area, and to support the LAC countries and initiatives in doing so. In addition, IABIN development is also funded by WB, so it is obvious that the WB and the IDB have to urge their contractors, consultants and partners to be coherent with the initiative.

Actually, information management inside IABIN is done through five established Thematic Networks (TN). These TN are connected by the IABIN Catalogue, but they work independently. The Thematic Networks are:

- Species and Specimens Thematic Network (SSTN) – Coordinated by INBio, Costa Rica.
- IABIN Invasives Information Network (I3N) – Coordinated by NBII, U.S.A.
- Pollinators Thematic Network (PTN) – Coordinated by CoEvolution Institution, U.S.A.
- Ecosystems Thematic Network (ETN) – Coordinated by STRI, Smithsonian Institution, Panama.
- Protected Areas Thematic Network (PATN) – Coordinated by Fundacion O Boticario, Brasil.

Because of the importance of geospatial data there exists another initiative in IABIN which have been identified as the Geospatial Network (GN). This initiative has also adopted standards for geospatial data and metadata.

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[3] www.tdwg.org
[4] http://dublincore.org/
[5] SINIA is the common name for the Biodiversity Information Systems of equally Chile and Nicaragua. URLs for both are provided in the → *Acronyms* section.

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IABIN has also envisioned the potential of creating a collaborative environment for digital images. Several organizations have developed standards for the adequate management of digital images in a networked environment, and nowadays, there is a structured collection of IABIN images in the NBII portal. As a consequence, this document will include instructions to make digital images fit with NBII standards.

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USE OF THIS GUIDELINES' DOCUMENT

When to follow the Guidelines?

This document and the Web decision-making interface which complements it are intended to serve as the main rapid reference for managing environmental information resulting from environment related projects supported by WB/IDB in the 34 countries that are members of IABIN. IABIN focuses only on information about **biological units**[6]**,** so that is the information that will be managed within the IABIN infrastructure. Nevertheless, other environmental information can be managed according to these Guidelines, at least in the basic concept of making it digitally available. In fact, it has been demonstrated that information management issues are essentially the same, independently of the type or provenience of data —v.g. geospatial information, socioeconomic information. That means that although there will be many WB/IDB projects related to biodiversity that will not be managed through the IABIN framework, —i.e. renewable energy, environmental development, road infrastructure— these guidelines will be still applicable for managing the information derived from them. A brief account of projects related to environmental information in LAC, which have been funded —at least in part— by WB/IDB is presented in → *Annex 1*.

Conversely, the biodiversity information management schema of those 34 countries is quite different. There are countries for which following the parameters established in the IABIN framework is just an alternative, and there are countries for which IABIN is the alternative, in order to obtain visibility and cooperation for their information management processes. This is evident in → *Annex 2*, where a summary of the state of art in biodiversity information management for each country is outlined, based on the information available in the Internet. Regardless of these differences, these Guidelines are designed also to provide an action route to administer and share biological information in a coherent and well documented framework, which can also be established in the national level (i. e. Colombia and its national biodiversity information network) or in the global level (i. e. Costa Rica or Perú which are actively participating as nodes for the Global Biodiversity Information Facility –GBIF--). In that sense, the Guidelines are not designed to be used mainly by informatics technicians or experts, but for the researcher or the government employee who wants to obtain the highest benefit from the biological information under its responsibility.

[6] According to SiB, a **biological unit** is every element of biodiversity, following the CBD (1992) and the concept of biodiversity presented by Noss (1996). Therefore, ecosystems, populations, organisms and genes are considered among biological units, for example, but water, economic benefits and traditional knowledge are not.

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How to use the Guidelines?

The Guidelines document is devised as a step-by-step decision checklist, which seeks to guide the readers through the different procedures needed to identify which type of information they have or they are going to collect, which options are available for standardizing that information, or to verify it according to internationally accepted standards and procedures, and how to provide it to the IABIN network, when applicable.

Thus, the Guidelines start with the *biological records* concept (→ *section 1*), in order to help the reader —final user— to discover which data types he/she is/will be dealing with. Some of the data types defined by IABIN are in fact transversal references to biological records (metadata of datasets, spatial data, bibliography, for example) that will be referred in the document as independent recurrent sections.

Each data-type section is clearly identified by a number, to make it easier for the user to go through the document, and indications to other sections that the user should consult when reading are indicated by an arrow (→), followed by the concept to be consulted in *italics*. Hyperlinks to software tools, URLs and initiatives are provided along all the text. Cited references are detailed in the References section of the document, as same as in foot notes when necessary.

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GUIDELINES

1. What does it mean to manage 'biodiversity information'?

The most extended and used concept of biodiversity is that of the Convention of Biological Diversity (CBD), which reads "**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."[7]. Researchers, government employees, decision makers, educators and other involved parties in knowledge, use and conservation of biodiversity are always producing information about *biodiversity*. However, that information does not comprise only the definition of the biological unit (→ *footnote No. 6*) of interest, but the identification of its **attributes** —all those particular characteristics (including any given name) which make the biological unit unique and interesting for any given purpose, in a given moment and place. That is the reason why, independently of the level of the biodiversity under treatment (genes, organisms, ecosystems) and despite the type of attributes we want to produce information for —according to Noss (1996) the attributes of biodiversity can be divided in three types: composition, structure and function—, our questions about biodiversity will always be combinations of what?, where?, when?, how?, and who?.

That is what has been stated by the SiB Colombia as "biological records concept" (BR). That concept is based in the fact that we are always trying to describe any biological unit with reference to five types of information, such as the identification referent (what), the spatial referent (where), the conceptual referent (how), the timeline referent (when), and the source referent (who). And IABIN has taken care of most of these types of information, either through its Thematic Networks, or by means of information products and services regarding biological units or the information about their referents. In the following sections, this concept will be detailed, in terms of IABIN data types and networks.

Nevertheless, it is important to remark that not all the information about biodiversity can be managed under the BR concept. The BR concept is for data, somehow atomized data. But in fact, a considerable amount of important environmental information (like theories, plans, management strategies or decisions) cannot be managed using the BR concept. All these types of information are very close to **unstructured information** or the information in which it is almost impossible to distinguish distinct elements, like information in free-text. On the opposite, biological records are **structured,** because it is possible to disaggregate each record in various parts that clearly can be named. Both structured and unstructured information can be shared through the Internet, and both can also be searched, indexed and made available through specialized searchers like the IABIN Catalogue (→ *section 3.1.2*

[7] CBD Webpage, Article 2. Available at http://www.cbd.int/convention/articles.shtml?a=cbd-02 Consulted 20080321.

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and footnote No. 9), but unstructured information does not need to be standardized always. If the elements of the information under treatment follow a given pattern, or are structured according a norm, then the information will be **standardized.** And, if the standardized information is also *structured*, it will be possible to talk about **interoperable** information.

2. Decision-making route for sharing information in the IABIN framework

2.1. Information processes

The information management schema explained herein contains five basic processes:

- **Description of resources**. This process refers to the use of *metadata* standards and catalogues to describe which information exists and what can be shared.
- **Data standardization**. Independently of how the information is going to be stored and shared, the idea with this process is to allow it to be used by others, whenever the information is available.
- **Data digitization.** In order to share information, it must be in digital formats. This process allows the user to know about the tools, the *standards,* the protocols and the people involved in building and storage of digital biodiversity-related data.
- **Data quality assurance**. This process provides the user with concepts and tools necessary for making their data useful for different purposes in different moments, to different people. That is the meaning of *quality* in the digital environment.
- **Data provision.** The process of making the information available encompasses the objective of these guidelines. Even when it can be done alone, it is expected that data sharing is the last step for the user (after the processes mentioned above) and the first one for the information network.

2.2. Information types

Each process will be developed according to the type of information under consideration. Options are:

- Information about **organisms**. Examples: Observations of individuals, biological collections, species fact sheets, ecological interactions of species, population studies, behavioral ecology studies, lists of species.
- Information about **areas.** Examples: Structure of biological communities, land covers, protected areas management, fragmentation, biogeochemical cycles.
- Information describing the conditions and the context in which datasets, products or information resources are being constituted, obtained or used. **Metadata**[8]. Examples: The legend of a map or its standardized description, credits of a book, survey backgrounds, technical specifications of a given project.

[8] In a formal definition, *metadata* are data about data. Then, the concept of what is data or what is metadata may be ambiguous depending on the context. For the purpose of this document, **data** are the records of biological units referred to space, time and source, while **metadata** are all the information that is necessary to ascribe any information resource to someone adequately, as same as the context information that allows the final user of data to evaluate its fitness of use.

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- **Images**. These guidelines take care of digital images that are supposed to be shared in the IABIN environment. Those images must have both a common format, and a common description. The description is equivalent to a metadatum of the image.

A schema of information types in the IABIN network is presented in Figure 1.

2.3. Information route

The combination of processes plus information types will determine the route to follow. In Table 1 the different routes are outlined, and connected to the contents that will be detailed in the different sections of the document. Despite that, for every alternative previously mentioned the first step should be always to document *metadata* of the datasets that will be produced or shared. After that, information about areas which contains maps, as same as any geospatial information, will need to be documented by other metadata types as well, in order to conform to the ISO 19115 norm and CSDGM of the Federal Geographic Data Committee of the United States of America (FGDC) (→ *recurrent section M. Metadata*). The procedures to document metadata in the IABIN framework will be described in recurrent section M.

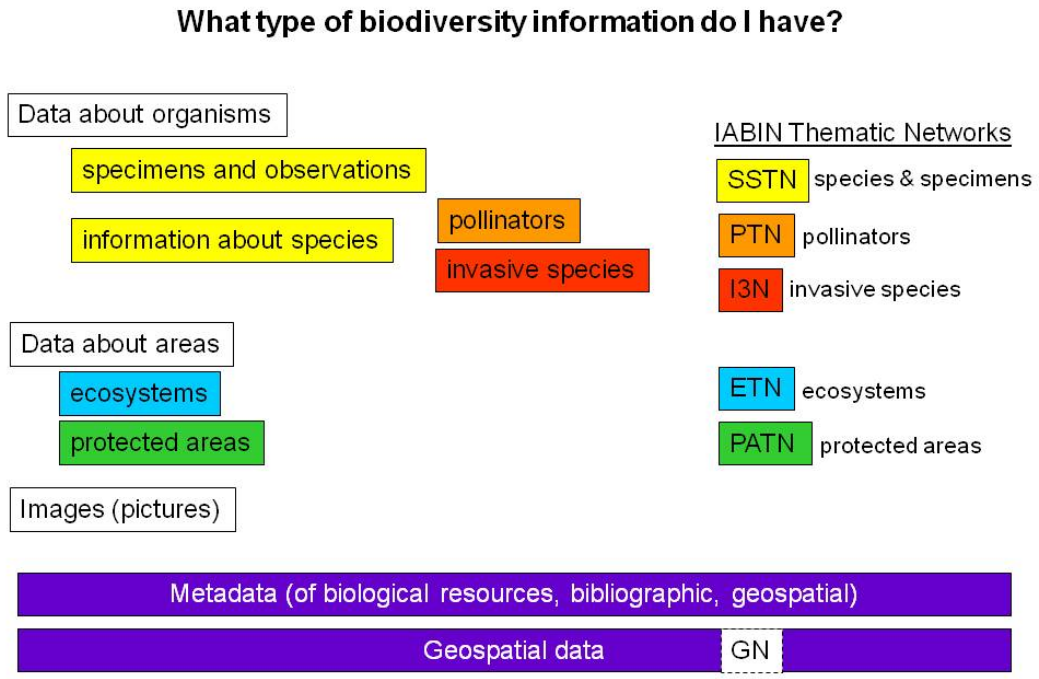

Figure 1. Types of information and the IABIN Thematic Networks

Table 1. Information route.

What would you like to do?	*Which type of information do you have? Information about...*						*Do you have images or maps?*	
	Specimens/ observations	Species			Areas		Images	Maps
		Any	Pollinators	Invasive - Alien (IAS)	Ecosystems	Protected Areas (PAs)		
1. Tell everyone what information you have: *Describe resources*	*Sections 3.1.1, 3.1.2*	*Sections 3.2.1, 3.2.2*	*Sections 3.1.1, 3.2.11.2*	*Section 3.2.2.*	*Section 4.1.2*	*Sections 4.2.1, 4.2.2*	*Section 5.1*	*Section 5.2*
1.1 Identify datasets	*Section 3.1.1*	*Section 3.2.1*			*Section 4.1.1*	*Section 4.2.2*		
1.2 Document metadata	*Section M.*							
2. Standardize your information to make it compatible with IABIN/ GBIF: *Structure data*	*Section 3.1.3*	*Section 3.2.3*			*Sections 4.1.3, 4.1.4 Figure 2*	*Section 4.2.3, footnote No. 72*	*Section 5.1-2*	
			Section 3.2.11.1	*Section 3.2.12.2, 3.2.12.3, 3.2.12.4*				
2.1 Describe where is/was your species/ecosystem/ image	*Section 3.1.4*	*Section 3.2.4*	*Section 3.1.4, 3.2.4*	*Section 3.2.12.3*	*Section 4.1.3, 4.1.5*	*Section 4.2.3 - Location*	*Sections 3.1.4, 3.2.4, Annex 3*	*Annex 3*
	Section S				*Annex 3*			
2.2 Describe the way in which you obtained the information	*Section 3.1.5*	*Section 3.2.3*			*Section M.2*		*Section M.3*	*Section M.2*
2.3 Describe who are you talking about (its identity)	*Section 3.1.6 - taxonomy*	*Section 3.2.5 – taxonomy*		*Section 3.2.12.1, 3.2.12.3, 3.2.12.4*	*Section 4.1.4 – Table 3*	Section 4.2.4	*Sections 3.1.6, 3.2.6, 4.1.4, 4.2.4*	*Sections 4.1.4, 4.2.4*
		Section 3.2.6 – common names						
2.4 Identify a pollinator			*Section T-3*				*Section T-3*	
2.5 Describe interactions between organisms			*Section 3.2.11.3*	*Footnote No. 35*				
2.6 Identify an invasive species				*Section 3.2.12.1*			*Section 3.2.12.1*	
2.7 Describe who has worked with your species of interest			*Section 3.2.11.4*	*Section 3.2.12.6*				
2.8 Indicate where to find information (citations)		*Section 3.2.8.*		*Section 3.2.12.5*	*Section M.2*		*Section M.3*	

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What would you like to do?	Which type of information do you have? Information about...						Do you have images or maps?	
	Specimens/ observations	Species			Areas		Images	Maps
		Any	Pollinators	Invasive - Alien (IAS)	Ecosystems	Protected Areas (PAs)		
2.9 Describe projects related with your area of interest				*Section 3.2.12.7*				
2.10 Describe a management plan of a protected area						*Section 4.2.5*		
3. Increase the quality of your data: *Verify data*	*Section 3.1.7*	*Section 3.2.7*		*Section 3.2.12.8*	*Section 4.1.7*	*Section 4.2.7*	*Section 5.1*	*Section M., Annex 3*
3.1 Verify nomenclature	*Section T*				*Section 4.1.5*			
3.2 Georeference your data	*Annex 3*							
3.3 Verify the spatial referent of your information	*Section S*	*Section S, Annex 3*						
3.4 Refer explicitly the sources of your information		*Section 3.2.8*		*Sections 3.2.12.5, 3.2.12.6*				*Section 5.2-1, 5.2-2*
4. Store your data in digital formats *Digitize data*	*Section 3.1.8*	*Section 3.2.9*	*Section 3.2.11.6*	*Section 3.2.12.9*	*Section 4.1.9*	*Section 4.2.8*		*Annex 3*
4.1 Use the TN tools	*Use ARA*		*Use ARA Contact PTN CI*	*Contact the I3N CI/ leader*	*Footnote No. 67, Contact PATN CI*			
4.2 Use another available tool	*See footnote No.15*	Use the SiB Catalogue*	*Section 3.2.11.6-1*	*Contact the SSTN CI*				
5. Disseminate your data: *Transfer resources*	*Section 3.1.9*	*Section 3.2.10*	*Section 3.2.11.7*	*Section 3.2.12.10*	*Section 4.1.8*	*Section 4.2.9*	*Section 5.1*	*Section 5.2-3*
5.1 Grant the custodianship to the IABIN TN	*Section 3.1.9-1*	*Section 3.2.10-1*	*Section 3.2.11.8-1,2*					
5.2 Grant the custodianship to the National Focal Point	*Section 3.1.9-2*	*Section 3.2.10-2, Annex 2*	*Section 3.2.11.8-1,2, Annex 2*					
5.2 Maintain self data custodianship	*Section 3.1.9-3 Use TAPIR/ DIGIR*	*Section 3.2.10-3*	*Section 3.2.11.8-3*					

* Available only for Colombian species.

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3. What information can I manage? Data about organisms

3.1. Specimens and observations data

3.1.1. How many datasets do I have?

A dataset is a cluster of data which share at least one common grouping criterion. To identify how many datasets one is going to administrate, and, eventually, to provide, the first step is to define that grouping criterion. The definition of grouping criteria depends entirely on the data manager or custodian, but there are several recommendations in that respect.

- Different methodologies for obtaining data in general represent different datasets, because the data obtained from the application of one or another method normally are analyzed independently. Example: After a bird inventory the researcher obtained data from three different ways, for instance sound recording, mist net traps and visual encounters. Even when the inventory comprises information about all the species recorded by all of those methods, observations and variables considered for each one of them are different, and they could be used for different purposes apart of the inventory. Consequently, this researcher will have three datasets to describe and manage.
- Sets of data stored independently normally represent different datasets.
- A dataset should be comprehensive enough to allow detailed analysis, but large enough to be efficiently managed under the tool selected for that purpose.

3.1.2. How can IABIN know how many and which datasets are available to share?

There are two ways for IABIN to know about datasets and data to be shared in the network:

- The IABIN Catalogue[9], which is a service that provides access to standardized descriptions of resources, and to the resources themselves, as long as they are available in the Internet. Currently the IABIN Catalogue provides the user a multilingual search interface (English, Spanish, Portuguese), user customizable display and sort options and categorization of the resources found, according to the IABIN TNs.
- The documentation of datasets with metadata, which, at the end, will be read by the IABIN Catalogue.

In that sense, almost nothing exists in the network if it is not documented with metadata, or indexed through the IABIN Catalogue. At present, there is only one tool

[9] http://www.iabin.net/view/IABIN-Catalog.html

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formally selected to document metadata in the IABIN framework, at least in the SSTN and ETN. For detailed information on how to document metadata of datasets about organisms, please refer to recurrent → section M.1.

3.1.3. Are my data structured in a way that others (IABIN, GBIF) can read and use them?

From the moment in which data are starting to be generated, they should be structured to guarantee interoperability; that is, following international standards. In case of managing information about organisms, there are two main conditions to be fulfilled in the IABIN/GBIF framework:

- Datasets must be documented by metadata (→ *section M*)
- Data (→ *footnote No. 8*) about specimens and observations must be structured following the Darwin Core (DwC) conceptual schema[10]. That structure aims to define a common set of elements to be shared through a digital biodiversity information network. However, only seven elements of the 46 proposed to date are mandatory —that means that contents for those elements must be provided when sharing any biological record which follows that structure. Nevertheless, in order to obtain interoperable datasets it is highly recommended to provide information for every concept described in DwC, as long as that information exists and it is available. The seven mandatory elements of basic DwC are (Table 2):

  - Global Unique Identifier (GUID). It is recommended that each record of the dataset contains a unique code which distinguishes that record from the others, whether those "others" are in the same or in other dataset. The recommendation to build a Global Unique Identifier is to build one by combining "[InstitutionCode]:[CollectionCode]:[CatalogNumber]". Example: "IAvH:BT:25695".
  - Date Last Modified. Information about the most recent date in which the record was modified. The date provided must be consistent with ISO 8601 standard (→ *M.3-1. Date.*). Example: 2005.
  - Basis of Record. This is the concept which allows the user to know what kind of evidence or record is being provided. It can be written as free text, but there is also a suggested controlled vocabulary. Recommended terms for this field are: "PreservedSpecimen", "FossilSpecimen", "LivingSpecimen", "HumanObservation", "MachineObservation", "StillImage", "Moving-Image", "SoundRecording", "OtherSpecimen".
  - Institution Code. A code to identify the institution which administrates the collection in which the record is stored. Given that there is not any universal code for those institutions, the code should be assigned according to the user's interests. Example: 182.40.112.1-1

[10] Darwin Core was developed in the framework of TDWG. The latest version of the basic Darwin Core is available at http://wiki.tdwg.org/twiki/bin/view/DarwinCore/DarwinCoreDraftStandard

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- Collection Code. The code or acronym for which the collection is known in the world. For herbaria, there is a controlled acronyms source, the *Index Herbariorum*[11]. For other collections, acronyms are not stored in the same way. It is highly recommended to consult the national focal point of IABIN (→ *Annex 2*.) to verify if there is a national codification for biological collections to be used. Example: COL (National Colombian Herbarium).
- Catalogue Number. This is the concept to save the unique number or combinations of letters and numbers which identifies the specimen or the observation in the collection which contains it. Example: KU 155253.
- Scientific Name. Scientific identification to the lowest taxonomic level available of the organism, plus all the information associated to it — name-author, year or authorship, *sensu* or *sec*. (according to or following) author, and indication of uncertainty. Example: *Scinax garbei* (Miranda-Ribeiro, 1926). However, uncertainties like *cf.* (*confertus*) or *aff.* (*affinins*) are not part of the scientific name, so they should not be provided in this field. In that case, the identification should be deemed to the known immediate superior taxonomic level.

Nonetheless, as it was explained in → section 1, all biological records contain a reference to spatial information. In that sense, it is important that the extension of DwC for geospatial information is considered since the beginning. Please refer to → section S for a detailed description of the geospatial information needed for organisms.

3.1.4. How to describe the place where the organism occurs?

The most useful way to indicate the presence of an organism is to georeference it. See → Annex 3 for indications and best practices for georeferencing, as well as the most widely used "Guide to Best Practices for Georeferencing", published by GBIF12.

Besides, there is a clear indication about how to describe the occurrence of an organism in a given place and time, which is the DwC Geospatial Extension (GE). Please refer to recurrent → section S.1 for details.

3.1.5. How to describe the collecting event?

If data come from a biological collection, the majority of times there will be an evidence of the collection, such as a specimen or a digital sound recording. In this case, it is necessary to solve these four questions:

- Who collected the specimen? (person or persons),
- When did it happen? (period of time),
- Where does the specimen come from? (locality and context), and

[11] *Index Herbariorum* is available online at http://sciweb.nybg.org/science2/IndexHerbariorum.asp
[12] Guide to Best Practices for Georeferencing. Arthur D. Chapman and John Wieczorek (eds.). The Regents of the University of California. 2006. This document is available online at: http://www.gbif.org/prog/digit/Georeferencing

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- How was it collected? How was the information obtained? (method)

Each element of the collection must be documented according with the current version of Darwin Core standard (→3.1.3). In fact, to locate the evidence of the record, it is necessary to register where the specimen is, in which biological collection it is deposited and what is the catalogue number assigned to it. Furthermore, and specifically with the intention to properly document specimens of a biological collection, there exists a Curatorial Extension (CE)[13] of DwC, which contains additional elements to be considered. As it happens with the GE of DwC, none of its elements is mandatory. However, using the CE would be the only way to relate different evidences of the same record which are stored in different biological collections.

3.1.6. How to describe the taxonomic information of the record?

Prior to register any taxonomic identity it is necessary to register who and when identified the organism with the chosen name. At present, that information can be found in the concepts "IdentifiedBy" and "DateIdentified" of the CE of DwC. Besides, for every name to be provided it is recommended to register the following taxonomic elements apart of the mandatory "ScientificName" (→3.1.3.):

- Authors of the scientific name provided, in a citation according the applicable nomenclatural code.
- The taxonomic hierarchy at least in the mandatory categories of the applicable nomenclatural code.
- The nomenclatural code[14].

Other biological elements as sex, life stage and attributes are considered in the same standard. Refer to the CE of DwC (→ *footnote No. 13*) to include other important taxonomic elements, like type status, preparations, etc.

3.1.7. How to increase the quality in observations/ specimens' data?

Using standards and documenting the information with metadata are ways to procure quality. Furthermore, it is recommended that the taxonomic and the geographic referents of a record are verified against a well-known authority source. For verifying scientific names, please refer to the recurrent → *section T.*

For increasing the quality of geographic information, the most important issue is to recognize that, in the first place, biological records always contain a spatial reference, so that must be provided as accurately as possible; secondly, it is important to remind

[13] http://wiki.tdwg.org/twiki/bin/view/DarwinCore/CuratorialExtension

[14] Nomenclatural codes internationally in use are: the International Code of Zoological Nomenclature ICZN (http://www.nhm.ac.uk/hosted_sites/iczn/), the International Code of Botanical Nomenclature ICBN (http://www.bgbm.org/iapt/nomenclature/code/SaintLouis/0000St.Luistitle.htm), the International Code of Nomenclature of Bacteria ICNB (http://www.ncbi.nlm.nih.gov/books/bv.fcgi?indexed=google&rid=icnb.TOC), the International Code of Nomenclature of Cultivated Plants ICNCP (http://www.ishs.org/sci/icracpco.htm) and BioCode.

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that georeferences are hypothesis, and thus it must be possible to fake them. Please refer to recurrent → *section S* and *Annex 3* to obtain a detailed description of the recommended procedures for describing and managing spatial information.

3.1.8. **My information is not in any digital format. How can I digitize it?**

In order to be shared through the Internet, the biodiversity information must be stored in any digital format available. In addition, the information about organisms resulting from WB/IDB projects must fulfill at least three requirements:

- The structure must comply, at least, with the requirements described in → *section 3.1.3.* plus the internal requirements for biodiversity information management in the respective country. Please contact the National focal point of IABIN to be informed about them (→ *Annex 2*)
- Data must be of public access and use, and they must be accessible in the Internet.
- Data must be shared through the national biodiversity information network — if it exists— and, as a whole or in part, in the SSTN framework.

The SSTN developed a data capturing tool for managing specimens and observation data called ARA (ATTA II) which is available by the SSTN's Webpage (http://species.iabin.net/) or via the Web portal for the implementation of these Guidelines. However, registration and authorization to use the tool are required; please contact Maria Mora, mmora@inbio.ac.cr, for more information. The main advantage of using the IABIN SSTN tool is that data will be stored under IABIN parameters from the beginning, so it will be easier to start data sharing.

Though, there are more options of biological data digitization tools which may be used[15], or even a spreadsheet may be useful. The only required condition is that the selected software is able to manage the Darwin Core concept schema for information about occurrences.

Ideally, the software should provide the user with the necessary tools to make data provision to IABIN or GBIF easy, or in an automatic way —that is, a data protocol and a data "connector", like DiGIR or TAPIR and TapirLink[16].

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[15] For instance, see the GBIF recommendations at http://www.gbif.org/links/tools or the IABIN section for biodiversity tools, at http://old.iabin.net/english/bioinformatics/guide/systematics.shtml. The SiB Colombia developed few years ago a guide to evaluate software for the administration of biological collections. It is available in Spanish through the SiB downloads section of the SiB Web portal (www.siac.net.co/sib_descargas.php).

[16] DiGIR and TAPIR are **protocols** (that is, routes or procedures for doing something) developed specifically for sharing biological information through distributed environments in the Internet. However, TAPIR is able to manage any kind of information. DiGIR contains a so-called software to allow data provision, while the implementation of TAPIR requires the use of one associated software for the same purpose. A list of software tools to manage TAPIR is available at the TAPIR Webpage: http://wiki.tdwg.org/twiki/bin/view/TAPIR/TapirSoftware

Table 2. Example of the use of mandatory elements of Darwin Core, for documenting biological records of specimens

GUID	DateLastModified	BasisOfRecord	InstitutionCode	ColectionCode	CatalogNumber	ScientificName
IAvH:BT:2569	20080304	OtherSpecimen	IAvH	BT	2569	*Quercus humboldtii* Bonpl.
182.40.112.1-1:ICN-A:45280	200503	PreservedSpecimen	182.40.112.1-1	ICN	45280	*Dendrobates truncatus* (Cope, 1861)
INVEMAR:SIBM:3456	2007	ObservedSpecimen	INVEMAR	SIBM	3456	*Lutjanus*

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In case of selecting a spreadsheet to store digital data, it is important to know the spreadsheet limitations for use. Information technologies experts always say that even a spreadsheet like MSExcel™ works like a database, it is not a database manager. Hence, there are a limited number of records to be properly managed in each spreadsheet; security conditions are not enough, neither for the information, nor for the users, and the possibility of loosing the information would be higher if the database were stored in spreadsheets than if it were stored under database software. Nevertheless, spreadsheets are very easy to use, and they are widely distributed too.

To structure the existing information in a format according with Darwin Core (for example, data in a spreadsheet with columns organized according with standards) please refer to → *section 3.1.3, Table 2.*

3.1.9. **How to disseminate the information?**

The first step is to verify that metadata are documented for the dataset to be shared. In that respect, please refer to recurrent → *section M* to verify that. After that, there are at least three options for sharing data about specimens and observations in the IABIN or the GBIF frameworks:

1. To grant the custodianship of the information to the IABIN SSTN.
    a. If data are stored in a spreadsheet, send the spreadsheet file by e-mail or via the Web portal to the SSTN to be disposed in the network server. The most used format for those data should be a comma or semicolon delimited text format (.txt).
    b. If data are stored in any data capturing tool, the software should produce a DwC structured file, in XML or text formats. It must be possible to create such a file in order to send it by e-mail or via the Web portal to the SSTN, or directly, to create a copy of the entire database —the software should provide the instructions to do so in an effortless way— and send it to the SSTN.

2. To grant the custodianship of the information to the National focal point of IABIN, or to the National node of GBIF
   Option 2 is possible only if the National focal point or the National node of GBIF provide the necessary infrastructure to host and share other's data. That's the case of Colombia, Costa Rica, Mexico and Spain, for instance. Please contact these institutions for more information (→ *Annex 2*)

3. To maintain self data custodianship, and to provide data directly from an institutional/own server. Several requirements must be met:

- An application Web server must be available (Apache Tomcat, IIS).
- The appropriate connectivity must be guaranteed (at least 300 Kbs)

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- The communication protocol must be installed in the server. SSTN recommends the use of TAPIR, more that DiGIR, because TAPIR is able to manage different concept standards, for specimens, species or other data types.

    a. To use TAPIR as the selected communication protocol, select one software tool for data provision and contact an IT expert to do the installation. Follow the instructions provided in the respective TAPIR provider Webpage (→Footnote No. 17), v.g. PyWrapper[17], TapirLink[18] or TapirDotNET[19].
    b. To use DiGIR as the selected communication protocol, follow the instructions and requirements provided in the DiGIR installation Webpage (http://digir.sourceforge.net/port/digir_portal_install.html). That installation must be done by an IT technician.

3.2. Data about species

Data about species may constitute occurrences —for which a standard like DwC would be applicable—, or **species factsheets.** These are standardized descriptions of the species, which compile a comprehensive set of attributes like distribution, natural history, taxonomic characteristics, uses or threats of the species, as same as detailed information about bibliographic references or other information resources, projects and experts that may help to better know the species. *Species factsheets* are normally developed for wide audiences, so they can also include multimedia resources and links to occurrences of the species that may be digitally available.

In the IABIN framework, occurrences of species are not shared independently of their descriptions. In that sense, only the development of species factsheets is considered in this document. Three TN manage information about species in IABIN: the SSNT (all the species), the PTN (pollinator species) and I3N (invasive species). In order to provide species descriptions to IABIN, please refer to the following sections, and specially, consult the Special groups of species section (→ *3.2.11*), to see if those groups describe better the information types under your management.

3.2.1. Is it possible to talk about datasets of species?

Of course! The format of species *factsheets* may be the grouping criterion necessary to constitute a *dataset* (→ *3.1.1*). Therefore, at least one metadata for each set of species factsheets to be provided to the SSNT must be documented. Please refer to → *section M* to review how to document and provide metadata.

3.2.2. How can IABIN know how many and which datasets are available to share?

[17] http://wiki.tdwg.org/twiki/bin/view/TAPIR/PyWrapper
[18] http://wiki.tdwg.org/twiki/bin/view/TAPIR/TapirLink
[19] http://wiki.tdwg.org/twiki/bin/view/TAPIR/TapirDotNET

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As it was mentioned in → *section 3.1.2*, the only way for IABIN to know about datasets and data to be provided to the network is to read their metadata, or to index them as Internet resources, through the IABIN Catalogue. Currently, the Species and Specimens Thematic Network of IABIN, which is in charge of the information about organisms, decided to use *Cassia*® as the tool for documenting metadata of species. For detailed information on how to document metadata of datasets about organisms and resources, please refer to recurrent → *sections M.1.*, *M.3*

3.2.3. **How to describe species?**

The best description of a species is the one that accomplish all the purposes for which it was done. However, it is important to recognize "species" as biological units (→ *footnote No. 6*). Actually, there is a recommended set of attributes that should be considered in species descriptions. Those attributes were established in a collaborative environment between IABIN and GBIF, through the development of the **Plinian Core** standard[20]. Actually, the SSTN recommends the use of Plinian Core version 2.3 for sharing information about species.

At present, Plinian Core (PLIC) contains about 130 accepted elements, structured hierarchically. About 10 of them comprise the minimum set of elements that must be shared in the IABIN environment, and they have been regarded as a FlatPlinian XML schema for convenience. The mandatory concepts to be included when sharing information in the IABIN network are:

- **Metadata**. Reference to the metadata of the dataset in which the species factsheet is included. In ABCD Schema[21] the concept "Metadata" is a complete extension. In a biodiversity information network where metadata are stored separately, this field should be filled with a reference of the unique identifier of the applicable metadata. Example: http://www.siac.net.co/metadatos//showMetadato.jsp?conjunto=4071
- **ScientificName.** Complete scientific name in the sense of DwC (→*3.1.3*).
- **TaxonRecordID.** A unique identifier inside the database for the species record.
- **InstitutionCode.** The code or acronym identifying the institution administering the collection in which the organism record is catalogue.
- **Language.** Language used to write the species information, according to ISO 639[22].
- **Creators.** Source for Dublin-Core standard element "Creators", or the person responsible for making available the information about the species. It might be the author or the editor, for example.

[20] The entire element definition of Plinian Core, as same as its XML schema are available at http://www.gbif.es/plinian/doku.php?id=Inicio

[21] At present, ABCD is one of the ratified TDWG standards for biological data documentation. Information about ABCD in the TDWG context may be found at http://wiki.tdwg.org/ABCD.

[22] It is possible to access the complete ISO 639-2 (and ISO 639-1) standard at the US Library of Congress. See http://www.loc.gov/standards/iso639-2/php/English_list.php

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3.2.4. How to describe the species distribution?

The better documented the information of species distributions reported in the area of interest, the better quality of the species factsheet. It is important to query different sources of information, in order to obtain the most complete list of occurrences for the described taxon. A very important source of information that is not usually considered is metadata catalogues, and indexes of information resources, like the IABIN Catalogue[23] or BioBot[24].

According to Plinian Core, there is a set of concepts that are useful to properly describe distributions of species; nonetheless, none of them is of mandatory documentation. Some of them are:

- **Distribution.** Description of the geographic extent or the places where the species has been reported, based on information from collections or observations, or literature.
- **Habitat.** Even when this is one of the less standardized attributes (the concept "habitat" may have many different valid interpretations), it is very important for a species description.
- **Territory.** It may be useful especially for vertebrates. It is equivalent to "territorial extension" (see IUCN thesaurus for definitions).
- **Endemicity**. This is a very interesting attribute for publics other than researchers, such as government employees, decision makers and educators. It refers to the uniqueness of the species for an area. It may be used in the sense of restricted distribution.
- **References**. Sources of the information provided.

Check names of places where species occur by using geographic dictionaries or gazetteers; most of them are online in the Internet. To obtain detailed descriptions of the procedures to check places, please refer to recurrent → *section S* and *footnote No. 12.*

3.2.5. How to describe the taxonomic identity of the species?

The names of organisms must be compliant with Darwin Core V. 1.4 (→ *section 3.1.3*). In Plinian Core, a scientific name is mandatory, buy you should also describe the hierarchy in which the name is immersed. Concepts as Kingdom, Phylum, Class, Order, Family and Genus may be documented regarding the taxonomic classification, as same as the attributions for the given name of the species (in the concept **CanonicalAuthorship**).

Other taxonomy concepts available refer to type specimens (**Typification**), **Synonyms** (other not valid or not accepted given names), and useful texts to

[23] http://www.iabin.net/es///view/IABIN-Catalog.html
[24] BioBot is a trilingual catalogue of resources for the Americas developed by NBII in the framework of IABIN. It is available online at: http://www.iabin-us.org/information_links/biobot.html

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distinguish the species under description from other species: **ScientificDescription** and **IdentificationKeys.** Please refer to the Plinian Core webpage for more information.[25]

3.2.6. How to register common names of species?

Common names or vernacular names are associated to specifically identified users and specific places of use. Plinian Core and SiB recommendations for registering common names include: to refer the name to a source (a citation or a contact), to a space (common names are usually used in a big region, zone or province), to a human group (if the information is available) and to a language (according ISO 639, see → *footnote No. 22*). If common names are stored in a database, they must be verified against any available and recommended authority file.[26]

3.2.7. How to increase the quality of the information about species?

This information type contains some degree of data processing and aggregation. As a consequence, it is important to refer it explicitly to the sources where it was obtained (→ *section 3.2.8*). Besides, it is highly recommended to properly describe and verify the taxonomic and the geographic information provided, as it was mentioned before (→ *section 3.1.7*). Please refer to → *recurrent sections M, S, T and Annex 3* for procedures to increase data quality of the information about organisms.

3.2.8. How to record information sources?

Every information resource (texts, books, articles, images or multimedia resources) different from biological datasets must be cited following the Dublin Core standard. For detailed information about that standard please refer to → *section M.3*. It could be useful to review the guidelines document provided by Dublin Core[27] as well.

3.2.9. How to digitize the information?

As it was previously mentioned for species, the information about organisms resulting from WB/IDB projects must fulfill the requirements described in → *section 3.1.8*. The SSTN finished the development of ARA, a species and specimens data capture tool, which will be provided to interested data providers; please contact the SSTN Coordinating Institution[28] or the National focal point (→

[25] www.pliniancore.org. For the versions of Plinian Core see http://www.gbif.es/plinian/doku.php?id=Inicio

[26] Thesauri may be also a very important authority source to verify common names. SiB Colombia provides a section of structured common names in Spanish (biological units) inside its Biodiversity Thesaurus. Information about it can be consulted at http://www.siac.net.co/sib/tesauros2/WebModuleTesauros/mostrarArbol.jsp?id=1&localizacion=0,1

[27] Guidelines for Encoding Bibliographic Citation Information in Dublin Core Metadata. This document is available online at: http://dublincore.org/documents/dc-citation-guidelines/

[28] The Coordinating Institution of the SSTN is INBio, in Costa Rica. The contact person to obtain information about the tools developed by the network is Dr. Erick Mata (emata@inbio.ac.cr).

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Annex 2) for detailed information. Otherwise, the IABIN species data capturing tool could be accessed via the Web portal for these guidelines.

In the case of Colombia, the SiB Web tool "Catálogo de la biodiversidad de Colombia"[29] is available to document information about species to be provided both to the national biodiversity information network and to the SSTN via a TAPIR connector. You can ask for a user name and password to the Content Administrator of the Catalogue in the SiB Colombia (sib_colombia@humboldt.org.co)

On the other hand, there are other options to digitize species data in order to provide them to IABIN; even any word processor software can be useful. The only required condition is that the selected software is able to manage the Flat Plinian Core concept schema for information about species. Ideally, the software should provide the user with the necessary tools to make an easy data provision to IABIN, or in an automatic way —that is, a data protocol and a data "connector", which in this case would be solely TAPIR. In order to structure the existing information in a format compliant with Plinian Core (an MSWord™ document, or a spreadsheet, for instance) please refer to → *footnote No. 25 and section 3.2.3.*

3.2.10. **How to disseminate the information?**

The first step is to verify that metadata are documented for the dataset to be shared. In that respect, please refer to recurrent → *section M* to verify that. After that, there are at least three options for sharing data about specimens and observations in the IABIN or the GBIF frameworks:

1. To grant the custodianship of the information to the IABIN SSTN.
    a. If data follow the Plinian Core concept schema and they are stored in a spreadsheet or in a text file, send the file by e-mail or via the Web portal to the SSTN to be disposed in its own server. The most used format for those data should be a comma or semicolon delimited text format (.txt).
    b. If data are stored in any data capturing tool, the software should produce a Plinian Core structured file, in XML format. It must be possible to create such a file in order to send it by e-mail or via the Web portal to the SSTN, or directly, to create a copy of the entire database —the software should provide the instructions to do so in an effortless way— and send it to the SSTN.

2. To grant the custodianship of the information to the National focal point of IABIN, or to the National node of GBIF

Option 2 is possible only if the National focal point or the National node of GBIF provide the necessary infrastructure to host and share other's data. That's the case of Colombia, Costa Rica and Spain, for instance. Please contact these institutions for more information *(→Annex 2).*

[29] http://www.siac.net.co/sib/catalogoespecies/welcome.do

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3. To maintain self data custodianship, and to provide data directly from an institutional/own server. Several requirements must be met:

- An application Web server must be available (Apache Tomcat, IIS).
- The appropriate connectivity must be guaranteed (at least 300 Kbs)
- The TAPIR communication protocol must be installed in the server. To use TAPIR as the selected communication protocol, select one software tool for data provision and contact an IT expert to do the installation. Follow the instructions provided in the respective TAPIR provider Webpage (→ *footnote No. 18*), v.g. PyWrapper[30], TapirLink[31] or TapirDotNET[32]. At present, the CI of the SSTN recommends TapirLink for data provision.

3.2.11. **Special groups of species. Data describing Pollinators.**

Please be careful! This section of the guidelines is a complement of the sections about specimens, observations and species descriptions developed above. The information of pollinators should be managed as information of specimens and species. However, there are supplementary conditions to be checked, as same as more data to be provided to the PTN, the applicable IABIN TN for pollinators.

3.2.11.1. Why is it necessary to include a section in this document specifically about data of pollinators?

To properly describe pollinators, it is important to describe their interactions, at least between the pollinator and the pollinated species. Standards for managing information about those interactions have been developed, so it is necessary to use them in order to increase the quality of the information provided. Moreover, in the IAIBN environment the information about pollinators is managed by the PTN, in parallel with the information about general species and specimens, which is managed by the SSTN.

3.2.11.2. Do pollinators' datasets require different descriptions from other species datasets? Can I create metadata for pollinators?

A very important condition to consider is that the description of a pollinators' dataset must include precise keywords related with pollination and pollinators. Use thesauri and controlled vocabularies to choose appropriate descriptors. Please refer to sections → *3.1.1.* and → *section M* to create metadata for pollinators' datasets.

3.2.11.3. How to describe pollinators? How to register the interactions between plants and pollinators?

[30] http://wiki.tdwg.org/twiki/bin/view/TAPIR/PyWrapper
[31] http://wiki.tdwg.org/twiki/bin/view/TAPIR/TapirLink
[32] http://wiki.tdwg.org/twiki/bin/view/TAPIR/TapirDotNET

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It is necessary to review the Interaction Extension (IE)[33] and the Pollination Extension (PE)[34] of Darwin Core to identify specific elements to document the plant-pollinator interaction. As the other DwC extensions, these do not contain mandatory elements. Additionally, it is highly recommended to register other kinds of interactions like predation, nesting, parasitizing, and environmental measurements based on elements from the previous extension and the Environment Measurements Extension (EME) [35].

The only additional and mandatory element for the IE of DwC with respect to the basic DwC is **RelationshipType**, which describes the type of relationship between an organism represented with DarwinCore and the related organism represented with the extension. Nevertheless, it is necessary to provide information for the remaining concepts of the basic DwC for each interacting organism. Please refer to the Interaction Extension Web page for examples on the controlled vocabulary (→ *footnote No. 35*).

3.2.11.4. How to inform about people working with pollinators?

Structure the information related with people who are working on pollination with the following elements (see how it looks like in the Webpage of The Pollinator Conservation Digital Library [36]):

- Research Interests
- Brief summary about research and academic experience
- Location. This is a complex concept which contains information about address, postal code, city, state/province, country, email, web, phone, and fax.

3.2.11.5. How to increase the quality of the information about pollinators?

Given that pollinators are organisms, conditions for verifying information about them are the same described in → *recurrent sections M, S, T and Annex 3*. Besides, considering that it is possible to record species data about pollinators, an explicit reference to the sources of the information is also important (→ *section 3.2.8*).

3.2.11.6. How to digitize the information?

There are at least two ways of storing the information about pollinators in digital formats compatible to the IABIN PTN.

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[33] Interaction Extension Concept List. Available online at: http://wiki.tdwg.org/twiki/bin/view/DarwinCore/InteractionExtension
[34] Pollination Extension Concept List http://wiki.tdwg.org/twiki/bin/view/DarwinCore/PollinationExtension
[35] Environment Measurements Extension Concept List. Available online at: http://wiki.tdwg.org/twiki/bin/view/DarwinCore/EnvironmentMeasurementsExtension
[36] The Pollinator Conservation Digital Library http://www.libraryportals.com/PCDL/people

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1. If the pollinators' information is about specimens or observations (occurrences), you can use any tool developed for BRs digitization, like the ones recommended in → footnote No. 15, as long as the tool is able to manage the different extensions of DwC related to pollinators (EME, IE, PE). Please refer to → section 3.1.8 for details.
2. If the pollinators' information refers to species fact-sheets, you should consider the options presented in section 3.2.9
3. Alternatively, you can use the Pollinators Digitization Tool, which has been recently developed. For more information on it, please contact the PTN Coordinating Institution[37]

3.2.11.7. How to disseminate the information?

Although the information about pollinators is information about specimens and species too, the IABIN TN which administers it is the PTN. There are several ways of providing pollinator data to the PTN.

1. To provide species data about pollinators (species factsheets), follow the Plinian Core concept schema plus the Pollinators interactions data[38]. Then proceed in accordance to the instructions explained in → *section 3.1.9.* These data may be provided to the SSTN directly.
2. To provide specimen and observation data about pollinators, you can either provide them to the PTN or to the SSTN.
   a. If your dataset is only about pollinators, you must provide it to the PTN. To do so, consider the following conditions:
      i. For data stored in any data capturing tool, the software should produce a file which contains information about all the elements considered in the Interactions, Pollination and Environment Measurements Extensions, structured in XML format. That file should be sent by e-mail or via the Web portal to the PTN.
      ii. For data stored in the PTN capturing tool, information exchange will be done automatically via a TAPIR provider. Only the conditions to install the provider software must be guaranteed. For information about the development of that tool, please contact the PTN CI (→ *footnote No 39*).
      iii. For data stored in a spreadsheet, you have to structure the concepts according to the applicable standards (→ *sections 3.1.3 and 3.2.3.*) manually. Besides, it is necessary to save the file in a text format to share it with the PTN. Furthermore, it is always possible to create a copy of the entire database in order to send the file to the PTN.

[37] The PTN Coordinating Institution is the CoEvolution Institute, USA. Contact Elizabeth Sellers (esellers@usgs.gov) or the network manager (iabinptn@coevolution.org) to obtain detailed information.
[38] See for example the prototype for documenting pollinator species data at http://groselha.pcs.usp.br/sowb/php/index.php

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b. If your dataset contains information about pollinators and other groups of organisms, you should provide the data about pollinators to the SSTN directly. Please refer to → *section 3.1.9 and 3.2.10* for instructions.

3. To maintain self data custodianship of species and specimens information, and to provide data directly from an institutional/own server, the requirements are:

- An application Web server must be available (Apache, IIS).
- The appropriate connectivity must be guaranteed (at least 300 Kbs)
- The TAPIR communication protocol must be installed in the server. As this network must manage both species and specimens information, TAPIR is the selected communication protocol. Select one software tool for data provision and contact an IT expert to do the installation. Follow the instructions provided in the respective TAPIR provider Webpage (→ *footnotes No. 30, 31, 32*).

3.2.12. **Special groups of species. Invasive Species**

Please be careful! This section of the guidelines is a complement of the sections about specimens, observations and species descriptions developed above. The information of invasive species should be managed as information of specimens and species. However, there are supplementary conditions to be checked, as same as more data to be provided to the I3N, the applicable IABIN TN for invasive species.

I3N was the first functional IABIN TN. It started to promote the standardized collection of data about invasive species few years ago, and more recently, it was the first IABIN TN actively exchanging data. For that reason, developments in the I3N are somehow different form the developments of other TNs. For example, I3N integrated the provision of species and specimens data through the development of a data cataloguing tool in Web. In that time, the IABIN Catalogue was not designed, and the model for data provision was established as a semi-centralized client-server schema. In that way, the "client" (final user, i.e. the researcher) obtained the rights for using the I3N software, but that use implied the acceptance of the client to facilitate data provision through the Internet and, in some cases, to give custodianship of data to I3N.

At present, I3N works with a "leadership" schema, in which there is at least one thematic leader for each country that hosts a IABIN focal point. To know about the leaders of each country for I3N, or to receive detailed information about this topic, please consult the I3N Webpage (http://invasives.iabin.net/).

3.2.12.1. How to know if the species I am interested in is invasive?

I3N provides information about invasive alien species of the Western Hemisphere, as same as controlled vocabularies to be used in accordance to the IABIN concept schema and application. In order to know if the species under consideration is invasive, the recommendation is to query the following resources:

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- The Global Invasive Species Database[39] of the Invasive Species Specialist Group –ISSG–, to see if the selected species is included. This application is maintained by the Global Invasive Species Program, GISP[40].
- The I3N Content Search, which aims to integrate all the information produced by the different countries which host an I3N node. It allows a free-text query, (including the use of vernacular or scientific names of species), and country-delimited queries[41]. When working properly, this search engine helps in finding the information of the countries from a unique access point.
- The recently published online book "South America Invaded", which comprises information about the invasive species living in most countries of the LAC area. It is available in English[42], Portuguese[43], and Spanish[44].

Those selected resources are just a small part of all the information resources available for knowing invasive species. However, they contain the highest probability to find an invasive species in the LAC area. To obtain a detailed list of information sources for invasive species please consult the GISP online databases Webpage[45] and the GISP invasive websites Webpage[46].

3.2.12.2. Why this "special section" is needed for invasive species?

There are two main reasons to structure these guidelines that way: Actually, invasive species really are a very special group of species, because there are a lot of aspects of their life history that are harmful for conserving the biodiversity on Earth. Besides, and in spite of the fact that invasive species are in accordance to the SSTN structure, the development of I3N is quite different from the one of the remaining networks, starting from the network architecture —as it was mentioned previously. Consequently, different controlled contents, standards and protocols must be considered to properly describe this group of species.

3.2.12.3. How to describe invasive species accurately?

The initial step to consider is to remember that they are species, so they can be described as biological units (→ *footnote No. 6*) at the organism level. In addition, it is important to recall the need of structuring the information in a way that may be useful for other interested people or institutions, and, for the purpose of these guidelines, in a way useful for the WB and the IDB. Thus, the minimum requirements for sharing information in the Internet through the IABIN framework

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[39] Available online at http://www.issg.org/database/welcome/

[40] GISP is a legally constituted association comprised of four Founding Members: The International Union for Conservation of Nature (IUCN), The Nature Conservancy (TNC), CAB International, and the South African National Biodiversity Institute (SANBI). http://www.gisp.org/index.asp

[41] Content Search of the I3N: http://i3n.iabin.net/search/mercury_search.html

[42] http://www.gisp.org/publications/invaded/gispSAmerica.pdf

[43] http://www.gisp.org/publications/invaded/gispSAmericapo.pdf

[44] http://www.gisp.org/publications/invaded/gispSAmericasp.pdf

[45] Available at http://www.gisp.org/links/index.asp?alphabet=A&worldmap=&country=&database=yes

[46] Available at http://www.gisp.org/links/index.asp?alphabet=A&worldmap=&country=

must be fulfilled (for specimens and observations descriptions see → *section 3.1.3*, for species descriptions please refer to → *section 3.2.3*). Remember that the only way for IABIN to know what information is being produced is to let IABIN know about it; therefore, metadata documentation is always the first task (→ *section M.*).

Nevertheless, in this case it is necessary to include in the descriptions those conditions that make invasive species so special.

- There is a series of attributes specifically designed for describing invasive species, the characteristics of the invasion, the trends of the invasion and the interactions of IAS. For the I3N purposes, all these attributes were included in the I3N Database Template[47]. That database is standard-dependent, even though if it can be modified by its developers to adjust it to the user needs. In order to obtain a copy of the database, it is required to fill in the **registration form**[48] and to send it to the Instituto Horus (database@institutohorus.org.br).
- There are two sets of conceptual elements for describing species that may be shared in the I3N network: the *Species detailed schema* and the *Short species report schema.* The second one is merely an indication of the occurrence of the species in any place, and it does not require an additional explanation. The first one may be equivalent to a extension of Plinian Core for invasive species description, and it involves the definition of the following additional attributes[49]:
  - **Organism types**. Characterizes the species by its biological form.
  - **Habitat preferences**. Describes the habitats where the species can successfully adapt, therefore having a higher potential to become invasive.
  - **Invasiveness**. The degree of invasion in each occurrence. Its valid values are controlled, as follows: "contained", "detected", "stablished", "invasive".
  - **Dispersal.** It describes the different ways species are propagated, and it only applies for plants and fungi.
  - **Pathways.** Refers to the routes through which species are transported.
  - **Vector.** Refers to the means of transportation through which the species are carried along a pathway.
  - **Management information.** This is a complex concept composed of information about strategies to control de invasive species. Those strategies may be categorized in Mechanical control, Chemical control, Biological control and Prevention measures.
  - **Nutrition.** No further information is provided in the Manual (→ *footnote No. 51*) for this concept.
  - **Reproduction.** Species reproduction types. It should contain a controlled list of valid values.

[47] Information on the I3N database template is available at http://i3n.iabin.net/tools/index.html.
[48] http://www.institutohorus.org.br/download/database_files/form_english.doc
[49] Texts are extracted and adapted from the Invasive Alien Species Database Manual (English), produced by IAIBN, Instituto Horus, TNC and Gekko (Grupo de Estudios en Conservación y Manejo, Universidad Nacional del Sur, Argentina). Available at: http://www.institutohorus.org.br/download/database_files/manual_english.zip

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- **Locality date.** No further information is provided in the Manual (→ *footnote No. 51*) for this concept.
- **Population status.** No further information is provided in the Manual (→ *footnote No. 51*) for this concept.
- **Impacts.** Information for this concept includes other species affected, economic impacts, social impacts, ecological impacts and impacts on health.

To obtain detailed information about these concepts, and about other concepts included in the Database Template, please refer to the Invasive Alien Species Database Manual (→ *footnote No.* 51). That Manual is available in Spanish[50] and Portuguese[51] as well.

3.2.12.4. How to describe observations and specimens of IAS?

Please refer to → *section 3.1.3.* to see the basic elements of DwC in order to describe occurrences of IAS. Besides, consult the Interactions Extension (→ *footnote 35*) of DwC to see if some of their elements are applicable to the interests of invasive alien species (IAS). At present, there is a TDWG working group in IAS, which may generate TDWG adopted standards –and interoperable protocols—that will be very useful[52].

3.2.12.5. How to refer documents related to IAS?

For each document to be referred, it is necessary to create a bibliographic card according to the Database Template, and which minimally contains the elements described in Dublin Core. Please refer to the manual in your spoken language (→ *footnotes No. 51, 52 and 53*) and to the recurrent → *section M.3* to verify that your bibliographic references are structured in accordance to IABIN standards.

3.2.12.6. How to refer contacts related to IAS?

The I3N Database Template contains an entire data section about contacts, and that is one of the concepts that must be provided in a standardized way to the TN. The recommended set of elements to be provided by the *Contact schema* is[53]:

- **First Name.** First name of the contact person.
- **Last Name.** Last name of the contact person.
- **Organization Name.** Institution where the contact person works.
- **Email.** E-mail(s) address for contact.
- **Address.** Mailing address(es): home or work address.
- **Phone.** Home or Office telephone number(s) for contact.
- **Fax.** Home or office fax number for contact.

[50] http://www.institutohorus.org.br/download/database_files/manual_espanol.zip
[51] http://www.institutohorus.org.br/download/database_files/manual_portugues.zip
[52] http://wiki.tdwg.org/twiki/bin/view/InvasiveSpecies/WebHome
[53] *Ibid.* footnote No. 49.

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- **Postal Code.** Zip code for mailing purposes.
- **Country.** Country where the contact person lives or works.
- **City.** City where the contact person lives or works.
- **Title.** Professional, academic or technical background.
- **Position.** Position that the contact person holds within the institution.
- **Expertise.** No further information is provided for this concept.

For detailed information about the above mentioned concepts, please refer to the Database Template (→ *footnote No. 49*). Please consider the information of the Manual as well, in your spoken language (→ *footnotes No. 51, 52 and 53*) and review the recurrent → *section M.3* to verify that your contact references are structured in accordance to IABIN standards.

3.2.12.7. How to describe projects related to IAS?

The I3N Database Template contains an entire data section about project, and that is one of the concepts that must be provided in a standardized way to the TN. The recommended set of elements to be provided by the *Project schema* is[54]:

- **Title.** Title of the project.
- **Creator.** Reference to the person registered in the "Contacts" for correspondence.
- **Email.** E-mail(s) address for contact.
- **Description - Temporal.** Indication of the starting and real or estimated finishing dates of the project.
- **Description - Spatial.** Area where the project takes place (cities, states, ecosystems, river basin, etc.). Add local geographic references, city/district and state/province whenever possible.

For detailed information about the above mentioned concepts, please refer to the Database Template (→ *footnote No. 49*). Please consider the information of the Manual as well, in your spoken language (→ *footnotes No. 51, 52 and 53*) and review to the recurrent → *section M.3* to verify that your project references are structured in accordance to IABIN standards.

3.2.12.8. How to increase the quality of the information about invasive species?

Given that invasive species are organisms, conditions for verifying information about them are the same described in → *recurrent sections M, S, T and Annex 3.* Besides, it is fundamental to follow the standards adopted for documenting projects, references (citations) and contacts described in → *sections 3.2.12.5, 3.2.12.6 and 3.2.12.7*).

[54] *Ibid.* footnote No. 49.

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3.2.12.9. How to digitize the information about IAS?

Even when it would be possible to use the same tools and recommendations given for occurrences (→ *section 3.1.8*) and species fact-sheets (→ *section 3.2.9*), the easiest and most recommended way to digitize your information about IAS is to use the tools developed by the I3N. Considering that every country has implemented those tools in an own way, the most efficient procedure is to contact the I3N leaders in your country[55].

3.2.12.10. How to disseminate the information?

Currently, the only way to provide information about IAS directly to the I3N network in an efficient way is to use the Database Template[56] and, ideally, the related application (data transport is automatic). Standards and protocols in the IABIN network are established for sharing biodiversity information in distributed environments; as a matter of fact, those standards are already designed for the I3N contents as well, but procedures to implement them have not been adopted by the I3N yet. Neither metadata nor data are being shared from the I3N to any other network inside IABIN.

Four XML schemas[57] for *detailed species reports, short species reports, contacts,* and *projects* have been developed by I3N in order to extract the minimum information needed from any database (even a spreadsheet may be useful) and send it to I3N; though the procedure is not clearly established yet. Nonetheless, if XML documents are generated, there must be an option to send them to I3N by e-mail or via the Web portal to the CI or to the data responsible (i3n@usgs.gov).

If your data to be provided contain species, specimens or observations other than invasives, you must provide them to the SSTN. In that case, please refer to sections → *3.1.9 and 3.2.10* to know how to do it.

4. What information can I manage? Data about areas

4.1. Terrestrial, Freshwater and Marine Ecosystems

4.1.1. Which information can I provide? Can I nominate datasets about ecosystems?

When thinking about areas, an obvious instrument or product comes to one's mind: a map. Maps are traditionally the expression of an area, even if they are a result of the interpretation of the real evidence, which might be images of remote sensors and

[55] Information about leaders and tools available in each LAC country may be found at http://invasives.iabin.net/
[56] http://i3n.iabin.net/tools/index.html.
[57] Available at the I3N Standards Webpage: http://i3n.iabin.net/tools/standards.html

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aerial photographs. However, what would be a map in terms of information management? A dataset, a cluster of data which share at least one common grouping criterion: the space, in this case, or the place where the ecosystem components and attributes occur.

Of course, the values of the attributes describing or comprising the ecosystems are also information that might be shared through the IABIN network: specimens, species, special groups of species –pollinators, invasive species--, environmental conditions, water resources, uses and management of biodiversity and policies, among others. For collecting and providing some of them, there are standards to be met in the IABIN framework (→ section 4.1.9). For the remaining ones, it is recommended to follow internationally adopted standards, like the ones proposed by the CORINE Land Cover initiative58.

Then, it is important that you define and describe the information held and, eventually, the one to be provided, in terms of datasets about areas. You can decide to share only maps, or only alphanumerical databases, or both. That is all possible. The important thing is to allow IABIN, or whichever initiative that manages information about areas in which you want to participate, know explicitly what types of information you have, where and how they are.

4.1.2. How can IABIN know how many and which datasets are available to share?

The only way for IABIN to know about datasets and data to be provided to the network is to register those datasets through metadata. Currently, the Species and Specimens Thematic Network of IABIN, which is in charge of the information about organisms, decided to use Cassia® as the tool for documenting metadata of species. For detailed information on how to document metadata of datasets about organisms, please refer to recurrent section → M.2.

4.1.3. How to describe ecosystems?

To describe ecosystems it is necessary to identify at least a minimum set of elements that have been defined by the Ecosystems Thematic Network (ETN) of IABIN:

- **Classification system:** given that classifications of ecosystems are subjective, it is important to clearly cite the system in which the ecosystem has been included, and the characters that make possible that inclusion.
- **Ecosystem class (name):** the name assigned to the ecosystem under description, following the selected classification system. The name of the ecosystem should be taken from a controlled vocabulary source.
- **Ecosystem location:** usually, this is represented by the polygon of the ecosystem, with its associate spatial database.

[58] http://reports.eea.europa.eu/COR0-landcover/en

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- **Associate maps:** according to the second bullet, and section 4.1.2, a map is really important to describe the ecosystem.
- **Description of the ecosystem at several spatial levels**. The ETN currently provides two standard formats to describe terrestrial and marine ecosystems. According to them, it is possible to provide detailed data regarding the ecosystem under description. Figure 2 summarizes the key elements for the description of ecosystems. The standard format for continental and insular waters is under development.
- **Information sources**: to increase the quality of the description and the classification designated to the ecosystem of interest, it is fundamental to properly cite the sources of the information provided.

4.1.4. Is my information structured in a way that others can read it and use it?

The form of making interoperable your information about ecosystems is to use the Standard Format. It is the basic unit for a relational database to query or search ecosystems in the IABIN framework. The standard format allows for the correspondence (cross-walk) between the different kinds of classifications[59]. There is a document of definitions accompanying the terrestrial standard format, which contains clarifications on the content that should be provided in each field60. Table 3 details the information to be provided according the different levels of specificity in the ecosystem description.

Ecosystem name

Location

System of classification

Maps

Sources

*Ecosystem description

	Continental Habitats	Marine Habitats
Global Context	macroclimate and macrobiogeography	climate zone
Regional Context	bioclimate and biogeographic providence	main marine ecosystem
Local Context	fisiography, coverage, phenology, hydrology	biochemical ecoregion, coverage, biotope
Specific information	soils, geomorphology, environmental services, present species	salinity, depth, substrates, energy, zones, impacts

[59] Ecosystem Thematic Network of IABIN (ETN) http://biogeodb.stri.si.edu/bioinformatics/IABIN/
[60] http://biogeodb.stri.si.edu/bioinformatics/IABIN/FormatoEstandar/GuiayDefiniciones.htm

Figure 2. Summary of important elements needed to describe ecosystems

4.1.5. How to choose and register ecosystems classifications?

There are many classifications of ecosystems and the choice of the most appropriate one should be agreed and conducted in the national level for each country. However, it is important to keep in mind that in order to exchange information on ecosystems, it is not essential to select a single type of classification, so that different types of classifications can be referenced with a source properly identified. The important point is that, if a classification system is referred, an adequate citation is provided –like one presented in the Citation format of the FGDC metadata standard. See recurrent → section M.2 for detailed information on it.

4.1.6. How to geo-reference cover types and polygons?

Please refer to → Annex 3 for recommendations.

Table 3. Standard formats to describe ecosystems in the ETN.
3A-Terrestrial Ecosystems[61]

Section	Mandatory fields	Optional fields
Basic data	Country Reference work (printed map, or memory technical report on the map) Ecosystem name Contact Institution or organization Brief ecosystem description (physiognomic - floristic approach)	Region of the country Current total area (ha) Potential area (ha) Changes estimated in recent decades Conservation status and trends of the ecosystem (with references)
Geospatial data	Map format URL of the digital information	Map name ID or class code on the legend Main source of information Date of the source of information Spatial scale Publication date
Description		
Level 1	Macrobioclimate Macrobiogeogaphy	
Level 2	Bioclimates Bioclimatic levels (thermotypes) Biogeographic provinces	
Level 3	Physiography (at the great landscape level) Type of coverage (predominant coverage) Vegetation phenology	

[61] http://biogeodb.stri.si.edu/bioinformatics/IABIN/FormatoEstandar/presentacionformatoestandar.html

Section	Mandatory fields	Optional fields
	Condition of surface water (if it is flooded or not) Hydrologic cycle	
Level 4	Geomorphology Hydrogeomorphology Total coverage / density Type of leaves	Soil draining class Soil types Sum of bases Cavern Vegetation height
Level 5	Water salinity	Soil pH Soil composition Specialized substrate Water mineralization Number of strata Coverage by strata Environmental services
Level 6		Plant species table (with reference, reliability and plant features) Animal species table (with reference, reliability and animal features)
Level 7 (standarized phytosociological classifications)		Alliance(s) and diagnostic species Association(s) and diagnostic species Community(s) and diagnostic species

3B-Marine Ecosystems Standard Format[62]

Section	Fields
Basic data	Country Reference work (printed map, or memory technical report on the map) Ecosystem name Contact Institution or organization Brief ecosystem description (physiognomic - floristic approach)
Geospatial data	This ecosystem has a map?
Description	
Level 1	Climatic zone
Level 2	Main marine ecosystem
Level 3	Biochemical eco-region System and subsystem Class and subclass Group Biotope complex and biotope
Classifiers	Salinity Cloistering General depth classes Relative position regarding the continental shelf Coverage classes and percentage

[62] http://biogeodb.stri.si.edu/bioinformatics/IABIN/FormatoEstandar/formatomarino.php

Modifiers	Energy type Intense energy Directorate of energy Interval tidal Depth category Deep benthic areas Sub-zone depth of the water column Primary source of water Profile Slope Temperature Anthropogenic impact Oxygen Turbulence categories Turbulence types Source of turbulence Photic quality Trophic status

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4.1.7. **How to increase the quality in ecosystems data?**

Three conditions help to ensure high quality in the information about ecosystems. The first one is to follow carefully well documented methods of classification, description and georeferentiation of the images, and the ecosystems subsequently. The second one is to document extensively every map and database with metadata. Please refer to → *section M.2* for a comprehensive explanation of geospatial metadata. The last one is to refer properly all the sources of the information provided, recognizing explicitly the responsibility of every part involved. That may be done in the metadata documentation, but it is important to acknowledge all the sources and collaborators also in the products obtained.

4.1.8. **How to disseminate the information?**

Ecosystems are the most comprehensive biological unit, so if you want to share information about ecosystems, you would probably have the opportunity to provide information about species, climate, soils, geomorphology, and so on. In that regard, for every type of information to be provided there is at least one consideration to be met, which is a proper metadata documentation for every dataset/ map to be provided. Please refer to recurrent → *section M* to obtain details. In the case of the ETN, they selected Cassia® as the cataloguing tool for metadata, using Dublin Core and FGDC metadata standards. For more information please contact the Colombian National Metadata Catalogue of Datasets Related to Biodiversity (metadatos@humboldt.org.co).

Furthermore, in the IABIN framework the ETN plays the role of an *integrator* among the different databases and spatial covers or representations that might be available through the entire IABIN network, with the aim of making them useful for decision making processes. In fact, the ETN provides a GeoIntegrator, which is a tool that allows the integration –using Web technologies—of alphanumerical and geospatial databases and GIS covers in an accessible unique point. All those information sources are distributed, and stored in *geoservers* independently, but the use of standards, like the ones of the Open Geospatial Consortium (OGC), makes their combination possible. Obviously, the most important requirement in that sense is that the information to be combined is already available through the IABIN network, and that it uses the concerted standards.

Then, the best alternative to provide ecosystems data is to give them in custodianship to the ETN[63] or the National Focal Point if it has the capacity of hosting the needed data type. Alternatively, there is a list of places in the ETN Webpage[64] (preliminary) which eventually could serve as hosting institutions for maps and databases.

Every institution which aims to provide maps via a *geo-server* must agree on an implementation plan, concerted between ETN, the Institution and the Geo-Sur Program[65]. That program finances the implementation of *geo-servers* in leading institutions in the Americas. ETN has developed a survey to define which institutions (and in which conditions) require help in setting up *geo-servers*. To answer the survey, please refer to the GeoSur Survey page: http://biogeodb.stri.si.edu/bioinformatics/IABIN/survey/survey_step1.php.

4.1.9. **What can I do if my information is not in digital formats?**

Digital formats are essential in order to integrate data from different sources in the ETN framework. Depending on the type of the data, certain conditions and standards may apply, as follows:

- For species and specimens data, Plinian Core and Darwin Core standards, respectively, must be used. Detailed descriptions of both, and their use, are presented in *section 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 3.2.4, 3.2.5 and 3.2.6.* To know how to digitize information about species and specimens, please refer to *sections 3.2.9 and 3.1.10, respectively.*
- For data of pollinators, please be sure of using the Interaction Extension, the Pollination Extension and the Environment Measurements Extensions of Darwin Core. The last one might be useful for other environmental measures,

[63] Homepage of the Ecosystem Thematic Network of IABIN (ETN) http://biogeodb.stri.si.edu/bioinformatics/IABIN/
[64] http://biogeodb.stri.si.edu/bioinformatics/IABIN/ImplementacionGeoservidores.html
[65] http://biogeodb.stri.si.edu/bioinformatics/IABIN/geosur.html

not necessarily linked to pollinators. See → *section 3.2.11.3* for more information.

- For geospatial data, please refer to recommendations in *section S and Annex 3.*

Digitization of standardized descriptions of ecosystems is possible directly by using the Web version of the Standard Format of the ETN[66] (marine or terrestrial, → *4.1.4.*). Besides, there is a link to the format from the ETN Home page (→ *Footnote No. 64*), by clicking on "Standard Format" button. Nevertheless, it is necessary to be a registered user in order to provide ecosystem description to ETN. Please contact the Coordinator[67] of ETN for more information.

4.2. Data of protected areas (PAs)

4.2.1. Which information can I provide?

The first thing to remember is that information about PAs is still information about areas, so the conditions for that information to be shared in the Americas through the Internet are basically the same as the ones established in → *section 4.1.1*. However, for this specific case, not all that information is interesting to, and therefore, managed by, the Protected Areas Thematic Network (PATN), which is responsible of the PAs information in the IABIN environment. The relevant information for PATN is that of the areas description, in terms of the policies that allowed its creation, its extension, and its categorization.

4.2.2. How the World knows about my information?

The only way of letting the World know about the information that you have, in this case, is to document it in the PATN documentation application[68] and/ or the World Database of Protected Areas (WDPA)[69], or to publish it directly in a public Web page, so the IABIN Catalogue is able to index the resource and provide information about it. There is not a clear policy of metadata documentation in any of them, but at least maps should be documented through metadata, according to the recommendations of the ETN (→ *section 4.1.2*), and recurrent → *section M.2*,

4.2.3. How to describe a protected area?

The PATN defined a set of attributes that must be documented to describe properly a PA; those are known as the "Site Core Attributes", and refer to broad topics mainly related to environmental policy issues. They are:

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[66] http://biogeodb.stri.si.edu/bioinformatics/IABIN/FormatoEstandar/presentacionformatoestandar.html.
[67] The Coordinator is Vincent Abreu, abreu@umich.edu
[68] Please contact the Coordinating Institution of PATN for more information
http://protectedareas.iabin.net/index.php?option=com_contact&catid=37&Itemid=120
[69] http://www.wdpa.org/

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- **Identification**: a unique and universal code assigned by UNEP-WCMC[70] via the last WDPA (→ *Footnote No. 69*). Example: 3009
- **Location**: a general description of the space that the protected area occupies. It comprises geopolitical units, physic and socio-cultural toponyms, coordinates or elevation, for example. Example: Colombia, Departamento Nariño
- **Extension**: territorial extension of the area under description, measured in Ha or Km^2. Example: 2.62 ha.
- **Designation**: name or category (local or regional) of the protected area. Example: Flora and Fauna Sanctuary.
- **Establishment**: date of creation or establishment, and status. Example: 1977, established. Example: 1977
- **Type of management:** a brief description of management activities (and sometimes documents) in the PA. Example: Implemented.
- **Governance:** information about the people or institutions responsible of maintain the PA. Example: Currently unknown.
- **Ownership:** information about the people or institutions who own the PA. Example: Currently unknown.

In the PATN Data Standards[71] it is possible to have detailed descriptions of these required elements.

4.2.4. How to identify a protected area around the world?

There is a unique identifier named "WDPA Site Code" which provides a unique code to identify any protected area –known-- at the global level. Please refer to the WDPA (→ *footnote No. 70*) for the codes and respective information.

4.2.5. How to refer a management plan of a protected area?

In the standard format of WDPA there is a minimum set of attributes to be described of a management plan. The main topics to report are: context, background, planning, input, processes and outcomes. The "PATN Data Standard - Management Effectiveness Common reporting format and Minimum data set"[72] gives the explanation of contents of minimum elements. Unfortunately, that document is not currently available in the Internet, so it is necessary to contact the

[70] The World Database Protected Areas (WDPA) is a program leaded by the World Conservation Monitoring Centre (WCMC), the biodiversity information and assessment arm of the United Nations Environment Programme (UNEP).
[71] PATN Data Standard - Site Core Attributes – Version 1.0 – 05/12/2007
[72] PATN Data Standard - Management Effectiveness Common reporting format and Minimum data set Version 0.9 – 05/12/2007

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Coordinating Institution[73], the National Focal Point (→ *Annex 2*) or the IABIN Contents Coordinator[74] for more information.

4.2.6. **How to relate geospatial information to protected areas?**

According the IABIN TI Expert Meeting, in 2007, geospatial data from IABIN TNs were supposed to be integrated through the IABIN Geospatial Network[75], still in the process of being recognized. However, recently the decision has come to be that the PATN and the ETN would be integrated via their coordinating institutions directly. In that sense, the important point is to remember that protected areas are still areas, therefore a good part of the information about them should be managed in the same way of the information about ecosystems (→ *section 4.1*). As long as the information on PAs is well documented, it will be easy to integrate it in other TNs or initiatives, as needed.

4.2.7. **How to increase the quality in PAs data?**

In this case there is a very important condition to procure data quality: only official information can be provided to the IABIN network or to the WDPA. Official means that the institution that manages the protected areas of the country should support the information provided, or should provide the information itself.

Besides, two other recommendations apply, just like in the case of ecosystems:
1) every map and database must be documented carefully with metadata, (refer to → *section M* for a comprehensive explanation of datasets and geospatial metadata)
2) All the sources of the information provided must be properly acknowledged, recognizing explicitly the responsibility of every part involved. That may be done in the metadata documentation.

4.2.8. **How to digitize the information?**

The best way to assure a correct digitization process for PAs information is to work directly with the WDPA application. For doing that, it is necessary to submit an application to UNEP-WCMC in order to be recognized as a qualified data provider[76]. Please contact the database administrator (protectedareas@unep-wcmc.org.) or the PATN CI for more information.

4.2.9. **How to disseminate the information about protected areas?**

It is possible to update the information within the Americas and Caribbean Database on Protected Areas and the WDPA by the procedures mentioned above (→ *section*

[73] Fundacao O Boticario is the Coordinating Institution. However, the contact for questions on the PATN is this address: http://protectedareas.iabin.net/index.php?option=com_contact&catid=37&Itemid=120
[74] Rita Besana, at rbesana@iabin.net
[75] Pers. com. Eduardo Couto Dalcin, PATN Coordinator.
[76] The registration format may be found at http://www.wdpa.org/Register.aspx

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4.2.8). Besides, it is expected that a Web service (WS) --a piece of code used to communicate machines-- is developed to offer the data providers the possibility of sharing directly their data to the network. Nevertheless, potential providers must comply with three conditions:

1) To adopt the data standard
2) To have resources and infrastructure to maintain a server in which the WS might be installed
3) To offer their datasets in XML Formats

Lastly, it is also possible to send an MS EXCEL© file with the information standardized to the CI, or to upload it directly from the Web portal of these Guidelines. If that was the case, the first condition to verify is the documentation of metadata for the resources being provided. Please refer to → section M for detailed information in that regard.

5. Other types of information

5.1. Images

Much of the environmental information may not be expressed by words, datasets or numbers. Sometimes, it is possible to express a environmental variables, or conditions, by a picture, or a remote sensing image. There are many evidences of BRs that may be referred to an image that one would like to save and organize.

IABIN has thought about it, despite the fact that neither IABIN nor GBIF nor any other biodiversity initiative, have decided to build a unique global repository for managing biodiversity/ environmental images. However, for some of the TNs, and information standards, it would be important to count on images as the support for the information provided. That is the case of species fact-sheets (→ *3.2*), invasive species (habitats and organisms, → *3.2.2*) and ecosystems (→ *4.1*), among others.

It is possible, though, to tell IABIN and the World that you have images that you would like to share in the Internet. GBIF is also thinking of indexing many images to be related with specimens, habitats and special conditions of the information that GBIF manages. Then, there are some recommendations in order to properly manage the images that, eventually, some day you are going to share:

1) As long as you have images of interest, try to maintain them in a good way to make them perdurable. The images should be catalogued (that is, codified, identified and properly stored).
2) Procure to always save the *metadata* of the images collected and stored. For general images there exist different metadata standards in the world. However, in the LAC

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area the easiest way to document your images is to consider them as an information resource and to describe them using Dublin Core as the metadata standard. For information on how to do that, please refer to → *section M.3.*

3) If you are interested in providing your images to any of the IABIN TNs, please contact the CI directly (→ *section 1*) or the National Focal Point (→ *Annex 2*).

5.2. **Maps**

As same as the images, it is possible to have maps or covers that are not describing an ecosystem, or a protected area, but are compiling and presenting environmental information: Distribution areas of some species, rivers, soils, use conflicts, etc. Those maps are very important and the majority of the times, unavailable for the researchers that need them, especially in the LAC area. Even knowing that geospatial information is usually restricted, and that it requires an special treatment and processing, it would be great if those restrictions were limited and the maps could be shared like the BRs.

It is possible, though, to tell IABIN and the World that you have maps that you would like to share in the Internet. GBIF is also thinking of indexing maps and land covers to be related with specimens, habitats and special conditions of the information that GBIF manages. Then, there are some recommendations in order to properly manage the maps that, eventually, some day you are going to share:

1) If you are the owner or the custodian of maps, try to maintain them in a good way to make them perdurable. If possible, try to catalogue them, and the best way to do it is by metadata. In the LAC environment, the most widely used metadata standard for maps (and geospatial information) is the ISO 19115. Please refer to → section M.2 for detailed information about metadata of maps.
2) Maps can also be documented as information resources, hence, they can be described by the Dublin Core metadata standard. For information on how to do that, please refer to → section M.3.
3) If you are interested in providing your maps to any of the IABIN TNs, please contact the CI directly (→ section 1) or the National Focal Point (→ Annex 2).

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6. Recurrent sections

❖ M – Metadata of datasets

The first task to do before creating and registering metadata is to select the standard and profile to be used, according to the type of information which is being described, as follows:

- Metadata of biological datasets: CSDGM with Biological Data Profile[77] (→ *section M.1*)
- Geospatial metadata: CSDGM or ISO 19115 (→ *section M.2*)
- Metadata of bibliographical resources –including books, articles, Web pages, information products-: Dublin Core (→ *section M.3*)

➢ M.1 Metadata of biological datasets

▪ How to create a metadata of a biological dataset?

1) Review the standard CSDGM-BDP in order to know the mandatory elements that must be described of the resource under documentation. A succinct description of the mandatory elements to be provided contains:
    a. **Citation**. The complete reference –i.e. bibliographic reference—for which the data set will be known. It comprises:
        i. Description. Brief description of the resource.
        ii. Time period. Extent of time covered by the resource.
        iii. Status. An indication of the stage of development of the resource.
        iv. Keywords. Keywords which properly describe the resource. Consider not to include terms that are already included either in the title or in the summary.
        v. Access constraints. Conditions to be achieved in order access the resource.
        vi. Use constraints. Allowed uses of the resource and constraints to be considered by the user.
    b. **Spatial domain**. A detailed description of the geographic extent of the dataset. It contains:
        i. Description of geographic extent. A free text to explain where the data come from.
        ii. Bounding coordinates. Four bounding coordinates must be provided (extreme North, extreme South, extreme East, extreme West) in geographic decimal format.
        iii. Bounding altitudes. Information about altitude is fundamental in biological datasets. Lower and higher values of altitude reported for the data in the dataset must be provided here, and meters is the international standard unit.

[77] Complete text of the CSDGM-BDP available at http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/biometadata/biodatap.pdf

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There are other metadata elements that should be provided if the dataset contains information about them. They are **taxonomy**, **analytical tools** and **digital transfer information.** Explanations about definitions and uses of those elements may be found directly in the text of the standard, with its appropriate extension. The necessary extension to correctly manage theses contents is the Biological Data Profile (BDP). http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/biometadata/biodatap.pdf (→ *M2-1*).

2) Select a metadata documentation tool. At present, there is only one tool intended to be used for documenting metadata of datasets about organisms in the IABIN framework, which is *Cassia*©, the cataloguing tool developed by the Coordinator Team of the SiB Colombia. That tool is in use for the SSTN and the ETN. However, there are other tools available in the market, which may be compliant with the CSDGM-BDP. For information about those tools, please review NBII Metadata Tools at the NBII portal[78] and the SiB documentation about *Cassia*©[79]. Any selected tool should provide the user with the necessary online help to make the metadata creation easier, and they must comply with the standards adopted by IABIN. In that sense, IABIN will provide or recommend the necessary tools to facilitate metadata gathering among and between its networks and the Secretary.

- **How to provide metadata of a biological datasets to IABIN?**

3) If metadata are documented through the IABIN Catalogue, they will be stored directly in any IABIN server. Just select the appropriate option in the cataloguing tool, and metadata will be stored in the central catalogue and thus, available through de IABIN network.
4) If metadata are documented through *Cassia*© or any other tool, the IABIN catalogue tool will find a way to gather those metadata to the central catalogue. Using *Cassia*©, there would be two options of providing metadata:
    a. If *Cassia*© is installed in any metadata node, different from the one of the SSTN
        i. To export all the metadata to be shared in XML format, using the command Export Metadata of the application.
        ii. To send the metadata files either to the Coordinating Institution of the SSTN or to the central metadata catalogue of IABIN. It is possible to send those files via e-mail or via the Web portal
    b. If *Cassia*© is installed in the node of SSTN, the IABIN Catalogue will gather or read their metadata directly.

[78] The Metadata Tools page is available at the following URL [Consultation date: 20080331]: http://159.189.176.5/portal/server.pt?space=CommunityPage&cached=true&parentname=CommunityPage&parentid=0&in_hi_userid=2&control=SetCommunity&CommunityID=255&PageID=338

[79] There is a downloadable guide for using *Cassia* as a cataloguer user, available at www.siac.net.co/sib_descargas.php

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➢ M.2 Geospatial metadata

▪ How to create geospatial metadata?

1) Usually, geospatial metadata are generated by the GIS software under which the spatial information of interest is managed. Therefore, there are two conditions to be checked in order to provide those metatada to the IABIN Network:
    a. Geospatial metadata must comply with the CSDGM or with the norm ISO 19115. To verify this condition, consult your GIS application manual.
    b. If geospatial metadata do not comply with the standards adopted by IABIN —a very improbable situation—, it would be necessary to map the existing metadata to the ideal standardized metadata. To facilitate that, it is necessary to know the descriptions of the elements in the CSDGM/ISO 19115 and the declared possible values for each of them, as same as to know the standard in which the extant metadata are structured. Mapping should be done field to field, according to the mandatory elements of the CSDGM. A detailed description of CSDGM is available at http://www.fgdc.gov/metadata/csdgm/ Besides, FGDC developed a workbook to explain in a user-friendly manner, the contents and the ways of using the CSDGM. That workbook is available at http://www.fgdc.gov/metadata/documents/workbook_0501_bmk.pdf
2) Once created, geospatial metadata are stored in the GIS metadata database. If the metadata to be provided to IABIN are compliant with the above mentioned standards, IABIN will gather them through the IABIN catalogue.
3) If geospatial metadata were not directly generated by the GIS software, a process like the one described in section M1-1, 2 should be followed (→ M1). Review section M2-1) to find the description of the suitable standards.

▪ How to provide geospatial metadata to IABIN?

4) In any case, IABIN will gather geospatial metadata through the IABIN catalogue. In that sense, it will be necessary to register the user metadata database in the IABIN catalogue. The procedure of this registry has not been established yet, but the ETN will indicate it when available. To receive more information about it, please contact the Networks Coordinator of IABIN (bramirez@iabin.net) or the ETN coordinator (abreu@umich.edu).

➢ M.3 Bibliographic metadata (metadata of general resources)

Since the beginning, IABIN adopted Dublin Core as the standard for structuring the general descriptions of general biodiversity information resources. Dublin Core is a frequently used standard in the World that aims to describe the context in which a resource was created, and the instructions to obtain it and to use it in a digital environment. The most concise version —the most widely applicable— conforms with ISO 15836 standard, and it comprises fifteen mandatory elements which are described in section M3-1.

▪ How to create metadata of resources?

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1) The first step is to review the elements of the standard, in order to provide the most accurate information about the resource under description for everyone. The elements of the standard include:
    a. **Contributor**. Entity responsible for making contributions to the resource.
    b. **Coverage**. Any indication about the space and time for which the resource is valid. May be a location, or a period of time, or both, but it always be represented as free text.
    c. **Creator.** Entity responsible for creating the resource.
    d. **Date.** Any suitable reference of the time associated to the resource. Examples are publication date, creation date, verification time. It must conform with ISO 8601 standard, so it must be written as follows:
        i. YYYY (4 digits of a year). Example: 2005.
        ii. YYYY-MM (4 digits of a year-2 digits of a month). Example: 2005-06
        iii. YYYY-MM-DD (4 digits of a year-2 digits of a month-2 digits of a day of the month). Example: 2005-06-18.
        iv. YYYY-MM-DDThh:mmTZD (4 digits of a year-2 digits of a month-2 digits of a day of the month-indication of "Time" (T)-2 digits of and hour:2 digits of minutes, and the Time Zone Designator (TZD), represented by a (+/-) symbol-2 digits of an hour:2 digits of minutes). Example: 2008-04-01T20:58+05:00.
        v. YYYY-MM-DDThh:mm:ssTZD (4 digits of a year-2 digits of a month- 2 digits of a day of the month-indication of "Time" (T)-2 digits of and hour:2 digits of minutes:2 digits of seconds, and the Time Zone Designator (TZD), represented by a (+/-) symbol-2 digits of an hour:2 digits of minutes). Example: 2008-04-01T20:58:16+05:00.
        vi. YYYY-MM-DDThh:mm:ss.sTDZ (4 digits of a year-2 digits of a month- 2 digits of a day of the month-indication of "Time" (T)-2 digits of and hour:2 digits of minutes:2 digits of seconds.1digit of a decimal fraction of second, and the Time Zone Designator (TZD), represented by a (+/-) symbol-2 digits of an hour:2 digits of minutes). Example: 2008-04-01T20:58:16.5+05:00.
    e. **Description.** Free text explaining what the resource is and briefly, what it contains.
    f. **Format.** All the indications that the reader would need to know what kind of physical resource is being described. Example: MSAccess™ database of 45Mb.
    g. **Identifier.** Unique identifier of the resource in any given collection fo resources of the same kind.
    h. **Language.** Language in which the resource is available. This field should be represented by a code, as it is defined by to RFC4646. That code includes values for:

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i. "language" following the ISO 639[80] standard;
ii. "script" following the ISO 15924 standard[81];
iii. "region" following the alphanumeric ISO 3166[82] standard, or the three-digit UN M.49 code[83].
iv. "variant", if there are any registered variants of the language.

i. **Publisher.** An entity responsible for making the resource available. It may be a contact or a service.
j. **Relation.** Information about related resources. Each one should be cited as a standard citation.
k. **Rights.** Description of the conditions under which the resource has to be used. Includes intellectual property rights.
l. **Source.** According to the Dublin Core Webpage, this field informs about a related resource from which the described resource is derived. The related resource should be cited as a standard citation.
m. **Subject.** It is recommended to include here keywords which describe the subject covered by the resource. Those keywords should be verified against a recognized authority source (i.e. a thesaurus[84]).
n. **Tittle.** The name assigned to the described resource and for which the resource is known.
o. **Type.** Specification of the genre or kind of resource, such as "collection" "image" or "software". It is recommended to use a controlled vocabulary for this field, available from DCMI at http://dublincore.org/documents/dcmi-type-vocabulary/.

2) Select a metadata documentation tool. As mentioned in section →M1-2, the IABIN Catalogue (under development), and Cassia© are available for documenting medatada, and both can fulfill the requirements of all the metadata standards adopted by IABIN. However, with a set of elements as short as Dublin Core, it would be possible to include a simple spreadsheet as one of the documentation tools. Therefore, IABIN will provide or recommend the necessary connecting tools to facilitate metadata gathering among and between its networks and the Secretary.

- **How to provide metadata of resources?**

There are two options to share standardized metadata in the IABIN network.

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[80] The complete list of ISO 639 codes for languages is available at http://www.sil.org/iso639-3/codes.asp [Query date: 20080330]
[81] The complete list of ISO 15924 codes for scripts is available at http://unicode.org/iso15924/iso15924-codes.html [Query date: 20080330]
[82] The complete list of ISO 3166 2-character codes for countries is available for download at http://www.iso.org/iso/country_codes/iso_3166_code_lists.htm [Query date: 20080331]
[83] The standard UN M.49 comprises not only political or administrative divisions, but regions. The entire code is available at http://unstats.un.org/unsd/methods/m49/m49.htm [Query date: 20080401]
[84] At least two thesauri in the specific field of biodiversity are available. In English, the Biocomplexity Thesaurus of NBII (http://thesaurus.nbii.gov/portal/server.pt) and in Spanish, the SiB Thesaurus (http://www.siac.net.co/sib/tesauros2/WebModuleTesauros/index.jsp). For more general terms, the Unesco Thesaurus (http://www2.ulcc.ac.uk/unesco/) and the AGROVOC Thesaurus (http://www.fao.org/aims/ag_intro.htm) are recommended herein

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a. If Dublin Core metadata were documented online, and they are stored in one of the applications recommended by IABIN which is in any of its Thematic Networks, the IABIN Catalogue will gather them in a semi-authomatic way.
b. If metadata are stored in any metadata documentation tool and they are not stored in any of the Thematic Networks, but in an institutional database, it will be necessary:
    i. Either to export the Dublin Core metadata in the proper format and send it to IABIN by e-mail or via the Web portal, or
    ii. To install a software for metadata provision in the server where metadata are stored (that software should be provided by IABIN), in order to start data provision.
c. If Dublin Core metadata are not documented in any metadata documentation tool, but in a spreadsheet, they can be provided to IABIN as an MSExcel™ file, or as a text file (.txt). The files can be sent to the appropriate thematic network via e-mail, or by using the Web portal.

❖ S – Spatial descriptions for species, specimens and ecosystems

➢ S.1 Occurrences of specimens

▪ How to describe the occurrence of an organism in a given place and time?

The place where an organism is found is usually regarded as its **locality**, which is composed of names of places –be them administrative units, topographic accidents or cultural or socially known places–, instructions for accessing the locality, elevation and sometimes, remarks, or notes. A very good description of a *locality* is like the guarantee that the organism will be placed in the correct place.

However, in the biodiversity information networks environment, the most used way to describe the presence of an organism in a given place and time is the **Geospatial Extension** (GE) of DwC.[85] It comprises the recommended set of elements to properly describe the provenience of the records, considering that a pair of coordinates is only one hypothesis of the precise place where the organism was found. In that sense, the GE wants to give the user (both the one who provides the record, and the one to uses it) a way to know where, and with which uncertainty, the organism was present at a given time.

Then, is important to remember that DwC was conceived to help exchanging the highest number of records, more than the more detailed –or sometimes best documented-- records; so it does not contain any mandatory concept in this extension. However, it is recommended to provide information of all of them, as long as the information exists. The GE elements are (descriptions taken from the TDWG GE page):

[85] http://wiki.tdwg.org/twiki/bin/view/DarwinCore/GeospatialExtension

a. **Decimal Latitude**. The latitude of the geographic center of a location where an event occurred (organism collected, observation made), expressed in decimal degrees. Positive values are North of the Equator, negative values are South of the Equator. Example: 4.286777.
b. **Decimal Longitude**. The longitude of the geographic center of a location where an event occurred (organism collected, observation made), expressed in decimal degrees. Positive values are East of the Greenwich Meridian, negative values are West of the Greenwich Meridian. Example: -74.35835.
c. **Geodetic Datum.** The geodetic datum to which the latitude and longitude refer. If not known, use "not recorded". Actually, the most widespread datum is the WGS84, but please be careful in documenting it when recording coordinates from a GPS, or a map. Example: Observatorio Bogotá.
d. **Coordinate Uncertainty in Meters:** Represents the upper limit of the distance (in meters) from the given *Decimal Latitude* and *Decimal Longitude* describing a circle within which the whole of the described locality lies. Leave the value empty if the uncertainty is unknown, cannot be estimated, or is not applicable (because there are no coordinates). Example: 30.
e. **Point Radius Spatial Fit:** A measure of how well the circle defined by the coordinates and uncertainty match the original spatial representation, as a ratio of the area of the circle to the area of the original spatial representation. For understanding this concept and its applications, please refer to the "Guide to Best Practices for Georeferencing"[86].
f. **Verbatim Coordinates:** A text representation of the coordinate data (Latitude/ Longitude, UTM, TRS, etc.) from its original source if it cannot be separated into its component parts. When using plain coordinates, for example, this field becomes important. Example: 200456, 286774.
g. **Verbatim Latitude:** A text representation of the Latitude part of the coordinate data from its original source. Example: 4º 35'N.
h. **Verbatim Longitude:** A text representation of the Longitude part of the coordinate data from its original source. Example: 74º32' W.
i. **Verbatim Coordinate System:** The name of the system in which the verbatim geographic coordinates were recorded. Example: "degrees, minutes and seconds".
j. **Georeference Protocol:** A reference to the methods used for determining the coordinates and uncertainties. Example: "Unknown."
k. **Georeference Sources:** A list of maps, gazetteers or other resources used to georeference the locality. The content of this concept is meant to be specific enough to allow anyone in the future to use the same resource to georeference the same locality. Examples: "NIMA Gazetteer".
l. **Georeference Verification Status:** A categorical description of the extent to which the georeference has been verified to represent the location where the specimen or observation was collected, taken from a controlled

[86] http://www.gbif.org/prog/digit/Georeferencing

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vocabulary source (still under development). Example: "verified by the GIS Unit".

m. **Georeference Remarks:** Comments about the spatial description determination, explaining assumptions made in addition or opposition to those formalized in the method referred to in Georeference Protocol. Example: "Datum WGS84 was assumed".
n. **Footprint WKT:** A Well Known Text (WKT) representation of the shape (footprint, geometry) that defines the location of the occurrence. For understanding this concept and its applications, please refer to the "Guide to Best Practices for Georeferencing" (→ *footnote No. 84*).
o. **Footprint Spatial Fit:** A measure of how well the geometry expressed in the footprint match the original spatial representation, as a ratio of the area of the footprint given to the area of the original spatial representation. For understanding this concept and its applications, please refer to the "Guide to Best Practices for Georeferencing" (→ *footnote No. 84*).

- **How to increase the quality of spatial data for occurrences?**

If one takes a look carefully on the GE of DwC, it seems obvious that the intention is to provide the most detailed information, in order to make the record useful for the largest number of people and situations. However, the following points are very relevant too:

1) Procure to document explicitly the methods, attributes and values followed to georeference any record. A good example of that, in Spanish, is the Methods and Attributes Catalogue of the SiB Colombia[87], where you can document and search methods, attributes, domains and the means to contact researchers who provided them.
2) Procure to document clearly the sources of the information provided. A source may be a person, or an information resource.
3) Procure to maintain as much original information as possible. Even if you have to interpret a description of a locality, or a coordinate description, or a text, please try to maintain the original information to avoid subjectivity.
4) When possible, compare your information to widely recognized sources. Check, for example, the correct writing of the places with a Thesaurus, and the correct description of places against a Gazetteer. And do not forget to cite them properly.

❖ **T – Taxonomic verification**

In order to increase the quality of taxonomic data, there are various fundamental recommendations:

1) Always provide scientific names in the less inclusive level of the taxonomic hierarchy that you know.

[87] http://www.siac.net.co/sib/metodos2/WebModuleMetodos/index.jsp

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2) If the name you are providing is on the species level, or below, follow the recommendations of the applicable nomenclature code. For plants, include in the name the author or canonic authorship, according the standardized citation for it. For animals, include the name and year of description, according the most recent accepted form of citation/ classification system in which you believe.
3) Always procure to verify the names provided against a recognized taxonomic source:

    - The most widely used source of names, in English, is the Catalogue of Life (www.catalogueoflife.org). It contains about one million names, but it is not region-specific.
    - Specific names sources for plants (in English), which contain extensive information for the LAC area, are W3Tropicos[88] (Missouri Botanical Garden) and IPNI[89] (International Plant Names Index).
    - For Spanish-speaking users, the 'Links'90 section of SiB Colombia Web portal (www.siac.net.co/sib) provides recommendations about different taxonomic names sources for organisms, with emphasis in those living in the LAC region.
    - For Portuguese-speaking users, .the Centro de Referemcia em Informacao Ambiental (CRIA) from Brazil provides very interesting sources and tools for species distributed in Brazil and the Neotropical region. See for example http://www.cria.org.br/projetos in section "Names" for further information.
    - A specific Taxonomic authority file has been launched for Apoidea (bees) pollinators; see www.itis.gov for more information.

4) When creating new content which includes taxonomic information (digitization of biological collections, observations and species factsheets, for example) try to avoid digitization of names. Instead, procure to select the names from a controlled source incorporated in your digitization tool. That is important because it has been established that the probability of making mistakes when writing/digitizing a taxonomic name is so high.

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[88] http://www.tropicos.org/
[89] http://www.ipni.org/
[90] http://www.siac.net.co/BancoConocimiento/S/sib_enlaces/sib_enlaces.php

Annex 1. Survey on environmental projects financed by WB/IDB in LAC area (1985-2008)

This sample of WB/IDB projects was obtained by querying the available datasets in the WB and IDB Web pages, considering only the "Environmental and Natural Resources management" area. Regarding the WB, 2.132 projects (among 12.208 in total) were found to be developed in this theme around the world, from 1985 to 2008. 514 (nearly 20%) of them correspond to the LAC area.

Table 1. Investment of the World Bank according product lines in LAC (1985-2008), considering only environmental and natural resources management.

Product line	No. Projects	Value[(1)]
Recipient Executed Activities (Actividades realizadas por los receptores)	6	6,55
IBRD/IDA - Banco Internacional de Reconstrucción y Fomento (BIRF) / Asociación Internacional de Fomento (AIF)	320	26746,32
Carbon Offset - Compensación de las emisiones de carbono	34	88,94
GEF Medium Sized Program - Programa de proyectos de tamaño mediano del FMAM	42	24,68
Montreal Protocol - Protocolo de Montreal	7	24,61
Global Environment Project - Proyecto sobre el medio ambiente mundial (GEF)	84	750,49
Rainforest - Selva pluvial	21	38,98
TOTAL	**514**	**27680,57**

(1) Values in USD millions (Valores en millones de dólares US$)
Source: Calculations based on data provided by the WB at http://www.worldbank.org (Cálculos a partir de los datos provistos por el Banco Mundial en http://www.worldbank.org)

The aggregated spatial distribution of the projects financed by the WB is presented in **Figure 1**. As it can be obtained from it, the biggest amount of investment is distributed mainly in four countries in the LAC area: Brazil, México, Argentina and Colombia. It is remarkable that, excluding Costa Rica, those are also the countries which are developing better technical and technological infrastructure for biodiversity information management in the region. Besides, Brazil, Argentina and México are correspondently the most extensive countries in LAC.

In **Table 2** the distribution of the projects according environmental areas is presented, considering both the World and the LAC area. Independently of the amount of resources assigned, there are two themes that comprise the majority of projects: Management of water resources, and Policy and environmental institutions. Biodiversity occupies the third place in number of financed projects. However, the first two may be subjected to standardized information management according the Guidelines.

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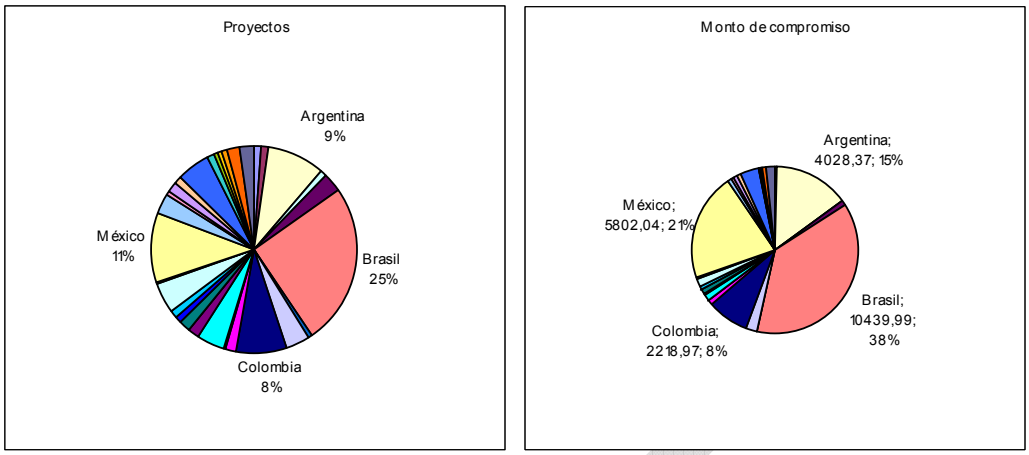

Figure 1. Projects and investments of the WB in LAC area between 1985 and 2008, considering only environmental management and natural resources.

In **Table 3** there is a summary of the subthemes inside Environment that have been defined by the WB.

Table 2. Distribution of projects according its environmental theme in the world and in LAC area.

Theme	Projects	
	World	LAC
Land management and administration	446	127
Management of pollution and environmental health	813	103
Management of water resources	612	195
Climate change	415	94
Policy and environmental institutions	777	195
Biodiversity	441	149
Management of the environment and natural resources, other aspects	304	76

Table 3. Subthemes defined by the World Bank

Biodiversity	Management and control of pollution
Air quality	Environmental Engineering
Climate change	Sustainable Land Management
Persistent organic pollutants	Environment and efficiency in energy use
Brown environmental issues and health	Coastal environments
Green environmental issues	Marine environments
Natural disasters	Politics and marketing of carbon
Disasters and environmental degradation	Environmental protection
Economics and environmental policies	Montreal Protocol
Ecosystems and natural habitats	Resources of wild flora and fauna
Environmental assessment and management	Environmental information systems
Global Environmental Fund (GEF)	Dry land and desertification
Environmental management	Tourism and ecotourism
Management of water resources	Protected areas
Management of natural resources	

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There are 29 subthemes identified, from which Biodiversity, the most relevant theme for IABIN, is the first. In that sense, it seems that only a very small amount of the information in WB projects may be managed following IABIN standards. However, below is an identification of the types of information that could be described and shared using IABIN/GBIF tools and the Guidelines document.

Project types of WB which produce information that may be managed in the IABIN framework

Conventions:	
M	Metadata of datasets related to biodiversity
O	Records of occurrences of species and specimens
+	Maps and land covers (natural, seminatural and anthropic)
U	Information about uses and local/traditional knowledge of biodiversity
FS	Specific, synthethic and digitized information about attributes of species.
FE	Specific, synthethic and digitized information about attributes of ecosystems

Land management and administration

- Management of natural resources and ecosystems, land management, property rights, management of water resources, irrigation districts. M +, FE, FS
- Sustainability, sustainable economic activities, renewable sources of energy. M
- Environmental rural, agricultural, forest, community, and institutional development. M, O, FE, +
- Conservation and management of biodiversity, protected areas, environmental services, restoration, biological corridors. M, O +, U, FE
- Pollution control. M, +
- Cultural diversity. M, U
- Disaster prevention and care

Management of pollution and environmental health

- Basic sanitation, aqueduct and sewerage, solid waste management, trapping gas, pollution management, air quality, reducing the consumption of substances affecting the ozone, environmental restoration. M +, U, FS.
- Transport and road infrastructure
- Agricultural development, mining; municipal, local and urban development, energy, hydropower and institutional development. M.
- Rural poverty reduction, social investment
- Protected areas. M, O +, FE.
- Nutrition and Health

Management of water resources

- Management of water resources / water, irrigation districts, ecosystem restoration, monitoring. M, O +, FS, FE.
- Basic sanitation, aqueduct and sewage, waste management, pollution management. M +.
- Land management, rural development. M + FE.
- Environmental services. M, +, FE, FS.
- Carbon sequestration. M, O, FE
- Recovery of traditional knowledge. M, U.
- Support for poverty reduction.
- Institutional strengthening
- Disaster prevention and care

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Climate change

- Financial assistance, market development, eComerce. M, O, U.
- Sustainable development, sustainable animal husbandry, forest-shepherd arrangements, sustainable harvesting and processing of agricultural crops, climate-friendly transport. M, O, U, FS.
- Carbon sequestration, gas capture, conversion of gas, reducing greenhouse gases, solid waste management.
- Energy efficiency, energy transmission, natural gas distribution, rural electrification.
- Alternative energy sources.
- Integrated ecosystem management, environmental protection, water, environmental services, ecosystem restoration. M, FE, +

Policy and environmental institutions

- Natural resources policy, adaptation to global climate change. M, +, FE
- Programmatic and institutional reforms, institutional strengthening, sector restructuring.
- Capacity building, support for social participation, support for existing networks. M, O, +, U
- Social investment fund
- Modernization and rehabilitation systems
- Cultural and religious values in conservation. M, U.
- Environmental technical assistance, information systems. M, O, U +, FE, FS..
- Pollution management
- Biodiversity conservation, protected areas, restoration of ecosystems. F, U, FE, FS, +.
- Reduction of ozone

Biodiversity. M, O, U, FS, FE, +

- Biodiversity, inventory of wetlands, biological corridors
- Protected areas, community management of protected areas, indigenous management in protected areas
- Integrated management of ecosystems, management of rural land, restoration of ecosystems, natural resource management, water resource management, maritime management
- Agricultural development, market development, market instruments, eComerce, crops and native wildlife, sustainable tourism, rural productivity
- Preservation of cultural diversity, rescue of ancestral knowledge
- Construction of IABIN
- Forestry and forest-shepherd development
- Capacity building
- Flood prevention, emergency assistance
- Urban infrastructure
- Reform to environmental sustainability
- Monitoring and analysis
- Environmental services
- Carbon sequestration, adaptation to climate change, adaptation to the decline of glaciers
- Implementation of adaptation measures in coastal areas, coastal pollution.

Management of the environment and natural resources, other aspects

- Rural poverty alleviation, strengthening of good governance and quality of life
- Rural land management, agricultural development, agricultural research and extension, sustainable management of ecosystems in productive landscapes, sustainable communities, community development, support for social participation, regional development. FE, U +
- Sustainable management of natural resources, integrated management of water resources, irrigation. M, O, FE, FS.
- Developing markets

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- Capacity building for environmental management
- Road management
- Fire prevention
- Carbon sequestration, protection of the ozone layer, reducing greenhouse gases. M., FE.
- Protected areas, administration and consolidation, conservation and sustainable use of marine resources, protection of indigenous lands, management of protected areas by indigenous, conservation of biodiversity, conservation of mountain ecosystems. F, FE, U +.
- Environmental learning and promotion of science, science and technology programme
- Environmental services. M, U.
- Energy efficiency, technical assistance to the energy sector, prototypes to use hydrogen fuel
- Forestry development, precious woods, forest resource management, sustainable forestry. F, FS, U.

With regard to the IDB, there were 1,057 projects funded by the IDB related with environment and natural resources, of a total of 14,167 in LAC area, between 1964 and 2008. The distribution of the projects by areas is presented in **Table 4**.

Table 4. Type and number of environmental projects financed by the Inter-American Development Bank (IDB) in Latin America and the Caribbean

Subtheme	IABIN management*	Number of projects
Pollution and waste management		63
Ecotourism	M, U	46
Forestation	M, FS, FE	53
Management and conservation of natural resources	M, O, FS, SF, + U	110
Management of water Resources	FE, +	79
Mitigation and prevention of natural disasters	FE, +	237
Environmental programs and institutions		273
Urban environmental topics		65

Finally, in a recent exercise in which we queried the IDB projects database using the term 'biodiversity' as the only search parameter, we found 35 projects conducted between 1994 and 2007, with a total amount of the investment equivalent to 76.5 billion dollars. The majority of these projects were non-reimbursable funds and activities related to biodiversity conservation, integrated management of ecosystems, and sustainable use of resources. It is important to emphasize that a single project obtained USD$ 40 million, in the form of a loan[1].

[1] *Programa Desarrollo Sustentable Costa Pacífico*. Proyecto CO0059. Colombia. Fecha de aprobación 06-JUL-1994.

Annex 2. National Capacity for the Biodiversity Information Management in Latin America and the Caribbean inside the IABIN Framework

Antigua and Barbuda
The website of the Environment Division - Ministry of Work, Transportation and Environment (http://www.environmentdivision.info/) provides static information of biodiversity; it describes the generality of several species of plants and animals of interest and selected papers on ecosystems. It provides news and information about environmental events, country's natural resources, including biodiversity, also has a portal BCH installed. There is no mention to IABIN or any of its thematic networks. This country is a member of the Commonwealth of Nations.

Argentina
The website of the National Environmental Management and Biodiversity Conservation (http://www.ambiente.gov.ar/?idseccion=8) is an administrative site of the Secretariat of Environment and Sustainable Development. It brings access to various sites that are responsible for the management and the study of biological resources. The Biodiversity Information System (SIB[1]) is maintained by the National Parks Administration (APN[2]) (http://www.sib.gov.ar/); it allows access to information of species in protected areas and mapping associated with protected areas. The Department of Biology, Biochemistry and Pharmacology of the Universidad Nacional del Sur is the I3N Leading Institution in the country. Its website (http://www.inbiar.org.ar/) provides access to information on invasive species in accordance with the I3N procedures. It allows institutions interested in participating in this network to download user and installation manuals of a web interface for sharing and managing information on invasive species. I3N leadership, the Biodiversity Information System (SIB) and the national node of GBIF are still not coordinated, but at least the last two are working on it.

Bahamas
The Commission for Environmental Science and Technology, Bahamas (BEST) (http://www.best.bs/) gives access to some documents on the management of natural resources and environmental impact studies. There are some policy documents relating to the conservation and use of the biodiversity. The Bahamas National Trust (http://www.bnt.bs/) has static information about endangered species, ecosystems and natural parks. There is a website of the IABIN National Focal Point, the Ministry of Agriculture and Marine Resources (http://www.bahamas.gov.bs/bahamasweb2/home.nsf) but there is no mention to IABIN in the website. National environmental data and information are available in the Internet through the World Resources Institute. This country is a member of the Commonwealth of Nations.

Barbados
There is a governmental website related to the biodiversity conservation in Barbados. The National Focal Point is the Ministry of Housing, Lands and Environment, (http://www.barbados.gov.bb/portfoli_housing.htm) but we could not find any mention to IABIN in this website. This country is a member of the Commonwealth of Nations.

Belize
The Ministry of Natural Resources and Environment of Belize (http://www.mnrei.gov.bz/) is the IABIN National Focal Point and is national node of the Mesoamerican Environmental Information System (SIAM[3]). It is a website with static administrative information concerning those activities of the ministry related with weather, land, geology and petroleum, forest and environment. CHM Belize (http://www.chm.org.bz/index.php) provides information about

[1] SIB: Sistema de Información de Biodiversidad
[2] APN: Administración de Parques Nacionales de Argentina
[3] SIAM: Sistema de Información Ambiental Mesoamericano

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procedures, legislation, expert events, a mapping tool and general information on biodiversity. CHM Belize has a recommended link to IABIN in its international links section. Belize Biodiversity Information System (http://fwie.fw.vt.edu/WCS/intro.htm) has a website maintained by the World Conservation Society (WCS) with information on species, sites of occurrence and references. The information is presented in a static format and focuses on groups of vertebrate species. This country is a member of the Commonwealth of Nations.

Bolivia

The IABIN National Focal Point of Bolivia is the Deputy Minister for Biodiversity, Forest Resources and Environment, Ministry of Rural Development, Agriculture and Environment (http://www.agrobolivia.gov.bo/index.php?cpo=mamb). Its website provides information and links to administrative regulations and different kinds of environmental documentation. The Biodiversity Information System (http://www.biodiversidad-bolivia.com/) gives access to lists of species of plants and animals of several groups of organisms, particularly those highly visible. It also allows access to static maps of coverage, endemism, species richness, density of population, protected areas, and so on. Additionally, the website of the Biodiversity Information System provides information on regulations, management plans, events, links, photos, tourism and bio. This is an initiative aimed at a wide audience that is interested in nature, promoted by following institutions: Association Armonia / Birdlife, BioTrade Sustainable Bolivia, Centre for Studies in Theoretical and Applied Biology - Biota, National Herbarium of La Paz, Bolivian Institute of Forestry Research Foundation, Friends of Nature, Faunagua Programme for the Conservation of Bats in Bolivia (PCMB[4]) and Environmental Protection Tarija (PROMETA[5]).

Brazil

Brazil is one of the American countries with the largest infrastructure for the management of biodiversity information. The Ministry of Environment is the national focal point in the IABIN framework. Its website (http://www.mma.gov.br/) gives multiple sources of information about policy and management, while allows links to thematic sites with specific information. The Ministry promotes the web portal of the Brazilian Biodiversity (http://www.mma.gov.br/portalbio). This is the site of the focal point of CHM Brazil, which provides general information on ecosystems and species of interest, as well as cover maps and documents related to biodiversity studies. It is related to the biosafety web portal of BCH Brazil. The Brazilian Institute of Environment and Natural Renewable Resources (IBAMA[6]) (http://www.ibama.gov.br/) provides documents on monitoring environmental licenses and legal environmental procedures.

There are many other institutions and initiatives working on biodiversity conservation in different levels. RcAmbiental (http://www.rcambiental.com.br/) has information on environmental legislation. The Environment Portal (http://www.portaldomeioambiente.org.br/) offers general environmentalist information. Atmosphere Brazil (http://www.ambientebrasil.com.br/) contains information of management and environmental sanitation. The Reference and Environmental Information Centre (CRIA[7]) (http://www.cria.org.br/), is a non-profit organization that promotes spreading of biological information of environmental and industrial interest, which contributes to the conservation and use sustainable biological resources of the country. It focuses on the structuring of information available online, on the development of information systems and on the participation as a node data provider to global networks as OBIS[8], GBIF[9], ITIS[10] among others. CRIA participates in the thematic network I3N of IABIN .

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[4] PCMB: Programa para la Conservación de los Murciélagos de Bolivia
[5] PROMETA: Protección del Medio Ambiente Tarija
[6] IBAMA: Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis
[7] CRIA: Centro de Referência em Informação Ambiental
[8] OBIS: Ocean Biogeographic Information System http:// www.iobis.org
[9] GBIF: Global Biodiversity Information Facility http://www.gbif.org

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Canada

The Biodiversity Convention Office is the IABIN National Focal Point of Canada; it is also the center of the Canadian Biodiversity Information Network (http://www.cbin.ec.gc.ca/index.cfm?lang=e). Its website provides general information on biodiversity and conservation. There are links to popular and technical information as well as to many publications. The Canadian Network works in a wide range of programs which include cross-cutting themes and actors from various levels, in order to implement provisions of the CBD and the national biodiversity strategy. The themes are agricultural biodiversity, ecosystem approach, indicators, biodiversity of islands, urban biodiversity, and invasive species, among others. There is a website on invasive species (http://www.ec.gc.ca/eee-ias/Default.asp?lang=En), but this is not articulated to the IABIN network I3N. This country is a member of the Commonwealth of Nations.

Chile

The National Environment Commission (CONAMA[11]) is the IABIN National Focal Point. Its website (http://www.conama.cl/portal/1301/channel.html) provides administrative and thematic information from the government. It is the point of accessing environmental management information, environmental services and governmental programs and general topics related to biodiversity. There are on-line services such as the System of Evaluation of Environmental Impact and the National Environmental Information System (SINIA[12]). SINIA (http://www.sinia.cl/1292/channel.html) provides information on natural resources, environmental pollution, wastes and regulatory documentation. It also provides guides, manuals and documents related to biodiversity, on the topics of forests, wetlands ecosystems, genetic resources, flora and fauna. The information in SINIA is presented by regions.

Colombia

The national focal point of IABIN and thematic networks in Colombia is the Alexander von Humboldt Institute (http://www.humboldt.org.co). The Humboldt Institute is responsible for focal points of CHM and BCH, as well as the coordination of the Biodiversity Information System of Colombia - (SIB[13]) (http://www.siac.net.co/sib). SIB is an alliance of institutions created to facilitate the management of data and information on biodiversity, and their availability to the public. Those institutions are research institutes of the National Environmental System of Colombia, research centers long career as the Institute of Natural Sciences of the National University of Colombia and various entities are linked through a distributed system an a scheme of regional networks, thematic networks and nodes. SIB gives information on specimens, species, and tools to manage biodiversity information.

Costa Rica

The IABIN National Focal Point of Costa Rica is the Ministry of Environment and Energy - (MINAE[14]). Its website (http://www.minae.go.cr/) provides information on environmental management and links to other sites with thematic information related to biodiversity. The National System of Conservation Areas (http://www.sinac.go.cr/) provides an overview of flora, fauna and ecosystems, natural resource management, as well as tourist information and maps of protected areas in the country. The National Institute of Biodiversity (INBio[15]) (http://www.inbio.ac.cr/es/default.html) is a research center created to conduct research and management of biodiversity. It is involved in two of the networks IABIN, ETN (ecosystems)

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[10] ITIS: Integrated Taxonomic Information System http://www.itis.gov
[11] CONAMA: Comisión Nacional del Medio Ambiente
[12] SINIA: Sistema Nacional de Información Ambiental
[13] SIB: Sistema de Información sobre Biodiversidad de Colombia
[14] MINAE: Ministerio de Ambiente y Energía - Costa Rica
[15] INBio: Instituto Nacional de Biodiversidad

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and SSTN (species and specimens). The Association for the Study and Conservation of Biodiversity (ACEBIO[16]) is the national leader of the I3N TN.

Dominica

The Ministry of Agriculture and the Environment is mentioned as the IABIN National Focal Point. However, it does not exist with that name anymore, so probably the responsibility was delegated in the Ministry of Health and Environment, or the Ministry of Agriculture and Fisheries. On the website of the CBD there is a document of the national strategy and plan of action for 2001-2005 biodiversity Dominica; in the document it is established (strategy number 9), the need to make an information system on biodiversity. It was impossible to find evidence of such a system on the Internet. This country is a member of the Commonwealth of Nations.

Dominican Republic

The Sub-secretariat of Protected Areas and Biodiversity of the State Secretariat for the Environment and Natural Resources (SEMARN[17]) is the IABIN National Focal Point in Dominican Republic. Its website (http://www.medioambiente.gov.do/cms/index.php) allows access to a National System of Protected Areas and to the sections of biosafety and invasive species; it has general information of activities related with those topics. In the case of invasive species there is a link to the thematic network I3N. The SEMARN also provides access to a geo-server developed in association with IABIN (http://maps3.cathalac.org/dominicana). There is a maps and metadata search service associated to the geo-server (http://www.medioambiente.gov.do/cms/index.php?option=com_mosforms&Itemid=172), as well as a Multiserver (Multi-server OpenGIS Web Mapping, http://clearinghouse5.fgdc.gov/multiviewer2/) also developed in the framework of collaborative projects with IABIN. The Multiserver can load layers of lakes, ponds, flood, wind, roads, rivers, isoyetas, hydrogeological and provinces of the Dominican Republic.

Ecuador

The National Biodiversity and Protected Areas Ministry of the Environment in Ecuador is the IABIN National Focal Point. Its website (http://www.ambiente.gov.ec/paginas_espanol/4ecuador/ecuador_megadiverso.htm) offers general information on the country's biodiversity, describes the state of the national protected areas, management plans and location. It also offers regulatory information of environmental management and licensing processes. It provides access to online services such as BCH Ecuador (called "Framework of National Biosafety") and to the Information System of Valued Species and Forestry Control (SIEVCOF[18]) (http://www.ambiente.gov.ec/sievcof.net2/index.php), which has restricted access. EcoCiencia, the Ecuadorian Foundation for Ecological Studies, is involved in two IABIN networks: ETN and PATN. Its website (http://www.ecociencia.org/index.php?option=com_frontpage&Itemid=1) provides access to corporate information and services provided by the laboratory of geographic information systems. It does not give basic or processed information about biodiversity in the Internet.

El Salvador

The Ministry of Environment and Natural Resources of El Salvador (http://www.marn.gob.sv/) is the focal point of global and regional initiatives for promoting awareness of the conservation and use of biodiversity. The Management Office of Biological Resources, under the General Directorate of Natural Heritage is responsible for the coordination of the focal points of CHM, CBD, IABIN and BCH (in preparation). It raised the establishment of a National Biodiversity Information System and the digitization of information on biological resources. The website of

[16] ACEBIO: Asociación para la Conservación y el Estudio de la Biodiversidad. http://invasoras.acebio.org/

[17] SEMARN: Subsecretaría de Áreas Protegidas y Biodiversidad de la Secretaría de Estado de Medio Ambiente y Recursos Naturales

[18] SIEVCOF: Sistema de Información de Especies Valoradas y Control Forestal

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the General Directorate of Natural Heritage (http://www.marn.gob.sv/index.php?fath=19&categoria=19) offers general information on goals, mission and activities carried out by different governmental offices. Information on wetlands and Ramsar sites are in the form of fact sheets in PDF, as well as management plans for protected areas. There are downloadable files of birds' lists, endangered species, formats of permissions and procedures.

Grenada

The Ministry of Finance is the IABIN National Focal Point in Grenada (Grenada, Carriacou and Petit Martinique), but there is no mention of the topic of biodiversity on its website (http://finance.gov.gd/). There is a website of CHM Grenada (http://grenada.biodiv-chm.org/index.php?menuid=1000&lang=en&cl=blue&q =) which reports some activities, even though there is no clarity about what is the office in charge of the CHM focal point. This country is a member of the Commonwealth of Nations.

Guatemala

The Technical Office of Biodiversity (OTECBIO[19], http://conap.gob.gt:7777/Conap/portal/otecbio) and the National Council for Protected Areas (CONAP[20], http://conap.gob.gt:7777/Conap/author/admin), both are the IABIN National Focal Point in Guatemala. There are two institutional information systems that include management of biological information, as part of the quantification of the natural capital of the country. One of them is the Environmental Information System of Guatemala (SIA[21]) (http://www.marn.gob.gt/sia/principio.htm) and the other one is the National Environmental Information and Spreading (SNIDA[22]) (http://www.sia.marn.gob.gt/). Both systems are maintained and integrated by the Ministry of Environment and Natural Resources (MARN[23]) (http://www.marn.gob.gt/).

On the environmental sector there are some institutions involved, the National Coordinator of Biological Diversity of Guatemala (CONADIBIO[24]); the National Council for Protected Areas (CONAP, http://conap.online.fr/primera.htm) containing images of maps of the protected areas in the country, tables and photographs of flora and fauna; the National Institute of Forests (INAB[25], http://www.inab.gob.gt/) with statistics and forest cartography, forest aptitude maps of the country; and the National Geographic Institute (http://www.ign.gob.gt/), which provides basic maps and some preliminary consultation services online. The Data Centre for Conservation (CDC- CECON[26]) is an initiative promoted by TNC, which conducts an inventory of species, ecosystems and protected areas using the methodology of Natural Heritage developed by TNC. Its website (http:// www.marn.gob.gt/cdc/Home.htm) provides general information about the operation of the Centre, but it does not give access to biological information. CHM Guatemala (http://www.chmguatemala.org) has information about cooperation and contacts.

Guyana

The Environmental Protection Agency Guyana is the IABIN National Focal Point. Its website (http://www.epaguyana.org/) has documents (downloadable), photographs, and information on procedures regarding environmental policy, education, protected areas, biodiversity research and environmental management. Many organizations have conducted studies on the biodiversity

[19] OTECBIO: Oficina Técnica de Biodiversidad
[20] CONAP: Consejo Nacional de Áreas Protegidas
[21] SIA: Sistema de Información Ambiental de Guatemala
[22] SNIDA: Sistema Nacional de Información y Difusión Ambiental
[23] MARN: Ministerio de Ambiente y Recursos Naturales
[24] CONADIBIO: Coordinadora Nacional de la Diversidad Biológica de Guatemala
[25] INAB: Instituto Nacional de Bosques
[26] CDC- CECON: Centro de Datos para la Conservación

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of Guyana and promoted the establishment of protected areas. Some of the most important are Smithsonian Institution, Missouri Botanical Garden, WWF, USAID and Conservation International. Each organization independently promotes the spread of the flora and fauna of Guyana, but usually also involves the University of Guyana. This country is a member of the Commonwealth of Nations.

Haiti

The Ministry of Environment of Haiti (http://unfccc.int/resource/ccsites/haiti/) is the IABIN National Focal Point, and the responsible of other international efforts to conserve biodiversity in the country. However, access to biodiversity data of Haiti is not allowed by now. Biodiversity data and information about the country are available on websites of the United Nations and the World Resources Institute (WRI).

Honduras

The Department of Natural Resources and Environment (SERNA[27]) is the focal point of IABIN in Honduras. Its website (http://www.serna.gob.hn/) incorporates tools for consultation and management of geographic information and also provides information on the approach to the National Environmental Information System (SINIA[28]), which is also a node of the Mesoamerican Information System (SIAM). The CHM in Honduras (http://indicadores.serna.gob.hn/dibio.serna.gob/) is operational too, and it provides information about biodiversity (species fact-sheets of the flora).

Jamaica

The Natural History Division of the Institute of Jamaica is the IABIN National Focal Point, as well as the thematic network I3N, CHM and BCH. Through its website (http://www.jamaicachm.org.jm/) it is possible to access different types of data sources and information on biodiversity and cooperation, research, dissemination and awareness; it also provides information on organizations and individuals who address the issue of biodiversity from multiple approaches. Sections with specific information on endangered species and ecosystems are under construction. The Institute of Jamaica is an agency of the Ministry of Information, Culture, Youth and Sports. This country is a member of the Commonwealth of Nations.

Mexico

The National Commission for the Knowledge and Use of Biodiversity (CONABIO[29]) is the national focal point of IABIN in Mexico. It manages the National Biodiversity Information of Mexico (SNIB[30]) and provides information on species of interest, ecosystems, standardization tools, contact information for researchers and institutions, as well as events and other information related to the biodiversity. The Conabio coordinates the organization of information from many research institutions and is the reference site in Mexico for the management of biodiversity information.

Nicaragua

The Environmental Information System of Nicaragua (SINIA[31]) is the IABIN National Focal Point. This system is coordinated by a governmental executive committee. Its website (http://www.sinia.net.ni/index.asp, currently under revision) provides information on institutional and regional nodes, information products in the form atlas, dynamic indicators, interactive maps, documents, experts and images. SINIA gives access to several licensing,

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[27] SERNA: Secretaría de Recursos Naturales y Ambiente
[28] SINIA: Sistema Nacional de Información Ambiental
[29] CONABIO: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. *www.**conabio**.gob.mx*
[30] SNIB: Sistema Nacional de Información sobre Biodiversidad de México. http://www.conabio.gob.mx/institucion/snib/doctos/acerca.html
[31] SINIA: Sistema de Información Ambiental de Nicaragua

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forestry, and land pollution databases. This system has an elaborate network of nodes that allows consultation on the part of various regional and local online. Through the Eco-Portal CCAD[32] is possible to obtain information on biodiversity in Nicaragua from many isolated initiatives (http://www.ccad.ws/ecoportal/biodiversidad/bionica.html).

Panama

The National Environmental Authority (http://www.anam.gob.pa/) is the IABIN National Focal Point and the national leader of the thematic network I3N in Panama. This entity is in charge of the Environmental Information System (SINIA[33]), defined as an organizational structure to coordinate the management and provision of data and environmental information. This structure is also a focal point of CHM, and it is in charge of the publication of environmental indicators. The SINIA's website (http://www.anam.gob.pa/Sinia/) delivers administrative and organizational information about the system and links environmental entities in the country. The Bureau of Protected Areas and Wildlife manages the National System of Protected Areas (SINAP[34]). The website (http://www.anam.gob.pa/areas%20protegidas/sinap.htm) of SINAP provides general information on the location, biota and documents relating to protected areas of the country, as well as lists of endangered species.

Paraguay

The Secretariat of Environment of Paraguay (SEAM[35]) (http://www.seam.gov.py/laseam.php) is the focal point of CHM and I3N, and together with the Data Center for Conservation (DGPCB) of TNC they are the IABIN National Focal Point. The project Paraguay Silvestre was developed by the SEAM to work on protected areas, with the support of UNDP and GEF; it focuses on conservation activities and participatory management in four areas of the country within the National System of Protected Areas of Paraguay (SINASIP[36]). Its website (http://www.paraguaysilvestre.org.py/sinasip.php) provides general information on the background and status of these protected areas, as well as some downloadable documents.
The CHM Paraguay is established, but currently, its website is not working. (http://www.seam.gov.py/enpab/chm/Presentacion_Anim.swf).

Peru

The National Ministry of Environmental (MINAM[37]) is the IABIN National Focal Point in Peru. The MINAM administers the National Environmental Information System (SINIA[38]) (http://www.conam.gob.pe:8080/sinia/), pretending to be the main environmental browser of Peru. The SINIA provides information on natural resources such as water, air and forests through a central, regional and binational[39] nodes; it gives access to documentation centers and downloadable documents on pollution and environmental management. The MINAM also administers the node CHM Peru (http://www.conam.gob.pe/chm/CHM.htm) and the focal point of the Cartagena Protocol; it is linked to nodes of national networks with information related to biodiversity and to international networks as GBIF, IABIN, GISIN[40], ANDINONET[41] and GTI[42]. CHM Peru provides information collected and processed on species and ecosystems of interest, contacts, and it is the main point of access to multiple sources of information on biological resources of the country.

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[32] CCAD: Comisión Centroamericana de Ambiente y Desarrollo
[33] SINIA: Sistema de Información Ambiental
[34] SINAP: Sistema Nacional de Áreas Protegidas
[35] SEAM: Secretaría del Ambiente de Paraguay
[36] SINASIP: Sistema Nacional de Áreas Protegidas de Paraguay
[37] MINAM: Ministerio del Ambiente de Perú. www.minam.gov.pe
[38] SINIA: Sistema Nacional de Información Ambiental
[39] Darwinnet with Ecuador (www.darwinnet.org)
[40] GISIN: Global Invasive Species Information Network http://www.gisinetwork.org
[41] BioNET-ANDINONET: The Andean partnership for taxonomy http://www.bionet-intl.org/opencms/opencms/whoWeAre/profiles/andinonet_p.jsp
[42] GTI: Global Taxonomic Initiative http://www.cbd.int/gti/

The Information System of the Biological and Environmental Diversity of the Peruvian Amazonia (SIAMAZONIA[43]) is the reference center for the Amazon region of the country. Its website (http://www.siamazonia.org.pe/) provides information and services similar to those of the CHM Peru and has details about the organizational structure of nodes. The National Institute for Natural Resources (INRENA[44], http://www.inrena.gob.pe/index_inicio.htm) is responsible for handling concessions, and permissions for using of biodiversity in Peru; it provides CITES permissions, and documents on procedures to be done in the natural areas by productive sectors. The Research Institute of the Peruvian Amazon (IIAP[45]) (http://www.iiap.org.pe/inicio.aspx) conducts research on the state of ecosystems and their uses in the Amazon region; it is a very important source of data and information. IIAP is the clearinghouse node of SIAMAZONIA.
The Natural History Museum, Ricardo Palma University is a national leader in the network I3N, however this initiative is not clearly linked with the national institutional framework developed for the issue of alien species.

St. Kitts & Nevis
The Department of Environment and Physical Planning of the Ministry of Sustainable Development is the IABIN National Focal Point in the island. There is a website that contains administrative information about activities of the Ministry. Information on biodiversity and natural resources of the country is available in international sites such as FAO, WRI and United Nations. This country is a member of the Commonwealth of Nations.

St. Lucia
The Ministry of Agriculture, Forestry and Fisheries of St. Lucia is the IABIN National Focal Point. It developed a national biodiversity program and a website (http://www.slubiodiv.org/) to publish all the information on activities and results of the program. Information is aggregated at the country-level and is available for download in PDF files. This program has the participation of governmental, private and international organizations with funding of GEF-UNEP. This country is a member of the Commonwealth of Nations.

St. Vincent & The Grenadines
Environmental Services of the Ministry of Health and Environment is the IABIN National Focal Point in the island. Its website just refers to a link to the Secretariat of the Convention on Biological Diversity[46]. This country is a member of the Commonwealth of Nations.

Suriname
The Ministry of Labor, Technological Development and Environment is the IABIN National Focal Point in Suriname. There is no website of the ministry available for viewing. The National Institute for Environment and Development in Suriname (NIMOS[47]), is responsible for advising to the Government on environmental matters and carry out environmental protection activities. Its website (http://www.nimos.org/en/welcome.html) has species lists, maps and documents on the biological resources of the country. Several international conservation and academic organizations have made actions in Suriname and the information obtained is directly reported by each of them.

Trinidad and Tobago
The Environmental Management Authority is the IABIN National Focal Point in the island. Its website (http://www.ema.co.tt/) provides information on environmental education, regulations,

[43] SIAMAZONIA: Sistema de Información de la Diversidad Biológica y Ambiental de la Amazonia Peruana
[44] INRENA: Instituto Nacional del Recursos Naturales
[45] IIAP: Instituto de Investigaciones de la Amazonía Peruana
[46] http://www.gov.vc/govt/Government/Executive/Ministries/Health&Environment/MHE_Int.asp
[47] NIMOS: Nationaal Instituut voor Milieu en Ontwikkeling in Suriname

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procedures, contamination, research papers and technical services. This country is a member of the Commonwealth of Nations.

United States

The IABIN National Focal Point in the United States is the National Biodiversity Information Infrastructure (NBII). NBII is a governmental program leaded by the Office of Biological Informatics of the National Geological Service (USGS), which meet together various kinds of participants throughout the country. NBII on its website (http://www.nbii.gov/portal/community/Communities/NBII_Home/) provides access not only to information on species, ecosystems, metadata, documents, websites, databases, etc.., but to standards, tools and technologies to manage, share and integrate biological information of multiple sources. NBII is a site of national and international reference for the management of biological information. The United States participate in thematic networks of IABIN through organizations such as the Coevolution Institute in the PTN and the Smithsonian Tropical Research Institute (STRI) in the ETN.

Uruguay

The Department of Environment of the Ministry of Housing, Lands and Environment is the IABIN National Focal Point in Uruguay. Its website (http://www.mvotma.gub.uy/dinama/index.php?option=com_frontpage&Itemid=1) provides general information on operational activities of the Department, which is also in charge of a National Environmental Information System (under construction). The Faculty of Science at the University of the Eastern Republic of Uruguay is the national leader of the network I3N (http://uruguayi3n.IABIN.net/); it has promoted several events to make public the schema of I3N inside the IABIN framework in Uruguay. There is a wide variety of organizations with activities on biological conservation and biodiversity research, but they are not linked each other.

Venezuela

The Office of National Biodiversity of the Ministry for the Environment of Venezuela (MARN[48]) is the IABIN National Focal Point. Its website (http://www.minamb.gob.ve/index.php?option=com_content&task=blogcategory&id=10&Itemid=63) provides general information on the issues addressed by this office, a list of projects and information associated with biosafety in PDF format. The biodiversity information is disseminated through various websites of many environmental non-governmental organizations, universities and research institutes that carry out activities in Venezuela.

* These countries are not represented in IABIN: Cuba and the overseas departments of France: French Guiana, Guadeloupe and Martinique.

[48] MARN: Ministerio del Poder Popular para el Ambiente de Venezuela

Summary of countries

Country / Region	Information System centralized	Web CHM	Opportunities	Description	Focal Point Operating
Antigua & Barbuda	yes	no	OECO, Commonwealth	General and static biodiversity information. Isolation of existing networks in the region.	no
Argentina	yes - protected areas	no	SIB Argentina	Data and information available for consultation in a variety of sources. Disconnection at national level.	no
Bahamas	no	no	OECO, Commonwealth	General and static biodiversity information. Isolation of existing networks in the region.	no
Barbados	no	no	OECO, Commonwealth	No information is available on the Internet.	no
Belize	yes - it is maintained by WCS	yes	CHM Belize, SIAM	No information is available on the Internet.	yes
Bolivia	yes - it is an alliance	no	Biodiversity Information System	Information available for on the Internet.	no
Brazil	no	yes	CRIA, CHM Brazil	Data and information available for consultation in a variety of sources. There are no links between thematic networks.	no
Canada	yes	no		Data and information available for consultation in a variety of sources. There is no links with I3N.	yes
Chile	yes	no	SINIA	Data and information available on the Internet.	yes
Colombia	yes	yes		Data and information available on the Internet.	yes
Costa Rica	no, although INBio does something similar	no	SIAM	Data and information available at INBio website.	no
Dominica	no	no	OECO, Commonwealth	No information is available on the web, with the exception of a PDF document in the CBD website.	no

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Country / Region	Information System centralized	Web CHM	Opportunities	Description	Focal Point Operating
Dominican Republic	no	no	SIAM	Information available on the Internet. Country has worked with IABIN the geospatial theme.	yes
Ecuador	no	no	Darwinnet to protected areas associated with CHM Peru	Information available on the Internet, it is managed by geographic EcoCiencia	no
El Salvador	no	no	SIAM	Data and information available on the Internet.	yes
Granada	no	yes, it is preliminary	OECO, Commonwealth	General and static biodiversity information. Isolation of existing networks in the region.	no
Guatemala	yes	yes	SIAM	Information available on the Internet.	yes
Guyana	no	no	Commonwealth	Information available on the Internet.	no
Haiti	no	no	Caribbean Environmental Program (CEP)	No information is available on the Internet.	no
Honduras	yes	no	SINIA	Information available on the Internet.	no
Jamaica	no	yes	OECO, Commonwealth	Information available on the Internet.	yes
Mexico	yes	no		Data and information available on the Internet.	yes
Nicaragua	yes	no	SIAM	Data and information available on the Internet.	yes
Panama	yes	yes, SINIA	SIAM	Information available on the Internet.	no
Paraguay	yes - protected areas	yes, the website does not work		Information available on the Internet.	no
Peru	yes, there are three, SINIA, CHM y SIAMAZONIA	yes	CHM Peru	Information available in the Internet.	yes
St. Kitts & Nevis	no	no	OECO, Commonwealth	No information is available on the Internet.	no

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Country / Region	Information System centralized	Web CHM	Opportunities	Description	Focal Point Operating
St. Lucia	no	no	OECO, Commonwealth	General biodiversity information available on the Internet.	no
St. Vincent & The Grenadines	no	no	OECO, Commonwealth	No information is available on the Internet.	no
Surinam	no	no	Nimos	Information available on the Internet.	no
Trinidad & Tobago	no	no	OECO, Commonwealth	Administrative information available on the Internet.	no
United States	yes	no		Data and information available on the Internet.	yes
Uruguay	no	no		Information available on the Internet at the University of the Republic.	no
Venezuela	no	no		Administrative information available on the Internet.	no

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Other relevant organizational structures

Regional Organizations

- The Organization of Eastern Caribbean States is a unit of the Environment and Sustainable Development (http://www.oecs.org/esdu/index.html). Its function is to assist member states with regard to sustainable use of natural resources to ensure the sustainability of the welfare of the people of the OECS. The website gives a list of environmental projects. Members: Anguilla, Antigua and Barbuda, Barbados, Belize, Cuba, St. Kitts, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, the Bahamas, Jamaica, Grenada.

- The Central American Commission on Environment and Development (CCAD) administers the Mesoamerican Environmental Information System (SIAM). This system integrates on its website (http://www.ccad.ws/siam.html) different national, regional and thematic nodes. From an Eco-Portal it is possible accessing to various sources of biodiversity processed information in countries of the region. Members: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and Dominican Republic.

- Caribbean Environmental Program (CEP) established by UNEP United Nations, to promote regional cooperation for the protection and development of the marine environment in the Caribbean region (http://www.cep.unep.org/).

- The Mesoamerican Biological Corridor Project (MBC), according to its webpage (http://www.tbpa.net/case_10.htm) is a concept of sustainable development for Mesoamerica that unites goals of conservation with sustainable development initiatives of local peoples throughout the region. Although the MBC has moved away from its original strong focus on a transboundary system of protected areas and connecting corridors, this remains to some degree at the heart of the MBC. It is a cluster of protected areas and the intervening land.

International Organizations

The Commonwealth of Nations (Commonwealth of Nations) is involved in environmental issues through their activities aimed at sustainable development. Technical cooperation is conducted through the Commonwealth Fund for Technical Cooperation (CFTC) (http://www.thecommonwealth.org/subhomepage/158192/). The Small Island Developing States allows for the design and monitoring of the environmental action plans of some states and encourages joint participation of these states in the global conventions relating to biodiversity. This program is supported by the Department of Economic and Social Affairs of the United Nations in the development of a website that promotes the establishment of a network with information about events and documents related to the topic of biodiversity, among others (http://www.sidsnet.org/).

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Functions of the National Focal Points of IABIN[1]:

- Serve as **national liaison on all IABIN issues**;
- Establish **national consultation mechanisms** as appropriate to stimulate national and subnational level involvement in IABIN activities;
- **Encourage the participation of national sources of original data** such as museums, herbaria including the possible formation of national information networks;
- Represent their governments' perspectives on technical issues;
- Seek funding opportunities for the development of biodiversity information and IABIN;
- Identify new project ideas and priorities for their countries;
- Remain informed of IABIN activities within their countries and act as a **clearinghouse** for such information;
- **Promote collaborations** between IABIN and other national and transnational initiatives, as appropriate;
- Act as a **primary communications link** for the network, keeping participating organizations informed concerning IABIN interests and activities.

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[1] "*Roles de los Puntos Focales Nacionales*" Inter-American Biodiversity Information Network. Available online at: http://www.iabin.net/index.php?option=com_content&task=view&id=32&Itemid=5. 5-Mar-2008. Bold terms were added later.

Institutions coordinating thematic networks and national focal points IABIN

Organization	Country/Region	Invasive Species (I3N)	Pollinators (PTN)	Ecosystems (RTE)	Protected Areas (PATN)	Species and Specimens (SSTN)	IABIN National Focal Point
Environment Division Ministry of Work, Transportation and Environment	Antigua & Barbuda						*
Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur	Argentina	x					
Museo Argentino de Ciencias Naturales	Argentina			x		x	
Dirección Nacional de Ordenamiento Ambiental y Conservación de la Biodiversidad/Secretaría de Ambiente y Desarrollo Sostenible	Argentina						*
Ministry of Agriculture & Fisheries	Bahamas	x					
The Bahamas Environment, Science and Technology (BEST) Commission. Ministry of Energy and the Environment	Bahamas						*
Ministry of Housing, Lands and Environment	Barbados						*
Land and Surveys Department/Ministry of Natural Resources and the Environment	Belize						*
Instituto de Ecología, Universidad Mayor de San Andrés	Bolivia	x					
Viceministerio de Biodiversidad, Recursos Forestales y Medio Ambiente	Bolivia						*
Fundação O Boticário	Brazil			x	**X**		
Instituto Horus	Brazil	x					
Universidade de São Paulo	Brazil		x				
Ministerio del Medio Ambiente	Brazil						*
Biodiversity Convention Office, Environment Canada	Canada						*
International Affairs Brach, Environment Canada	Canada						*

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Organization	Country/Region	Invasive Species (I3N)	Pollinators (PTN)	Ecosystems (RTE)	Protected Areas (PATN)	Species and Specimens (SSTN)	IABIN National Focal Point
Comisión Nacional de Medio Ambiente (CONAMA)	Chile	x					*
Instituto Alexander von Humboldt	Colombia	x			x	x	*
Instituto Nacional de Biodiversidad (INBio)	Costa Rica			x		**X**	
Asociación para la Conservación y Estudio de la Biodiversidad (Acebio)	Costa Rica	x					
Ministerio del Medio Ambiente y Energía (MINAE)	Costa Rica						*
Environmental Coordinating Unit, Ministry of Agriculture and the Environment	Dominica						*
Dirección de Vida Silvestre y Biodiversidad / Secretaría de Medio Ambiente y Recursos Naturales	Dominican Republic	x					
Subsecretaria de Áreas Protegidas y Biodiversidad, Secretaria de Estado de Medio Ambiente y Recursos Naturales	Dominican Republic						*
Dirección Nacional de Biodiversidad y Áreas Protegidas, Ministerio del Ambiente	Ecuador	x					*
EcoCiencia	Ecuador			x	x		
Recursos Biológicos, Ministerio de Medio Ambiente y Recursos Naturales	El Salvador	x					*
Planning Division, Ministry of Finance	Grenada						*
Oficina Técnica de Biodiversidad (OTECBIO), Consejo Nacional de Áreas Protegidas (CONAP)	Guatemala	x					*
Guyana, Environmental Protection Agency	Guyana						*
Ministry of Environment	Haiti						*
Corporación Cressida / Secretaría de Recursos Naturales y Ambiente (SERNA)	Honduras						*

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Organization	Country/Region	Invasive Species (I3N)	Pollinators (PTN)	Ecosystems (RTE)	Protected Areas (PATN)	Species and Specimens (SSTN)	IABIN National Focal Point
Natural History Division, Institute of Jamaica	Jamaica	x					*
Comisión Nacional para el Conocimiento y uso de la Biodiversidad (CONABIO)	Mexico	x					*
Ministerio del Ambiente y los Recursos Naturales (MARENA), Sistema Nacional de Información Ambiental (SINIA)	Nicaragua						*
Dirección Nacional de Patrimonio Natural / Autoridad Nacional del Ambiente (ANAM)	Panama	x					*
Centro de Datos para la Conservación (DGPCB), Secretaría del Ambiente, Presidencia de la República del Paraguay	Paraguay	x					*
Museo de Historia Natural, Universidad Ricardo Palma	Peru	x					
Ministerio del Ambiente - MINAM	Peru						*
Department of Physical Planning and Environment, Ministry of Sustainable Development	St. Kitts & Nevis						*
Ministry of Agriculture, Forestry & Fisheries	St. Lucia						*
Environmental Services, Ministry of Health and the Environment	St. Vincent & The Grenadines						*
Ministry of Labor, Technological Development and Environment	Suriname						*
Environmental Management Authority	Trinidad & Tobago						*
Coevolution Institute	United States		**X**				
National Biological Information Infrastructure (NBII)	United States	x	x				
Smithsonian Tropical Research Institute (STRI)	United States			**X**			
United States Geological Survey's Biological Informatics Office	United States	**X**					

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Organization	Country/Region	Invasive Species (I3N)	Pollinators (PTN)	Ecosystems (RTE)	Protected Areas (PATN)	Species and Specimens (SSTN)	IABIN National Focal Point
Biological Resources Division, US Geological Survey, US Department of the Interior	United States						*
Facultad de Ciencias, Universidad de la República Oriental del Uruguay	Uruguay	x					
Dirección Nacional De Medio Ambiente Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente	Uruguay						*
Oficina Nacional de Diversidad Biológica, Ministerio de Ambiente y los Recursos Naturales	Venezuela						*
Red de Herbarios de Mesoamérica y el Caribe	Mesoamerica					x	
NatureServe	International			x		x	
The Nature Conservancy (TNC)	International			x	x		
IUCN-Sur	International				x		
United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC)	International				x		
World Institute for Conservation and Environment (WICE)	International				x		
WWF	International				x		
Integrated Taxonomic Information System (ITIS)	International		x				

x Member of consortium
X Coordinating Institution
* IABIN National Focal Point

Source: IABIN National Focal Points. Information confirmed 30-Oct-2008. Available for download on the website http://www.IABIN.net

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Annex 3.

Libertad y Orden
Ministerio de Ambiente, Vivienda y Desarrollo Territorial

GUÍA PARA LA GEORREFERENCIACIÓN DE INFORMACIÓN SOBRE BIODIVERSIDAD

AÑO 2008

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CÓMO GEORREFERENCIAR INFORMACIÓN?

Este documento es producto de la revisión de guías, manuales y/o protocolos ya existentes, así como de la experiencia del trabajo de investigación biológica en campo y del manejo de información geográfica sobre biodiversidad. A lo largo del documento se recurre a citas y enlaces (sobre Internet), de forma que se llegue a instructivos reconocidos mundialmente (estándares) sobre ciertos procedimientos obligatorios. Para otros pasos, se hacen explicaciones cortas manejando, en lo posible, un lenguaje que no discrimina la disciplina de desempeño o nivel de conocimiento del lector, lo que promueve y permite su uso a todo nivel (diferentes investigadores, generadores o tomadores de información sobre biodiversidad).

Buena parte de éste manual cita e invita a la consulta del documento de Chapman y Wieczorek (2006). Este documento corresponde a uno de los productos del proyecto de BioGeomancer, y en él se describe la forma en que mejor se puede llevar a cabo la georreferenciación de datos biológicos (espécimen y de observación), a partir de la revisión de varios proyectos (MaNIS, MapSteDI, INRAM, GEOLocate, NatureServe, CRIA, ERIN, CONABIO, etc.) que previamente ya han desarrollado pautas y herramientas para georreferenciar y que constituyen un muy buen punto de partida. El documento proporciona pautas para la mejor práctica a nivel mundial para georreferenciación.

El proceso de verificación de una georreferencia o de toma de la misma, se trata a continuación, a manera de lista de chequeo, en la que según la situación del investigador se plantean tres posibles situaciones, cada una con la descripción de procedimiento a seguir. Tales situaciones pueden ser:

- Ya se tiene información con su referencia espacial y debe verificar que ésta última cumpla con el estándar planteado para IABIN.
- La información que se tiene no posee referencia espacial, o ésta es imprecisa y/o incompleta, debiendo tratar de asignar una o corregirla, según el caso.
- Tomará información a futuro, por lo que deberá seguir un procedimiento para la obtención de datos en campo, que posteriormente puedan ser incorporados a IABIN.

LISTA DE CHEQUEO

□	1	Tiene información……	SI (pasar a 2)
			NO (ver

			6)
☐	2	Tiene la información, el registro de georreferencia o referencia espacial? http://www.gbif.org/prog/digit/Georeferencing	SI (pasar a 3)
			NO (ver 5)
☐	3	Sobre el registro de la referencia espacial que acompaña la información:.....	(pasar a 3.1)
☐	3.1	El registro representa un punto?..... Posee un archivo de puntos	(ver 7 y luego volver a 4)
☐	3.2	El registro representa una línea?..... Posee un archivo de líneas	
☐	3.3	El registro representa un polígono o área?..... Posee un archivo de polígonos	
☐	4	El registro de georreferencia está completo ?..... Es confiable (fuente identificada) Posee coordenadas, datum y se conoce el error de exactitud de dichas coordenadas[141]	(ver 8)
☐	5	Cómo asignar una referencia espacial a una dato que no la tiene[142]?.....	(ver 9)
☐	6	Planea tomar información en campo y posteriormente desea registrarla en IABIN.....	(ver 10)
☐	7.	**Geometrías para la representación espacial (localización) de información sobre biodiversidad** Qué geometría tengo o deseo para la georreferencia?.....	(pasar a 7.1)
☐	7.1	Tiene puntos? (cuando se usan) • Geometría que permite representar información precisa respecto a ocurrencias, idealmente de *Especies, Especies Invasoras o Polinizadores*[143]. Esta ocurrencia de especies puede provenir de: - el simple avistamiento mientras la especie se alimenta (caza) o se aparea (reproducción-anidamiento), - de observación durante muestreo sobre estación de trabajo o - por asentamiento permanente o temporal de la especie (observación de nidos, huevos o juveniles). • Es una geometría alternativa para representar la ocurrencia dentro de una transecto de estudio, al cual se le quiere asociar un registro, siendo la geolocalización en éste acaso de aproximación media. • Alternativamente, los puntos pueden ser usados para la referencia espacial de *Ecosistemas* y *Áreas Protegidas*, ante la inexistencia	NO (pasar a 7.2)

[141] http://www.gbif.org/prog/digit/Georeferencing
[142] http://www.gbif.org/prog/digit/Georeferencing Apéndice página 45
[143] Redes temáticas de IABIN: Especies, Especímenes, Especies Invasoras, Polinizadores, Ecosistemas y Áreas Protegidas.

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		de otro referente geoespacial mas preciso, pero se usa en este último caso como el mínimo registro geoespacial del ecosistema o área protegida (punto medio interior que puede ser complementado con el radio de distancia de acción de la especie. **Requerimiento:** una pareja de coordenadas (latitud-longitud o eje X y eje Y, en metros).	
☐	7.2	Tiene líneas? • Geometría que permite representar información con aproximación media respecto a la geolocalización de asentamiento de *Especies*, *Especies Invasoras* y *Polinizadores* en un espacio mas amplio y menos definido, imposibilitado para de ser definido por varios puntos, e imposible de ser delimitado con una frontera (áreas a partir de polígonos). Puede usarse como fuente el punto inicial y final de transectos de trabajo de campo, recorridos geoposicionados mediante GPS (tracks[144]). • Es una geometría especialmente útil para la geolocalización medianamente aproximada o precisa de la ruta seguida por especies migratorias (o en movimiento). • Alternativamente puede usarse para representar el área de acción de las mismas, refiriéndose entonces a información de mediana a baja aproximación. **Requerimiento:** al menos dos parejas de coordenadas (latitud-longitud o eje X y eje Y, en metros) que representarán una línea recta. A mayor número de parejas de coordenadas (puntos), mejor delimitación de la línea por conexión de los puntos. O un vector o conjunto de vectores, ya sea, derivado de la conexión de puntos, o líneas georreferenciadas ya trazadas (cartografía).	NO (pasar a 7.3)
☐	7.3	Tiene polígonos? • Geometría que permite representar información geoespacial poco aproximada para ocurrencia de especies. El área delimitada representa entonces, el rango de movimiento de *Especies*, *Especies Invasoras* o *Polinizadores*. En algunos casos se suele utilizar el contorno correspondiente a la cobertura vegetal (terrestre) o subacuática (acuática) a la que se asocia la especie a reportar, situación que puede lograr llevar a una georreferencia de mediana aproximación. Puede provenir de la cobertura de la tierra o fondos subacuáticos cartografiados o de delimitaciones realizadas a partir de descripciones cuyo detalle permite mediana o baja aproximación en su geoposición, de acuerdo al detalle de tales descripciones respecto a la frontera. • Es la geometría mas precisa para la geolocalización de registros de *Ecosistemas* y *Áreas Protegidas*. Puede generarse a partir de la interconexión de puntos, por la interpretación de coberturas a partir de imágenes satelitales de tipo óptico (cobertura de la tierra o de fondos someros), por la delimitación de contornos sobre áreas de influencia de variables climatológicas y/o oceanográficas (temperatura, salinidad, etc) o por la digitalización de mapas ya existentes (digitales o análogos). Requerimiento: al menos tres parejas de coordenadas (latitud-longitud o eje X y eje Y, en metros) que representen un área al conectarlas. A mayor número de parejas de coordenadas (puntos), mejor delimitación del contorno. Existencia de un polígono georreferenciado ya trazado (cartografía).	Volver a 4

[144] http://www.elgps.com/diccionario.html http://www.isuzu4x4club.com.ar/CursoGPS.html

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☐	8	**Requerimiento de información mínima para el potencial ingreso de datos espaciales o de SIG al IABIN**	(pasar a 8.1)
☐	8.1	1. Es un registro de coordenadas (un par o varias en archivo tipo hoja electrónica[145])? • Cual es la fuente: identificar la fuente que generó la información. En lo posible, mencionar la institución o proyecto generadora de la información, así como la fecha de creación. • Posee coordenadas[146]: mencionar el sistema de coordenadas y unidades. • Posee datum[147]: describir el referencial completo. • Se conoce el error de exactitud de dichas coordenadas[148]: mencionar el valor de exactitud y sus unidades.	NO (pasar a 8.2) SI (pasar a 8.3)
☐	8.2	Es un registro en un archivo de algún formato cartográfico[149] de cualquier geometría (punto, línea o polígono)? • Cual es la fuente: identificar la fuente que generó la información. En lo posible, mencionar la institución o proyecto generadora de la información, así como la fecha de creación. • Posee coordenadas: mencionar el sistema de coordenadas y unidades. • Posee datum: describir el referencial completo. • Se conoce el error de exactitud de dichas coordenadas: mencionar el valor de exactitud y sus unidades. En general la información anterior deberá estar registrada en el METADATO[150] del archivo o archivos geográficos.	SI (pasar a 8.3)
☐	8.3	Para registro ideal dentro de IABIN, la configuración de la georreferencia deberá ser: • Fuente. • Coordenadas geográficas, usando grados decimales[151]. • Datum, una vez se tenga clara al descripción de todo el registro espacial de la información, entregar la información espacial basada en el referente espacial o datum WGS84[152], siempre y cuando se cuente con el conocimiento o la asesoría técnica especializada (sistemas de información geográfica u herramientas para proyección) para la proyección[153] de la información desde el referente espacial original, que puede variar por cada país o zona de planeta[11], al referente WGS84, reconocido y mundialmente utilizado. • Error de exactitud calculado.	FIN
☐	9	**Ubicación de datos carentes de georreferencia espacial, imprecisa y/o incompleta** Se presentan alternativas para lograr solucionar:	FIN

[145] Archivo tipo Excel (por ejemplo) http://titoazariel2.wordpress.com/2007/06/06/historia-de-la-hoja-electronica/
[146] http://www.gbif.org/prog/digit/Georeferencing páginas 68-70
[147] http://www.elgps.com/diccionario.html
http://www.isuzu4x4club.com.ar/CursoGPS.html
http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.search&searchTerm=datum
[148] http://www.gbif.org/prog/digit/Georeferencing páginas 22-31
[149] http://es.wikipedia.org/wiki/Shapefile
[150] http://www.udistrital.edu.co/comunidad/profesores/rfranco/metadatos.htm#metadatos http://www.gbif.org/prog/digit/Georeferencing
http://es.wikipedia.org/wiki/Metadato
[151] http://www.gbif.org/prog/digit/Georeferencing páginas 8-9
[152] http://www.gbif.org/prog/digit/Georeferencing vi, página 10,15,23-24
http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.search&search=true&searchTerm=WGS84
[153] http://leupold.gis.usu.edu/unix/imagine/FieldGuide.pdf Appendix B http://www.colorado.edu/geography/gcraft/notes/datum/edlist.html
http://www.colorado.edu/geography/gcraft/notes/datum/datum_ftoc.html

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		• Compilación de herramientas para georreferenciar http://herpnet.org/herpnet/Gazetteer/GeorefResources.htm • Descargar y revisar: http://www.gbif.org/prog/digit/Georeferencing página 21 en adelante. • Usar herramientas para localizar a partir de descripciones, o detallarlas para mejorar aproximación del dato espacial: http://www.gbif.org/prog/digit/Georeferencing página 44. • Si no se logra algo con las opciones anteriores, reportar: País de colecta, región y localidad[154].	
☐	10.	**Proceso para toma de datos en campo, cuya información permita ser incorporado a IABIN** Para la toma de datos en campo de describen el procedimiento mínimo que incluye tres etapas: preparación de la misión, la toma de información y su almacenamiento posterior.	(pasar a 10.1)
☐	10.1	**Preparación para salida al campo:** incluye la revisión de una lista de chequeo de material a llevar al campo, definir formulario de campo, hábitos para asegurar datos obtenidos durante el trabajo en campo.	(pasar a 10.1.1)
☐	10.1.1	Obtención del equipo para toma del dato geoespacial. Para esto se debe obtener un Sistema de Posicionamiento Global, cuyas iniciales en inglés responden a lo que se conoce como GPS[155]. Así pues, mediante el uso en campo del GPS[156] podremos obtener el dato de posición sobre la tierra del punto sobre el cual se esté toman el o los datos. Los hay de varias marcas o compañías fabricantes, de varios tamaños, materiales (resistente o no al agua o a la humedad) y por consiguiente de distintas exactitudes en el dato a reportar. En general a mayor número de satélites contactados mayor exactitud tendrá el valor de la coordenada registrada por el instrumento. Por consiguiente será muy importante al momento de tomar el dato, registrar también el valor de exactitud (error) del mismo, que se expresa en unidades de distancia. Para llevar a campo se deberá preveer tener al menos dos (2) GPS, en lo posible de las mismas características. Enlace para descarga de manuales y software de GPS para distintos fabricantes: http://www8.garmin.com/support/userManual.jsp?market=3&subcategory=All&product=All http://www.magellangps.com/products/gps_units.asp http://www.trimble.com/index.aspx http://www.leica-geosystems.com/corporate/en/downloads/lgs_page_catalog.htm?cid=227	(pasar a 10.1.2)
☐	10.1.2	Aprovisionamiento de baterías para GPS. Siempre es importante llevar a campo un conjunto de baterías suficiente……....	(pasar a 10.1.3)
☐	10.1.3	Aprovisionamiento del cable para descarga de datos desde el GPS a un computador y un software para realizar tal descarga…… Existen varias herramientas: http://www.easygps.com/ http://es.wikiloc.com/wikiloc/help_q7towin_es.html http://www.download.com/G7ToWin/3000-12940_4-10676231.html http://www.gpsbabel.org/download.html	(pasar a 10.1.4)
☐	10.1.4	Configuración del GPS. Antes de salir a campo se deberá hacer una prueba de funcionamiento y exactitud del GPS, así como la correcta configuración del sistema. Si se puede lograr, tratar de calibrar el instrumento[157]. Los parámetros a ajustar, siempre serán:	(pasar a 10.1.5)

[154] http://www.statoids.com/

[155] GPS (Sistema de Posicionamiento Global): es un sistema que proporciona una dirección disponible nueva, única e instantánea para cada punto de la superficie del planeta. De origen militar, en la actualidad emite también una señal para usos civiles. Aunque GPS no es una tecnología genérica sino una concreción de los sistemas de posicionamiento mediante radiofrecuencia propiedad del Departamento de Defensa de los EE UU, en la práctica hoy por hoy constituye un nuevo estándar internacional que permite determinar ubicaciones y distancias. Asociado a otras tecnologías, el GPS permite, también, localizar objetos y personas http://www.gps-para-pda.com/que-es-gps.html
Diccionarios: http://www.alegsa.com.ar/Dic/gps.php http://www.isuzu4x4club.com.ar/CursoGPS.html

[156] Enlaces instructivos para uso de GPS: http://www.manualscout.cl/ficha-127.htm
http://www.ibcperu.org/doc/public/src/00362.pdf http://www.portalplanetasedna.com.ar/gps.htm
http://www.trimble.com/gps/whygps.shtml http://www.el4x4.com/spa/item/CursoGPS.html
http://www.elgps.com/faq.html

[157] La calibración del GPS consiste en la comparación del registro de una coordenada, en el instrumento, de un punto geodésico (procedimiento opcional).

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		Unidades[158]: Formato de la coordenada (grados decimales –máximo 8-). Datum: Se refiere al punto geográfico referencial. Idealmente usar WGS84, mundialmente utilizado. Pero también puede usar el utilizado para el país, por la institución o organismo encargado de la cartografía nacional. En éste último caso, se preferirá una vez finalizada la toma de la información, realizar la proyección del dato al referencial WGS84, preferido para IABIN (ver 8.3). Unidades de medición: Se refiere a las unidades empleadas para la medición de distancias lineales con el instrumento (GPS). Generalmente se selecciona de acuerdo al sistema de medidas (Sistema Métrico Decimal o Sistema Inglés) adoptado por el país. Hora (zona horaria)[159]: asignar la que corresponde a la ubicación del respectivo país. Fecha: se actualiza al definir la zona horaria y con la señal de los satélites.	
☐	10.1.5	Formulario de campo. Se refiere a las tablas diseñadas para el almacenamiento de la información registrada durante la visita al campo. Estos formularios deberán incluir al menos tres columnas en las que se pueda registrar la fecha, hora y el número del consecutivo del punto marcado (waypoint[160]). Esta información constituirá la parte del dato que se referirá a la geoposición, acompañando al resto de las anotaciones o registros de información. Se recomienda, también, especificar el modelo del GPS utilizado ese día del trabajo. Modelo GPS | Fecha | Hora | Waypoint | Error | Anotaciones[161]	(pasar a 10.2)
☐	10.2	**Trabajo en campo:** Antes de dar inicio a la jornada de trabajo, se deberá encender el GPS con anticipación (5 minutos aprox.), permitiendo así la búsqueda de señal satelital para dar comienzo al registro de datos de geoposición con el mínimo de error en exactitud posible.	(pasar a 10.2.1)
☐	10.2.1	Realizar sincronización de relojes de los investigadores en campo con la hora y fecha del GPS (y del computador a utilizar durante el trabajo, en caso de tenerlo).	(pasar a 10.2.2
☐	10.2.2	Toma de información durante el trabajo de campo. Qué registro voy a realizar ?	(pasar a 10.2.2.1)
☐	10.2.2.1	*Especies, Especímenes, Invasores* y *Polinizadores* pueden ser georreferenciados usando cualquiera de las 3 geometrías ya descritas (ver 7), cada una entregará distinta aproximación. Idealmente la ocurrencia de una especie se debe registrar como un punto. El punto es una geometría simple que se obtiene directamente con el uso del GPS.	SI (ver 10.2.3) NO

[158] http://www.gbif.org/prog/digit/Georeferencing página 8
[159] http://www.fgienr.net/time-zone/ http://enciclopedia.us.es/index.php/Zona_horaria http://guiadelmundo.com/docs/hora/ Definición: http://www.hora.es/cultura/zonahoraria.jsp
[160] http://www.elgps.com/diccionario.html http://www.isuzu4x4club.com.ar/CursoGPS.html
[161] Corresponde a comentarios referentes al dato de posición (localidad, descripción del paisaje, etc), de forma que lo complemente.

			(pasar a 10.2.2.2)
☐	10.2.2.2	*Ecosistemas* y *Áreas Protegidas,* estos exigen más información espacial para su geolocalización, y asimismo más herramientas para su delimitación. En campo, idealmente pueden ser georreferenciados sobre tres situaciones, dependientes de la disponibilidad de ayudas y/o herramientas:	(pasar a 10.2.2.3)
☐	10.2.2.3	Con ayuda de herramientas de teledetección previamente procesadas, o mapas preexistentes. Es decir usando imágenes satelitales en papel (mapa-imágenes), o mapas de cobertura de la tierra (recientes), se puede lograr la delimitación exacta del área de interés, asociando los atributos del trabajo de campo al área definida. Permitiendo esto, generar fácilmente cartografía (posteriormente).	SI (ver 10.2.3) NO (pasar a 10.2.2.4)
☐	10.2.2.4	Usando solo la observación en campo y algún mapa topográfico. De acuerdo a la extensión del área a caracterizar, se podrán hacer recorridos bordeando el contorno del área, o en su defecto marcando "waypoints" sobre extremos de un polígono de forma tal que contenga el área de interés, buscando obtener tantos puntos como el polígono demande para definirla, sin sobre o sub estimar el área a contener[162], de interés. Esto permite luego realizar una estimación de la superficie además de la localización. En casos en que el área sea de gran extensión y/o de difícil acceso, se podrá tratar de definir límites hacia los 4 puntos cardinales, o usar el mapa de campo para localizar tales límites a partir de localidades o accidentes de relieve, por ejemplo.	SI (ver 10.2.3) NO (pasar a 10.2.2.5)
☐	10.2.2.5	Sin ayuda cartográfica alguna, usando solo la observación en campo. Si otra ayuda además del GPS durante el trabajo de campo, será necesario mas esfuerzo. Al menos tratar de registrar bordes, o un punto medio y un radio a partir del mismo, en un intento por definir un círculo que contenga el área de interés. Este tipo de georreferencia, deberá ser descrita y tratada con sumo cuidado, ya que se logra tan solo una referencia regional o local de baja exactitud.	SI (ver 10.2.3)
☐	10.2.3	Finalizada la jornada de trabajo del día, grabar el recorrido o "Track"[163] en la memoria del GPS.	(pasar a 10.2.4)
☐	10.2.4	Descargar la información obtenida del día (waypoints y tracks) en el GPS, realizando copias de seguridad. Esto se puede hacer usando un computador, el cable de descarga GPS-PC y un software de descarga de datos[164].	FIN

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[163] http://www.elgps.com/diccionario.html http://www.isuzu4x4club.com.ar/CursoGPS.html
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