Integration of Biodiversity Database in Taiwan and Linkage to Global Database

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Abstract

Background

Although the land of Taiwan is not large, it possesses extraordinarily abundant biodiversity resources and many endemic species. To properly manage and utilize these resources, a complete database and a national website for biodiversity must be built in advance in order for the public to easily retrieve all the relevant information. Furthermore, the establishment of a biodiversity database is fundamental to the promotion of conservation, education, and biodiversity research.

The biodiversity databases in Taiwan were dispersed to various institutions and colleges with limited amount of data by 2001. The information of Catalog of Life, specimens, and alien species were not integrated until the five-year program, National Digital Archives Program from 2001-2006. Meanwhile, Biodiversity Action Plan was enacted by Executive Yuan, and it is requested by National Science Council, Academia Sinica and various institutions to establish databases and integrated together under a national portal for biodiversity.

Department of Life Sciences, National Science Council appointed Academia Sinica to gather taxonomists to construct the Catalog of Local Experts and the Catalog of Life (excluding alien species) for Taiwan biodiversity from 2002 to 2004. The catalogs were placed under Taiwan Biodiversity National Information Network (TaiBNET) http://taibnet.sinica.edu.tw. Presently,

more than 10 institutes and museums that collect the specimen data (animal and plant) and distribution information of Taiwan are integrated by Darwin Core and they can be queried via Union Catalog of National Digital Archives Program, TaiBIF, and TaiBNET. Figure 1 show how these databases were integrated based on the species names and GIS distribution as the primary key. The integrated databases allow users to search for various species web pages by the name and distribution of the species by using GIS technique.
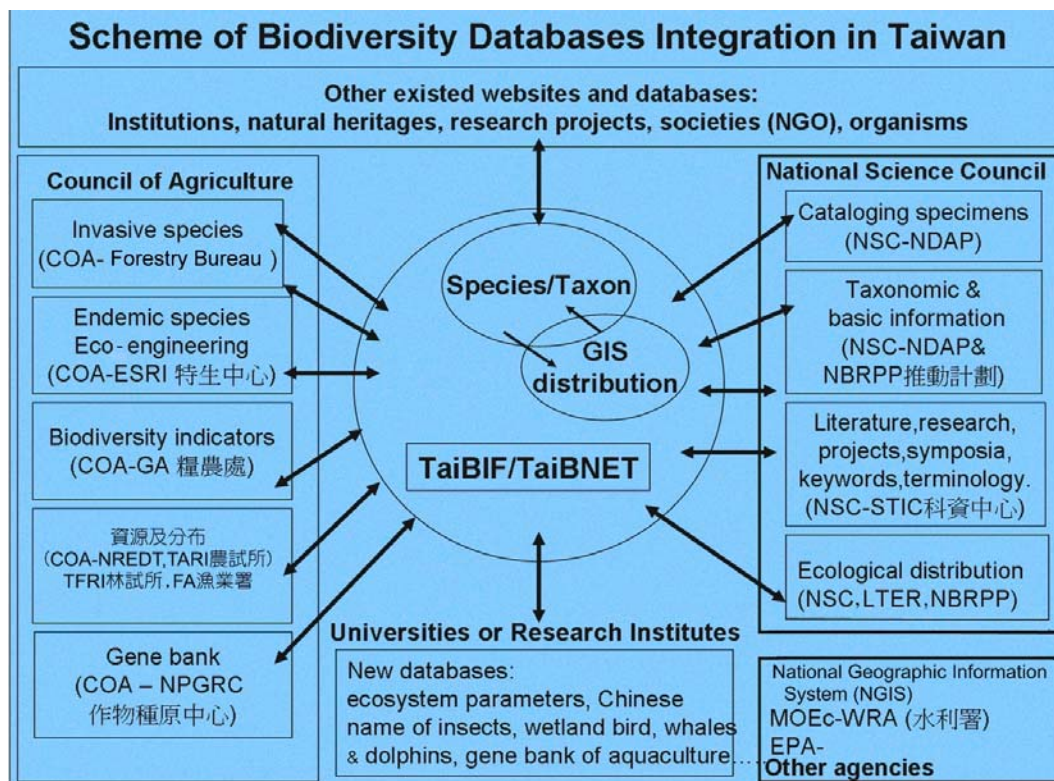

Figure1. The established and integrated databases of Biodiversity and Eco-Engineering take the species and GIS distribution as the primary key.

TaiBIF -- Taiwan portal of GBIF

TaiBIF stands for Taiwan Biodiversity Information Facility and is in charge of integrating Taiwan's biodiversity information, including Catalog of Life (a list of Taiwanese native species) and local experts, the illustrations of species, the introduction of native species and invasive species, Taiwan's terrestrial and marine organisms, biodiversity literature, geographical and environmental information, information about relevant institutions, organizations, projects,

observation spots and publications, etc. Furthermore, TaiBIF uses DiGIR (Distributed Generic Information Retrieval) with Darwin Core as its standard to reach the goal of data exchange. Both Chinese and English websites of TaiBIF are online for public use (Figure 2) http://taibif.org.tw .

Figure 2. Website of TaiBIF. (in Chinese)

There are three ways of connecting and sharing data from local databases to global databases/networks (Figure 3). (1) The linkage of global species databases with the Fish Database of Taiwan and FishBase by life taxa. (2) The connection through national nodes like TaiBIF to GBIF. (3) The linkage to local Species 2000 AO.
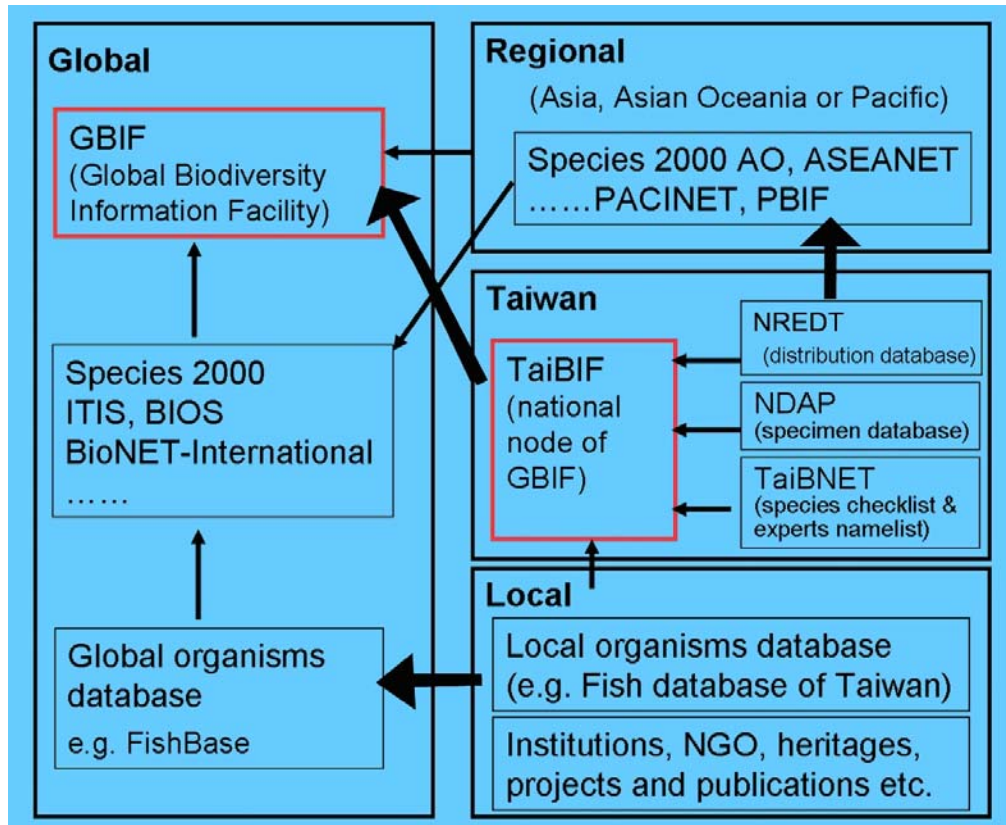
Figure 3. Integrate Taiwan Biodiversity National Information Network with global databases.

Content of TaiBIF

1. Catalogs of Life and Local Experts on Biodiversity

TaiBIF is derived from the Catalog of Life and the Catalog of Local Experts on Biodiversity established by the Taiwan Biodiversity National Information Network (TaiBNET). The TaiBNET database has recorded around 46,000 indigenous species and 650 local experts on biological diversity. It provides a search engine for data query based on an up-to-date database. The information includes classification hierarchy, Chinese name, author and year, and authorized citation, and can be retrieved via species name, classification hierarchy, and full text search.

2. Furthermore, users can click on the species hyperlink with the text of the scientific name and link to domestic or global databases as NDAP species data, Species 2000, and Discover Life to retrieve the details, such as the descriptions of characteristics, pictures, habitats, specimen records,

relevant literature, geographical distribution, etc.

3. Integration of Specimen, Observation and Habitat Databases

TaiBIF provides a search engine for specimens, observation records, and distribution of native species. TaiBIF visitors can easily retrieve information about the distribution, habitat, specimen records, observation records, and ecological function of the species. The specimen data are the research results of NDAP. The observation data are collected by various experts from field studies and EIA reports sponsored by NSC, COA, or the Ministry of the Interior (MOI).

4. Ecological Image System

The system provides services including catalog service, map service, photograph query, photography upload, and geography tags.

Data Providers of TaiBIF

TaiBIF not only collects the local species lists and their specimens, distributions, photographs, and habitats, but also cooperates with 3 major organizations and 2 universities in Taiwan for different purposes as following:

1. Science and Technology Information Center, National Applied Research Laboratories (STIC): Linkage the biodiversity database of documents and workshops between TaiBIF and STIC.

2. Council of Agriculture and National Taiwan University: To inquire about 'Natural resources and Ecology GIS database in Taiwan' and 'The Biodiversity Information of Taiwan R.O.C.' for related laws, regulations, policy and the international trend.

3. Ministry of Education and National PingTung University of Science and Technology: To inquire about education information and make linkage with Taiwan Forestry Research Institute's "100 of the World's Worst Invasive Alien Species and Endangered Species

Database" and Endemic Species Research Institute's Eco-engineering Database, and National Plant genetic Resources Center's Germplasm Bank.

In addition, TaiBIF also supplies the information of national related organizations, publications, national parks, activities and news.

Future Developments of TaiBIF

More than 311,000 people have browsed TaiBIF site since July 2004. So far, TaiBIF will be greatly improved once 150,000 specimen records become available in 2006. The future developments of TaiBIF are as follows:

1. Continue to collect new biodiversity data and photos and integrate other sources into TaiBIF with the function for the new data.

2. Cooperate with government agencies and various institutions to facilitate the establishment, exchange and integration of biodiversity information, including National Geographic Information System, Encyclopedia, Eco-engineering, germplasm bank, resource distribution, ocean, alien invasive species, agriculture, Ecological Observation Grid, environmental assessment, science education, specimen archives, references, and genetic codes.

3. Introduce advanced information technology to TaiBIF, such as Data Grid, Web Service, Data Mining tools, etc. And construct TaiBIF as a knowledge management platform to provide more comprehensive and powerful services.

4. Apply international standards, such as EML (Ecological Metadata Language), into TaiBIF and facilitate international cooperation.

5. Participate in international organizations such as GBIF, OBIS, Barcode of Life Data Systems (BOLD), CMOLD, Discover Life, etc., and improve international cooperation.

After completing the steps mentioned above, TaiBIF is expected to become a data sharing platform, an information generating engine, a bridge between Taiwan and the world, and a foundation for future biodiversity studies.

The future task in 2006-2007 including:

1. provide over 150 thousand digitalized specimens to Global Biodiversity Information Facility (GBIF)

2. Collect over 5,000 domestic lives in specimen and ecological photographs

3. Increase species records to 47,000 and establish introduced species checklist

4. Biota Taiwanica (English edition) will be internet access

5. Establish domestic reference of database including the retrieve and integration of books, documents, compact disk and database

6. Integration of ecological distribution of the plant species, animal and marine life.

Biodiversity Informatics is an emerging field to provide integrated services of distributed multi-model, multi-type and multi-disciplinary content resources, and to foster new research paradigm and new knowledge from them. A new infrastructure supporting better data collection, analysis, query and access, management, resource discovery, and dissemination is necessary to meet the requirements of biodiversity researchers, data curator, and museums etc. TaiBIF is an organization which collects and integrates biodiversity data of various institutes in Taiwan. Based on the experiences of TaiBIF and related works, a web-based content management system (CMS) would be the most viable solution to reach the goals stated previously.