SHORT COMMUNICATION

Sharing Italian Botanic Gardens’ living collections: The role of the National Biodiversity Network

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Abstract

This paper presents the role of the Italian National Biodiversity Network in making available biodiversity data from Italian Botanic Gardens at a national and international level. The case study of the Botanic Garden of Rome is presented explaining procedures and methods for collecting georeferenced data on living plant species and making them available through web-based applications.

Keywords: BioCASE, Botanic Gardens, GBIF, BGCI, web-GIS

Background

Since its institution in May 2012 (Martellos et al. 2011; Attorre et al. 2013), the Italian Biodiversity Network (IBN; http://www.naturaitalia.it/banchediati.do) has been rapidly developing and growing in terms of data availability, partners, and functionalities.

Data availability: at the moment, about 2.3 million records of primary biodiversity data of plant and animal species from about 60 database are aggregated and made accessible through the portal; the latest acquisition is the Italian vegetation database, provided by the Italian Botanical Society, which includes plant species occurrences from georeferenced published phytosociological relevés over the last 20 years (Blasi et al. 2011; Landucci et al. 2012; Chytry et al. 2016; Lucarini et al. 2015) with a total of about 380,000 records for 5519 taxonomic entities across the country.

In the next future, the Portal will integrate also data related to species such as repositories of the ecological data, for instance the re-calibrated ecological indicators developed for the Italian territory (Pignatti 2005), of morpho-anatomical data, which are used in the production of digital identification keys (Martellos 2010) and for morphological analyses (e.g. Viscosi et al. 2009), and of available image archives for several groups of plants and animals (see e.g. Nimis et al. 2003, http://www.dryades.eu).

Partners and data provider: at the moment, six universities, the Institute for Environmental Protection and Research, the National Forest Service, the Toscana Region, the Lazio regional biodiversity observatory, the national park of Abruzzo, Lazio and Molise, and the Civic Natural History Museum of Verona have joined the Network. This result is not surprising since universities are the main collectors and users of primary biodiversity data. However, mechanisms should be put in place to enlarge the number of partners, for instance establishing appropriate monitoring procedures for protected areas, and supporting the digitalization of their collections for natural history museums.

Functionalities: a significant increase in query rate was achieved, thanks to an Extract, Transform, Load process that queries the BioCASE web services (Biological Collection Access Service; http://www.biocase.org) of all the remote nodes (Focal Points). Data are harvested with the BioCASe protocol and returned as Accessing Biodiversity Collections Data (ABCD)-structured documents. Returned data
Figure 1. Map of the woody plants collected in the Botanical Garden of Rome.
are loaded into a staging database where they are transformed to match the data warehouse schema and loaded into the data warehouse database for online analysis. Differential updates of the data warehouse are scheduled periodically. Query results are downloadable in CSV format so as to be immediately used by modeling tools such as Maxent (Phillips & Dudik 2008; Alfaro-Saiz et al. 2015) and Biomod (Thuiller et al. 2009). Species occurrence data are integrated with a geo-portal where ecological maps such as bioclimate, ecoregions, potential natural vegetation, and others (Smiraglia et al. 2013; Blasi et al. 2014), and updated administrative boundaries (Protected areas, Natura 2000 sites) can be visualized and downloaded to be used for analytical and modeling purposes.

**Italian Biodiversity Network and Botanic Gardens**

Within this context, the IBN can also play an important role in making available to the public biodiversity data from Italian Botanic Gardens (IBGs). A first important step was to include in the Network the database containing the occurrence of both allochthonous and autochthonous species collected from a network of 34 IBGs and listed in the annexes and appendices of the Convention on International Trade in Endangered Species (CITES; also known as the Washington Convention). The database, CITES & IBGs (http://www.societabotanicaitaliana.it/cites/), was created to contribute to the objectives and targets of the Global Strategy for Plant Conservation and currently contains 4901 occurrences, georeferenced according to the centroid of the IBGs, for a total of 1604 taxa many of which, according to IUCN criteria, are seriously threatened of extinction, such as Copiapoa fieidleriana (K.Schum.) Backeb., Encephalartos horridus (Jacq.) Lehm., Euphorbia cylindrifolia Marn.-Lap. & Rauh, Mammillaria carmenae Castañeda, Oroya peruviana (K. Schum.) Britton & Rose, and Swietenia mahagoni (L.) Jacq. (Anzellotti et al. 2014).

However, IBGs host a much greater plant species richness accumulated in the course of decades that deserves to be made available to a number of potential stakeholders including curators, gardeners, conservation biologists, taxonomists, and ecological tourists through the network.

In this paper, we describe the case study of the Botanic Garden of Rome (BGR) that can be replicated at a national scale.

In order to share data through the IBN, it was necessary to record the georeferenced location of all woody plants growing on the ground, being acclimated to the current climatic conditions of area. As a first step, an accurate planimetric map of the BGR was produced using a system composed by a Differential Global Positioning System and Total Station. Then, all the woody plants were mapped using the same system with a centimeter spatial accuracy (Figure 1). A total of 1590 specimens of woody plants were recorded, belonging to 113 families, 278 genera, and 500 species whose nomenclature refers to the Catalogue of Life 2015 checklist (http://www.catalogueoflife.org/).

All this information can be visualized through a web-based GIS application developed using ArcGIS Server software with a dedicated Flex–XML graphical interface and available at the BGR website (https://web.uniroma1.it/ortobotanico/). Taxonomic and spatial query tools allow the users to retrieve the information on what and where to find within the BGR.

The final part of the whole process was to insert the georeferenced data (Martellos & Attorre, 2012) in the IBN. The IBN uses the BioCASE protocol, and ABCD as Data Standard. Data from BGR were flagged by selecting in the standard terms catalog the “naturalized” status for the “establishment means” concept.

A further important development for IBGs is the collaboration with international aggregators of biodiversity data such as the Global Biodiversity Information Facility (GBIF – http://www.gbif.org/). While the whole IBN is not aggregated with the GBIF yet, IBGs can ask for an endorsement by a thematic node as the Botanic Gardens Conservation International (https://www.bgci.org/), the largest Botanic Gardens network, which, since 2004, is facilitating the transfer of information from plant institutions into GBIF’s database. Another possible option is to join the BioCASE Europe network as data providers, hence being eventually aggregated with the GBIF together with all BioCASE Europe data.

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Supplemental data

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