Geospatial Web services applied to Species Distribution Modelling Network

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Abstract. *Biodiversity researchers build up predictive models for species distribution. These models are useful for biodiversity conservation policies. Species distribution modelling needs data from several sources and produces results of different algorithms. To advance biodiversity science, scientists need to share models, data and results. This paper presents the Web Biodiversity Collaborative Modelling Service (WBCMS), a set of geospatial Web services that enables sharing of species distribution models and results. WBCMS is part of the OpenModeller, an international project for collaborative building of biodiversity models.*

1. Introduction

Biodiversity research deals with huge volume of data from different sources. Methods for data analysis are largely used to allow researchers make inferences about diversity, abundance and spatial distribution of species over different geographical areas. By combining features of the physical landscape and the biological information of the species under investigation, biodiversity researchers build up predictive models for species distribution. Models are useful to help biodiversity preservation. There is a lot of knowledge hidden on the model's output. Biodiversity knowledge is essentially inserted on the modelling process, as well as, on the species distribution map or other results of a particular model. In order to advance on biodiversity science, scientists should exchange models and their modelling process besides sharing data and conclusion notes. So, collaboration among researchers is not only about data exchanging. It involves interaction between the scientific models, as well as program aggregation and comparison of experiments [Osthoff, Almeida, C.V.Monteiro et al. 2004].

This scenario points to the need for a computational infrastructure that supports collaborative biodiversity studies, allowing sharing of data, models and results [Ramamurthy 2006]. In this text, we present an approach that supports cooperation for biodiversity modelling. We describe a set of geospatial Web services that support knowledge sharing, the Web Biodiversity Collaborative Modelling Service (WBCMS). The architecture proposed is part of the OpenModeller[1] Project [Muñoz 2004; Giovanni 2005].

[1] http://openmodeller.cria.org.br/

This paper is organized as follows. Section 2 presents WBCMS and a prototype. Section 3 shows final comments.

2. WBCMS

Consider a distributed environment in which researchers perform species distribution modelling locally, and wish to share their experiments through the Web. In this context, we propose the Web Biodiversity Collaborative Modelling Service (WBCMS). It is a set of geospatial Web services that shares explicit and implicit knowledge about model generation and results (Figure 1).

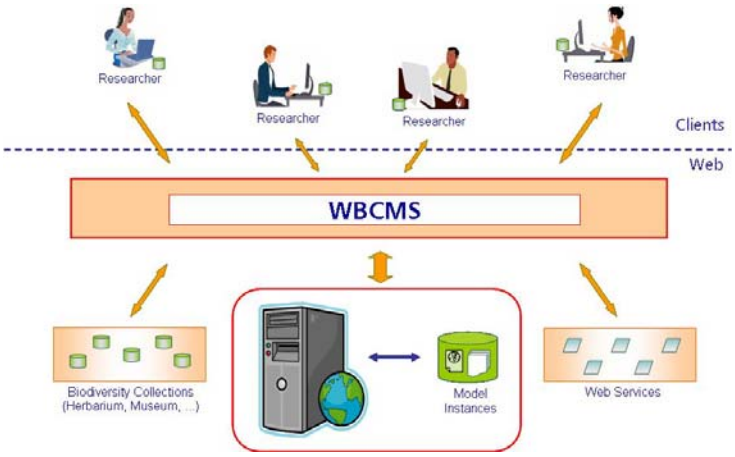

Figure 1. WBCMS Architecture

The key idea in WBCMS is a *model instance*. A model instance aims to capture all relevant information about how a model is run. A model instance includes data and metadata on models, results and algorithms that describe an experiment as a whole. They are based on the modelling results. However, the researcher should add other data to complement the model instances with information about the experiment. The WBCMS builds a catalogue of model instances and deals with remote data and Web services.

The scientist uses a browser for accessing model instances at the server. This application supports geospatial and textual queries, such as *"Are there model results for this region?*", and *"If I have a problem, how can I look for similar results?"*. The idea is that the researcher examines model instances, and learns from them. He should be able to understand how a result was produced. He also should be to compares experiment results, to reproduce them, and to use them for his own models.

2.1. Prototype

We have implemented a WBCMS prototype using Apache Server, PHP and MySQL. We have used *Coccocypselum erythrocephalum* Cham. & Schltdl species to illustrate WBCMS use. Initially, OpenModeller Desktop tool performed a predictive species distribution model. Then we used a client form to send model instance components to WBCMS. It's a client application form with model instance metadata, and model data with taxonomic data related to *C. erythrocephalum* species. Researcher can visualize model instance by a browser (Figure 2).

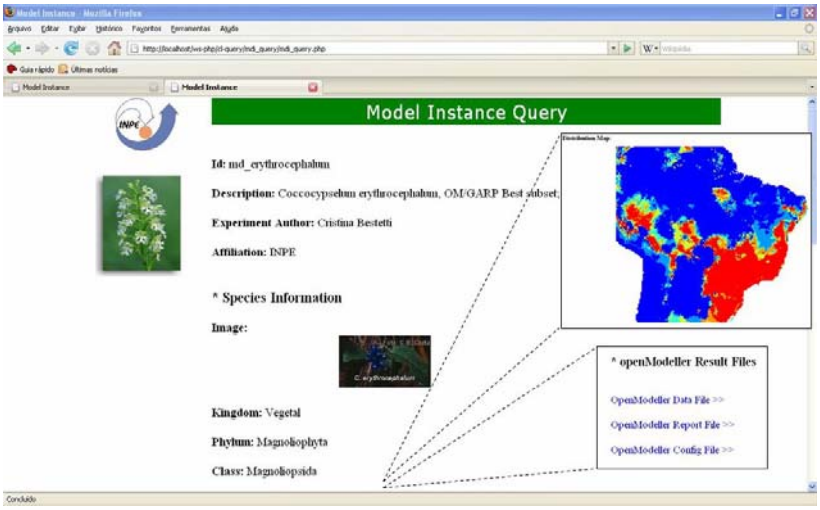

Figure 2. Model instance visualization

Figure 2 presents form that displays *md_ erythrocephalum* model instance with species distributions map and provides access to result files uploaded.

3. Final Comments

In this text, we presented the Web Biodiversity Collaborative Modelling Service. The WBCMS architecture has been partially implemented up to this moment. The next step in our work is to implement the whole approach architecture.

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[2] http://www.fapema.br/