Digitising Mersing: A Web Based Biodiversity Analysis Tool for the East Coast of Johor

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Introduction

Biodiversity and ecosystem informatics is one of the newest members of the 'informatics' sub-disciplines, which all generally focus on the management and analysis of biodiversity data. Like other informatics sub-disciplines, biodiversity informatics depends on fundamental computer science and information science principles to facilitate the management of heterogeneous data. Application of bioinformatics in biodiversity and ecosystem management and its impact on ecological research are extensively documented and demonstrated (Pfeffer et al. 2003; Ostendorf 1998). Increasing recognition of the impact of biodiversity in the economic and social well being has increased its importance and is considered as key issues in sustainable development policies. In addition, the advent of the Internet and advances in information technology has created a potent tool for disseminating information and has capacity to reach at a faster and wider global audience. Such phenomenon combined with the increasing emphasis on biodiversity has created an impetus for the sharing of scientific publications and biodiversity knowledge resulting in biodiversity data more accessible to science and society (Bisby 2000; Oliver et al. 2000; Edwards et al. 2000).

Currently, biodiversity data itself are legacy in nature, usually difficult or even inaccessible, flat file formatted and with existing geospatial information in numbered coordinates that is almost meaningless in first instance. Availability of an easy Web based intuitive interface will facilitate and accelerate mapping and analysis of biodiversity data will accelerate reseachers ability to generate information and added knowledge about biodiversity.

We have developed a web-based application called VIBIGIS (**Vi**sualisation of **Bi**odiversity using **G**eographical **I**nformation **S**ystem) to support survey mapping and species richness assessment for Mersing and the East Coast of Johor. The application is

a web-based biodiversity tool that provides users the means to visualise raw biodiversity data, utilise geospatial visualization and deploy core biodiversity analyses.

System Overview and Implementation

VIBIGIS is developed as a web based solution for both open and closed network. It serves as an online access to view, deposit and curate biodiversity data. Accessibility can be achieved by any computers with a web browser and an Internet connection. A Geographic Information System (GIS) is an efficient method to handle, evaluate and display spatial data. To achieve this, Autodesk Mapguide (http://mapguide.osgeo.org/) was used. It is the same engine that powers G4NRE application developed by JUPEM's MaCGDI (Guan 2007). Biodiversity data from multiple sources can then be swiftly overlaid for inspection and analysis. The search option provides an interface for a large number of queries to the database which is built using MySQL (http://www.mysql.com/). Its built in query function and can be used to search the database for typical taxonomic information, *de rigueur* for any biodiversity database. Search queries can include keywords, time and spatial GIS coordinates. Determining patterns of change in species richness and the processes underlying the dynamics of biodiversity are of key interest within the field. To develop the portal, Asynchronous JavaScript (AJAX) and XML were used for the for client side development. The user interface was developed to avoid long latency times. Our application design strategies included a focus on user interface and usability by minimising the space taken by the task pane and tool selection in the graphical user interface (GUI). This is achieved by using drop down menus and pop up task panes, thus freeing more space for viewing the GIS mapped data (Figure 1). In principle, our strategy is to utilise open access as extensive as possible as it would encourage mass participation in the development of VIBIGIS. Using open source will also conserve our resources in developing effective technological responses to the growing threats to biodiversity (Fonseca & Benson 2003; Gaikwad & Chavan 2006).

Results and Discussion

Currently, biodiversity information is accessible through the web through global databases such as Global Biodiversity Information Facility (GBIF), Fishbase, Encyclopedia of Life (EOL), ZipcodeZoo and Biodiversity Heritage Library (BHL). Although it is deceptively easy to access raw information, it is difficult to visualise the spatial data within these datasets. Pioneer databases that originated from flat file sources are usually not robust and lack much functionality that is required to infer geospatial trends and pattern. Initially, queries were limited to basic keyword based search focusing on taxonomic data. The more recent additions such as GBIF-Mapping and Analysis Portal Application (GBIF-MAPA), Australian Virtual Herbarium (AVH), ASEAN Centre of Biodiversity (ACB), Israel Biodiersity Information System (BioGIS) or related tools (GBD-Explorer, BioGeomancer (Guralnick 2006), Diva-GIS) have been enhanced by

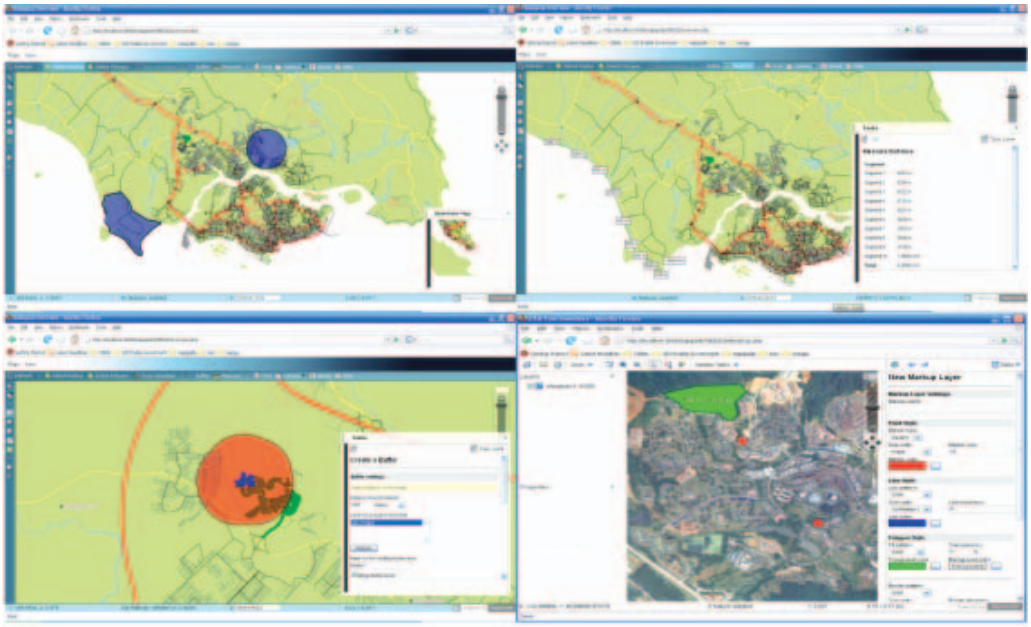

FIGURE 1: Overview of VIBIGIS Functionalities. Clockwise from Top (A) Map Selection Features with Smaller Overview Map (B) Measurement Tools between Points (C) Creating Georeference Points for Legacy Data (D) Zone Selection Tool

incorporating spatial and temporal visualisation capabilities. VIBIGIS plans to complement these ongoing efforts by providing a similar platform for researchers in Malaysia.

In theory, basic mapping function is identical to Google Maps (http://maps.google.com/). However, the current version of VIBIGIS has several useful functionalities unavailable in other visualisation platforms. Interactivity in VIBIGIS mapping tools allows users to measure distances between species, create buffer zone, choose radius distance, measure within a polygon, calculate area size and measure species density (Figure 1B and 1D). Users are able to utilise mapping navigation such as zooming in, out, extend as well as customary functions such as selecting and panning (Figure 1A). All of these functions will be performed on various satellite imagery format or vector maps that are updated online in real time. Maps are loaded locally instead of based on external sources like Google Maps. As it is web based, only web browsers are needed unlike Google Earth (http://earth.google.com/) which requires visualisation software installation at the user side. A unique functionality is the ability to georeference legacy data. Georeferenced data can be created from any text format (pdf, .xls, .doc) to GIS recognised formats (kml, kmz, shp) "on the fly" using a built in converter or pinpoint on a conventional map to create new GIS coordinates (Figure 1C). This concept is similar to GeoLocate (http://www.museum.tulane.edu/geolocate/) and BioGeomancer (http://www.biogeomancer.org/). However, these solutions focused on localities in North America and are not web based.

Conclusions

The creation of VIBIGIS is an initiative towards cataloging all the biodiversity information in Malaysia. It aims to provide a tool to digitise legacy data and make it amenable for biogeographical and ecological analyses. VIBIGIS is easily updated remotely to populate and curate its content in real time. We are currently working on a species richness analysis tool (SRA) and a survey gap analysis tool (SGA). In the future, we hope to add a compendium of biodiversity analysis tool to increase VIBIGIS functionality.

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