A WEB GIS FOR WETLANDS OF KERALA USING OPEN SOURCE GEOSPATIAL SOFTWARE

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Introduction
The Web GIS is a relatively new application tool of geographic information and internet technology, enabling a host of users to interact with geospatial information. By its very scope, this tool, among other applications, has potentially an enormous impact on natural resources management as well. (Kearns et al 2003) Thus, for an effective management involving multiple stakeholders, this tool has tremendous relevance and in fact, the National Spatial Data Infrastructure (NSDI) of India, primarily, targets geospatial information as a major source of data and information (www.nsoi.org). It has also, now been globally acknowledged that delivering the geospatial information and data to various stakeholders is best achieved thru world wide web. A number of examples of web enabled geospatial information exist using both proprietary (www.esri.com/news/arcwatch/0610/web-gis.html and http://www.proceedings.esri.com/library/userconf/proc03/p0545.pdf) in open source geospatial domain (see for example http://2009.foss4g.org/presentations/). The Kerala Biodiversity Board, Thiruvanathapuram, sought such a model of web GIS to be implemented for the inland wetlands of Kerala. Among other goals, this effort was also aimed at providing an extensive baseline information and data on spatial distribution of wetlands in the state. This base line data has been organized at four hierarchical administrative units, viz., District, Block and Municipality or Panchayat for the entire state. Further with the aim of taking the data to the actual stakeholders, a web based Geographic information system has been developed and has been dovetailed with Google earth map application.

The paper aims to show case this effort which can be extended to other natural resource management activities and for conservation as well. We believe, this effort is one of the first of its kind in conservation and management of fast depleting wetland ecosystems in the country (Vijayan et al. 2004).

Development of a Web GIS

We provide an account of the use of open source geospatial tools at four hierarchical levels of Panchayat, block, distinct and state.

A spatial database was developed for it in PostgreSQL / PostGIS database. The major advantage of creating spatial database for the entire state is that the data in a central database including well defined privileges. This makes it possible to extend the more standard SQL queries with spatial queries. In order to provide an application user interface, Google maps API was used. This was done as this would provide an excellent on line and a highly responsive, intuitive mapping interface with embedded, detailed street and aerial imagery data. Google Maps provides not only the map, satellite image or a hybrid of both but also a range of operations on the map including zooming.
panning, information pop-ups and overlays. Google Maps API provides an interface into these operations through
JavaScript objects. The following datasets were used at 1:12500 scale.

1. Land use and land cover
2. Roads
3. Place Names
4. Drainage
5. Kerala State Boundary
6. Kerala Panchayats
7. Other administrative units like blocks or districts. (These were obtained through union function available in
PostGIS on the fly)

In order to make the data uniform without structured errors, the data cleaning operations were done to correct the
problem. These operations included snapping, merging and the problem of redundant polygons. The database
structure was designed accordingly to the designed needs of web enabled information system. Projection was assigned
to the shapefiles which were created using GDAL library tool. For projecting vector data OGR tool was used from the
library. The shapefile data was loaded to PostgreSQL/PostGIS database using OpenJUMP. It was done in 3 steps as
follows. To speed up the performance, indices were generated using GIST on geometry columns.

A carefully chosen set of tools ensured the development of Web-GIS application for Kerala Wetlands.

1. An Apache Web server running PHP and PostgreSQL/PostGIS
2. Populating the spatial data into PostGIS database
3. Outputting XML with PHP
4. Generating HTML page for map visualisation
Web GIS features

Intuitive user interface for querying the spatial data on www.keralawetlands.in

The interface which was developed for Kerala Wetlands Web-GIS application allows users to query against spatial data available in the PostgreSQL/Post-GIS database. A simple query tool was included.

Figure 2: WEB GIS page for Kerala Wetlands. This application has full page map with query interface with
show/hide option. This provides user maximum view for the map and without any interruption of query interface.

A user can query the wetlands of the following predefined size classes

- Less than 0.6 ha
- 0.5 to 1.0 ha
- 1.0 to 1.5 ha
- 1.5 to 2.0 ha
- more than 2.0 ha
Search tab also provides the flexibility to find wetlands using radius from the centroid of the polygon and can also search out the fishery data (pan fish) at different levels. In addition, simple overlay can be done for the themes of

- Fallow Lands
- Paddy lands
- Place Names
- Roads
- Drainage

Geo Tools
Using Geo tools tab, user can measure the distance between 2 wetlands or can measure the area of the same. In Geo Tools measuring tools such as Polyline and Polygon are provided for.

Statistics
User can also find out the statistics of wetlands, paddy lands, fallow lands and fishery data at district or block or panchayat level by appropriate query.

Advantages

- Free (except for developer time)
- Quick development time - depending on complexity of application
- End product is light weight application, client side scripting
- Intuitive user interface - general public already familiar with Google Maps interface and basic navigation
- Fast, good response time
- Google provides solid background services (satellite data, roads, traffic data, street view, geocoding)
- Effective for displaying selected GIS data - not every mapping application requires multiple, complex map layers
- Great on-line resources for learning, multitude of samples and tutorials
- Best for focussed applications

Limitations

- Limited functionality compared to some commercial products
- Difficult to overlay more complex GIS data
- Difficult to overlay multiple GIS layers

Cannot read directly from GIS database, must convert to other formats (XML, KML) (but parts of process can be automated with scripting)

Conclusions
The Open source geospatial tools provide tremendous scope for scaling up the outreach on wetland ecosystems of
Kerala. Many more critical biodiversity data sets such as plant, bird, herpetofaunal and others would tremendously help enlarging the scope of such an outreach programme. This would needless to emphasize would facilitate at very no or marginal costs an effective involvement of local stakeholders in the management of wetlands. Moreover, it is also possible to move into local language version of the Web GIS. The Govt of Kerala has been a pioneer in adopting open source software. Therefore, it augurs well for implementing the web GIS applications for effective people’s participatory process in natural resource management.

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Open source geospatial case studies