Web GIS Information System for Medicinal Plant resource management, conservation and planning- a Geo-visualization for *Rauvolfia serperntina*

Prerna Purohit[1], Neelam Rawat[2], Kishor Chandra Kandpal[3] Divya Uniyal[4], Govind Singh[5] & Durgesh Pant[6]
Uttarakhand Space Application centre(USAC), Dehradun

Email: 1.prernapurohit22@gmail.com(USAC)
Email: 2. neel2406@gmail.com(USAC)
Email: 3. kandpalkishor128@gmail.com (USAC)
Email: 4. divya.uniyal@rediffmail.com(USAC)
Email: 5. gopi.negi78@gmail.com(USAC)
Email: 6. durgesh.pant@gmail.com(USAC)

KEY WORDS: Web GIS, *Rauvolfia serpentina*, Geoserver**,** web GIS platform, thematic maps, Geo-spatial

ABSTRACT:

Medicinal and aromatic plants play an important role in healthcare. The inventory, location of plant species, utilities, frequency of occurrence and its systematic geographical based information data using Web GIS information system can plays an important role in its management and conservation. Uttarakhand State is very rich in Medicinal and Aromatic plants resources. A comprehensive geospatial database and web based geovisualization of these economically important species can be helpful in various management and planning activities. The present paper deals with web based information system for *Rauvolfia serpentina* which is one of the important medicinal plants. The generated multilayered database like, LULC, location of plant species, soil layers, distribution, suitable site for cultivation, utilities and other collateral information was integrated using ArcGIS software and publish on web platform. This information was generated using administrative boundaries like district, block and village as well as forest boundaries for user inter phase. This web based information system will quite helpful in knowing present distribution, extend and suitable zone for cultivation of species in the selected zone. There are multiple choices for GIS Servers e.g. MapServer, GeoServer, mapnik, QGIS server, MapGuide etc. We choose Geoserver because of its administration applications and its services like Web Feature Service standard(WFS), Web Map Service(WMS), Web Coverage Service (WCS) and Web Processing Service specifications. In Geoserver we can get source code of a layer map and can link to that source code in any web site to display it to client through internet. This allows the users to share the collected data through using web GIS platform for resource management, conservation and planning of medicinal and aromatic plants sector in the State.

INTRODUCTION

The last decades has witnessed the rapid growth of using Web Geographical information system (Web GIS) in conservation of Medicinal Plants. As of late 2000, very few websites were devoted solely to Medicinal Plant mapping, its conservation and its information like location, name of species etc. Today many countries and region have realize the benefits of Web GIS for conservation of Medicinal Plants and have developed their own Web GIS server for public awareness and ease of access to information of Medicinal Plants. GIS has been widely adopted in Medicinal Plants as Medicinal information is inextricably linked to specific location in the form of latitudes and longitude. Unlike other information systems used in Medicinal Plants, GIS can improve the spatio-temporal aspect of Medicinal Plants by supporting maps and spatial analysis. Specifically, maps can visually present geo-referenced Medicinal data in a straightforward manner, thereby easily communicating information to end users and making people aware of Medicinal Plant and its uses. With the wide growth of the World Wide Web (WWW), Web GIS become increasingly available online due to its functionality, resulting in the emergence of Web GIS. Web GIS allow you to link maps to create dynamic display, and make site more interactive to end users. This allows the web browser users to share the collected data through using web GIS server for resource management, conservation and planning of medicinal and aromatic plants sector in the State. With this technology, we can share the same

information with any other interested parties via the Internet, allow end user to query, add information and access information. An important step towards conservation of medicinal plants is to map their habitat, and maintain a database system so that proper conservatory measures can be taken.

The current study selected the dehradun district and the main forest types are Moist Bhabar-Dun Sal Forest (3C/C2bi), Lower Himalayan Moist Temperate Forest (12C1), Himalayan Subtropical Pine Forest (9/C1), and Northern Dry Mixed Deciduous Forest (5B/C2) (Champion and Seth, 1968). Although, according to field visit of Dehradun district in natural habitat the Rauwolfia serpentine is frequently found growing under shade. It is one of the important medicinal plant and we have use webgis technique to link these information to a website. Web GIS can store all information about plants and make people aware of it by linking it to client site with the help of Geoserver. In web GIS we have lot of GIS Server for example GeoServer, MapServer, Mapnik, QGIS Server and ESRI GIS Server. As we know that if our data is in shape file format, it should not be access due to client side limitation because shape file is not a Web GIS format were as Geo Tiff could take lot of time due to size. Geoserver can over come from these issues because of its administration application. In Geoserver we can easily get source code of any publish layer and can link that source code to our website. Web GIS Geoserver is a big step towards conservation of medicinal plants.

IMPORTANCE OF WEB GIS SERVER

Web GIS Information System is a GIS System that uses web technologies to communicate among different components of the system and to interact with end users. Web GIS is a recognize technology which is mainly composed of data handling tool for storage, recovery, management and analysis of spatial data. The simplest architecture of a Web GIS must have at least one client and one server were client is a desktop application or web browser application that allows users to communicate with web server, and the server is a web server application. As we know most of the data we have in the shape file or Tiff format which are not the Web GIS format, were as tiff take lot of time due to its size. Web GIS send rendered images in the form of internet friendly format as we know there are two image format which are perfect for internet i.e. JPEG, PNG. Web GIS contain lot of GIS server i.e. GeoServer, MapServer, Mapnik, QGIS Server and ESRI GIS Server from these servers we are using Geoserver because of its administrative applications. As we know JPEG and PNG is a best internet format but if size of data is big, it will also take some time to download from sever. To overcome from these issues we are using Web GIS Geoserver because in Geoserver we can get source code of published layers and that source code can be link to any website. Web GIS Geoserver consists of many services like Web Map Service (WMS), Web Coverage Service (WCS), Web Map Tile Service (WPS) and Web Feature Service (WFS).

STUDY AREA

The study area has been selected the dehradun district of Uttarakhand. Dehradun valley is situated in lesser Himalaya of Uttarakhand State and occupies an area of 1277 km2, which is bounded by Shivalik hills in the south and Lesser Himalayas in the north. This Dehradun district is divided into two major parts: the main city Dehradun surrounded by Shivalik and the Jaunsar Bavar, which is in the foothills of Himalayas. In the north and northwest it borders on the district of Uttarkashi and in the east by Pauri. In the west, it is bordered by Yamunanagar district of Haryana and the Tons and Yamuna rivers. To the south are Haridwar and Uttar Pradesh's Saharanpur district. Dehradun district is a forested landscape with forests, agriculture, settlements, orchards and tea garden, dun valley has the Terai and Bhabar forest. Shroearobusta, Terminaliatomentosa, Anogeissuslatifolia, Mallotusphilippensis, Dalbergiasissoo, and Acacia catechu are some of the important tree species in the Valley.

APPLICATION ARCHITECTURE

1) PHP Programming: PHP is a server side scripting language that is used to develop static web site or dynamic web site or web application. PHP stand for hyper text preprocessor. PHP script can only be interpreted on a server were clients computer accessing the PHP script require a web browser only. PHP is a more secure language as compare to Perl or C for writing CGI programs.

2) HTML: HTML stands for hyper text markup language for creating web pages and web application. The markup tells the web browser how to display a web pages words and images for the user. With Cascading Style Sheets (CSS) and JavaScript it forms a triad of cornerstone technologies for the World Wide Web.

3) Geoserver: Geo-server is an open source server written in java and allows end user to share process and edit geospatial data. It publishes data from any major spatial data source using open standards. GeoServer can connect with traditional GIS architectures such as ESRI ArcGIS. GeoServer has evolved to become an easy method of connecting existing information to any web site as well as and can create maps in a variety of output format. GeoServer functions as the reference implementation of the Open Geospatial Consortium Web Feature Service standard(WFS), and also implements the Web Map Service,(WMS) Web Coverage Service (WCS)and Web Processing Service specifications.

4) Java Script: Java script is a high level, dynamic, weakly typed, object-based, multi-paradigm, and interpreted programming language. It is small and light weighted programming language and in a host environment (for example, a web browser),JavaScript can be connected to the objects of its environment to provide programmatic control over them JavaScript alongside HTML and CSS is one of the three core technologies of World Wide Web content production. It makes webpage's interactive and provides online programs, including video games.

METHODOLOGY

Data representation on map and publication of the data for use in academic and research field is an important step towards geographical study. ArcGIS 10.4.1and Erdas 14 were used to prepare spatial data layer and simultaneously the botanical map of the study area. The mapping of the vegetation survey to acquire the species occurrence geocoordinates was done through hand held GPS (Global positioning System). The spatial data was converted to attribute data in GIS platform for species and was simultaneously linked with the base layout map. In web GIS, on server side we need software to read our data because software has to understand the source format of data in order to read, render it in memory and then pass it on to us over the internet. Now, if our data is in shape file format or is in GeoTiff format, it should not be display as due to the client side limitations because shape file is not a web GIS format and GeoTiff could take a lot of time due to its size. As we know there are two image formats which are perfect for internet i.e. JPEG and PNG. So this software should render our data in JPEG/PNG format and pass it on to us over the internet. In Web GIS server we are using Geoserver. In geoserver, first we create workspace and then data store (every time because here we are linking our data i.e. shape file, geoTiff, database etc) to GeoServer then we has to create a layer for each dataset. By using the resources, we have to create/publish a layer, and to see how it looks, click "Layer Preview", in GeoServer menu and to open it click on OpenLayers link. A new web page will open with an interface and to get source code of that layer just right click on the page (the one showing your layer), and click view page source. After getting source code of layer we can link that code to any website to display.
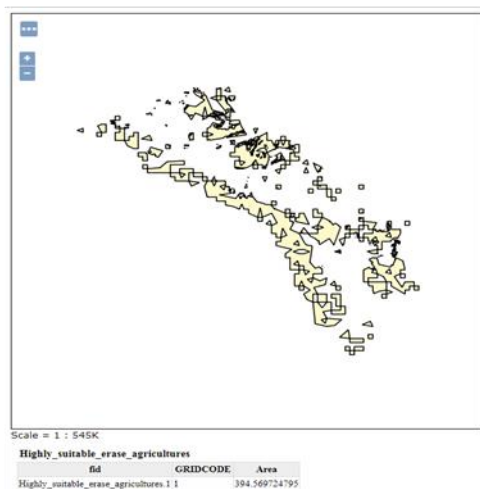

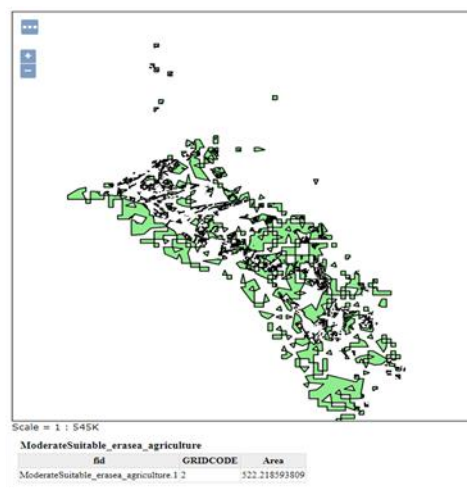Figure 1: Highly Suitable Agriculture

Figure 2: Moderate Suitable Agriculture
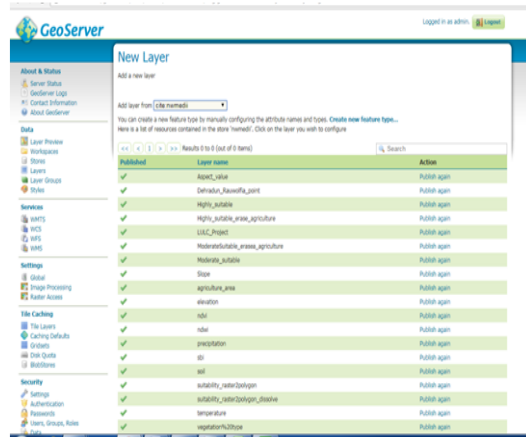
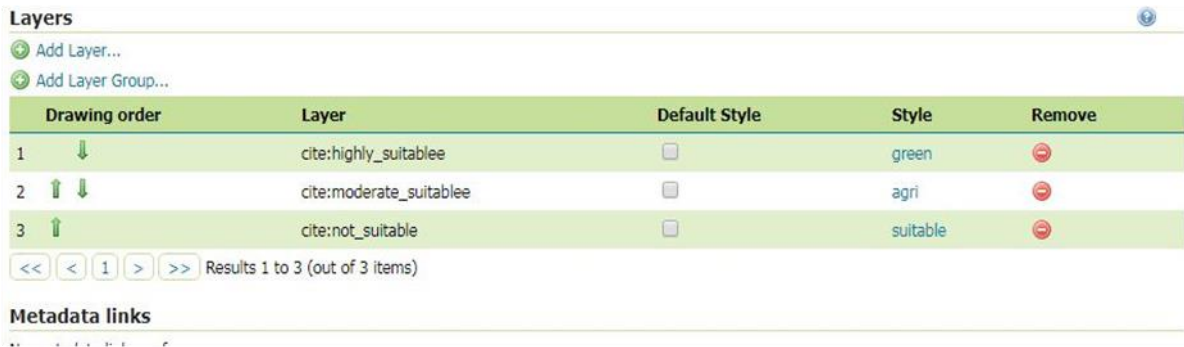Figure 3: Geoserver Workspace

Figure 4: Geoserver Layer Publish

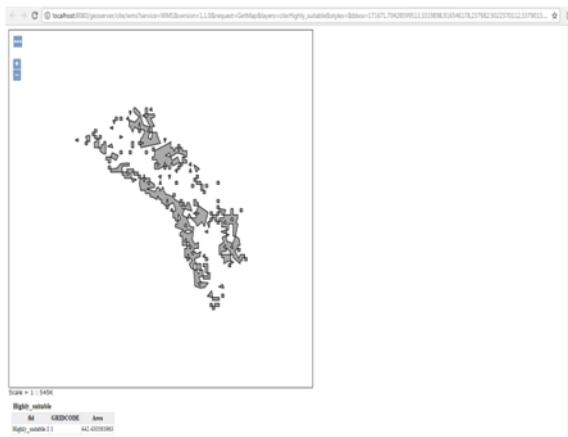Figure 5: Geosever Layer Group

Figure 6: Layer Map

Figure 7: Source Code of Layer Map

RESULT

Web GIS Geoserver accepts both shape files and raster files, Geoserver consist of many services like WMS, WFS, and WCS. Web GIS GeoServer can easily publish any layer, here we have define three fields in that layer for agriculture area i.e. Highly Suitable, Moderate Suitable and Not Suitable, we have given color to these fields for uniqueness and can also see attributes behind that layer by clicking any were on the layer. We can also link layer to any website and can also get source code for that layer (figure 8). After linking this source code to website, any user can visit and share information through internet and use for implementation and other uses.
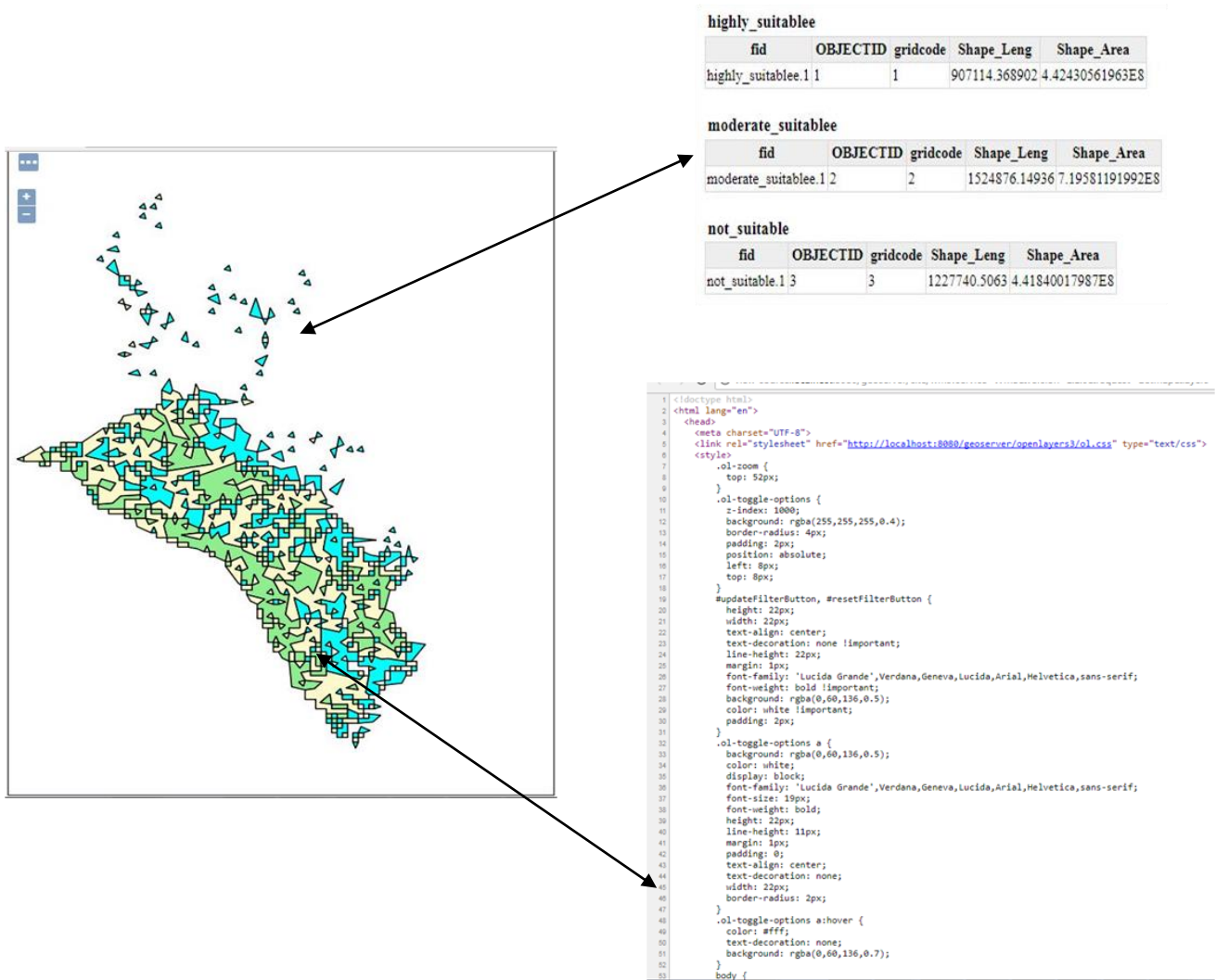

Figure: 8 Source code and attribute of Publish layer