# Availability of Spatially Distributed Environmental Information Through GIS Web Services Online : ColombiaCase Study

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#### Abstract

This paper presents the Geoportal of Colombian Environmental Information (GCEI) of Valle University (Colombia) for aiding the research and planning management of sustainable development. The GCEI was designed to be used by the scientific community under RENATA (National Academic Network of Advanced Technology), which is equivalent to UCAID – University Corporation for Advances Internet Development. The spatial environmental information is derived from remote sensing data available from Moderate Imaging Spectro-radiometer (MODIS) Resolution which are: daily precipitation and temperature, water bodies, thermal anomalies, forest fires, and vegetation cover (VC). The GCEI allows the spatial information to be: 1) displayed by a graphic interface, 2) interrogated by SQL queries, 3) downloaded for use in personal computer and 4) printed with cartographic features. The GCEI can be found at http://gismodel.univalle.edu.co/renata/renatacol/portal.php.

The Geoservices included in the GCEI are: Web Feature Services (WFS), Web Map Service (WMS) and Web Coverage Service (WCS) which aid information, management, queries production and data download . The GCEI is recognized as a Geovisor of geographic information, where both geographical and alphanumerical queries can be performed like a Geographic Information System (GIS); it has the basic tools of a GIS for display management, query generation, cartographic production and printed maps production.

#### Conclusions

The spatial environmental information available online derived from remote sensing data are useful source for supporting research , where there area no other data sources available.

#### Introduction

The aim of this project is to make environmental spatial information for Colombia available online in geographical format that can be displayed, consulted by queries, spatially analyzed, downloaded and printed as a geographic map. The GCEI uses free software and geo-services, which is further improve by the adopting of standard format from Open Geoespatial Consortium (OGC) [1]. An environmental geographic database was built on the basis of MODIS remote sensing data [2]. The geographic information includes historical and new data updating daily, which are available through RENATA [3].

The GCEI seeks to bridge the gap between spatial-date environmental information and researchers using a decision support system. The GCEI automates Geomatic processes for spatial data analyses, obviating the need for users to dedicate an entire team for spatial processing of remote sensing data, often without the appropriate infrastructure, tools and specialist knowledge to generate such information.

## Results

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Below area six examples of the GCEI products derived from the environmental spatial information available online, shown as screen capture snapshots.



The integration of GIS tools with spatial updated information within an interface is a good alternative for decision makers as it provides information on time, in situ and without cost to support decisions makers.

The spatial environmental information derived from remote sensing data requires considerable human labour, appropriate infrastructure and an expert team. The GCEI is a useful shortcut for researchers, reducing time, resources, people, and producing standard information, allowing better resource targeting.

## Bibliography

### [1] <u>http://www.opengeospatial.org/</u>

[2] <u>https://lpdaac.usgs.gov/lpdaac/products/modis\_products\_table</u>

[3] <u>http://www.renata.edu.co/index.php/quienes-somos-identidad-y-objetivos-de-renata.html</u>

#### [4] <u>http://sigotn.igac.gov.co/sigotn/</u>

## **Materials and Methods**

The GCEI has basic and thematic information. The basic information is cartographical reference data adopted from the Land Use Planning of Colombia [4]. It is in vector format, and includes political boundaries, geographic features, soil [4] and ecosystems [5] polygons, and elevation data from the Shuttle Radar Topography Mission (SRTM) [6] with 90m of spatial resolution.

The thematic information included in the GCEI is:

- Daily rainfall (mm), calculated with the MODRA algorithm developed by the Chinese Weather Center and uses two spectrum channels of MOD09: 0.65µm which is used to identify optically transparent cirrus and 1.3µm which is used to identify precipitable clouds [7].

- Temperature (degrees Kelvin ) derived from MOD11A1 and MOD11A2 using surface reflectance and emissivity, atmospheric adsorption, and solar emissions and radiation [8].





Figure 3. Rainfall distribution for few dates (mm/day)

Figure 4. Temperature distribution for few dates in Colombia (average Kelvin degrees)



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[10] <u>http://glcf.umiacs.umd.edu/data/ndvi/index.shtml</u>

[11] <u>http://modis-land.gsfc.nasa.gov/vi.htm</u>

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- Vegetation cover derived from NDVI MODIS product from MOD13Q1 sources [7]. This uses the blue, red and near infrared reflectance with 469µm, 645µm y 858µm wavelength respectively. This product usually has sixteen days temporal resolution and 250m spatial resolution and can be downloaded from [9], [10] and [11].

The tiles for Colombian window were H10V07, H10V08, H10V09, H11V07, H11V08, and H11V09 from http://remotesensing.unh.edu/modis/ modis.shtml. The original imagery were re-projected to geographical system to build a mosaic, and then the cloud effect were removed with the quality data.

Vegetation cover information was produced on the basis of 2010 and 2011 available data. The procedure involves: a- Cleaning the atmospheric effects; b- Filling the missing values; c- statistical representative analysis; d- Principal components generation; e- cluster analysis; f- statistical significance review for each cluster; g- validation with field data.

