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Amazonia Landscape Mapping and Biodiversity Estimation using Remote Sensing and Local Communities Knowledge and Know-How

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Abstract This project aims to set-up and test a methodology for landscape mapping of Amazonia and the assessment of thc biological diversity of Amazonia by applying the knowledge and know-how of the local communities, Remote Sensing and Geographic Information System technology It also intends to provide ground truthing for the remote sensing of Amazonia and to contribute to the baseline data sets of pristine biotopes against which "trouble spots" can be monitored

Keywords: Amazonia, landscape ecology, biodiversity estimation, remote sensing, local communities knowledge, sustainable development,

BIODIVERSITY REDUCTION

In a recent issue of Nature May 11, 2000 dedicated to biodiversity the following estimates were given:

- 5% to 20% of the species have already been lost
- tropical forest is lost at a rate of 0.5% to 2% a year
- 50% to 70% of species are found in tropical forests
- loss of 50% to 80% of thc species of an ecosystems causes the collapse of most biogeochemical ecosystem processes

Only l0 percent of thc existing species are known and classified. We know even less about their distribution and still less about their interactions.
Indeed, " like children playing with fire, we do not fully understand, and therefore cannot predict, the ultimate consequences of tampering with global biodiversity" .

BIODIVERSITY ASSESSMENT

Biodiversity is the variety of living organisms considered at all levels of organization, from genetics through species, to higher taxonomic levels, and including the variety of habitats and ecosystems, as well as the processes occurring therein
The "ecosystem approach" is the primary framework for the implementation of the Convention on Biodiversity and requires that in the assessment of biodiversity:

- all the components of biodiversity should be considered .
- all forms of relevant information, including scientific and local knowledge, innovations and practices should be considered
- identification and monitoring of ecosystems and habitats as well as identification, monitoring and assessment of species should be included

REGION

Xixuau-Xiparina Nature Reserve and Lower Rio Jauperi basin , State of Roraima, Brazil.
0* North - 2* South - 61* West - 62* East (110 Km * 220 m). The unexplored, pristine rainforest harbors a rich wildlife including several threatened mammal species. Being placed between hydrographic basins of different geological ages, it is of great biological relevance. The total population is 570 people in 5 communities. The Associação Amazônia, largely composed of people belonging to the local communities, has been working in the region since 1991.

LOCAL COMMUNITY KNOWLEDGE AND KNOW-HOW

Rationale for using local community knowledge for biodiversity assessment

- the Convention on Biodiversity requires the application of the knowledge of local communities
- the SBSTTA said that traditional and indigenous people knowledge and perspectives should bc included in current taxonomic systems
- higher taxon richness and species indicators are useful surrogates for biodiversity
- scientific taxonomy covers more species than indigenous taxonomy, but it all the same covers only ten per cent of existing species
- according to the "ecosystem approach" biodiversity assessment also requires identification and assessment of ecosystem and habitats

DATA COLLECTION METHODOLOGY

The precisely GPS localized verbal real time recorded reporting by the members of the local community will be transcribed. Successively significant key words will be extracted from the transcription,, numerically coded and inserted as categories into raster maps of the GIS becoming thus amenable to the standard GIS processing, using standard GIS tools.

TESTING AND CALIBRATION

Contemporaneously with landscape mapping and biodiversity assessment other bio-diversity surveys will be made which will use more traditional methodologies and whose results will be used to test and calibrate the methodology under study. In particular these results will be used to calibrate the coefficients of the alpha . and other measures of biodiversity so that comparable data is produced .

SATELLITE IMAGERY

Time Series Data from Landsat TM-5, Landsata TM-7 , Envisat MERIS,: ERS-1 SAR, ERS-2 SAR, Envisat ASAR

The high resolution panchromatic band of Landsat TM 7 will be used for sharpening the lower resolution data. MERIS data appears very promising and although it will have lower spatial resolution than the Landsat data it will have a higher spectral resolution especially in very promising zones of the spectrum. Of particular interest will be the Meris Global Vegetation Index The utilisation in tandem with ASAR and the consequent synergy which should arise, will also be very intersting.

GEOGRAPHIC INFORMATION SYSTEM

The GIS utilized is based on GRASS, a freely available GIS. It has the following components: on-site workstation, . off site workstations, web server and. java implemented web client.

The following cartography (duly rectified and registered) was used: IBGE Topographic maps 1:250.000 and Levantamento Planinimetrico do Xixuaú 1:50.000 as well as the following digital maps: DCW, GT003.0, HYDRO 1 K, GDEM

The following Vegetation Indices are produced: Normalized Difference Vegetation Index and Tasseled Cup Transformation indices:: Brightness, Greenness, and Wetness

Spectral Mixture Analysis

Spectral Mixture Analysis (SMA) assumes that the reflectance of each pixel is a linear combination of contributing sub-pixels components. The spectral signature of these components, or. endmembers can be obtained from the image itself via Principal Component Analysis (PCA) and Parallel Coordinates Representation (PCR). For this purpose, the freely available graphical analysis program XOBI was utilizes

Hierarchical Clustering

The larger component areas of the landscape were singled out using the classification of the vegetation cover in the IBGE topographic maps of the area in scale 1:250000 as spectral signatures .Successively the areas thus obtained were further subdivided with the help of unsupervised clustering to obtain a layer of sub-patches. Next the endemembers of these patches will be found with PCA and PCR and the patches will be analyzed with SMA to provide a third level of patches. This hierarchy of patches should reflect the hierarchy of the landscape ecosystems. The patches and sub-patches thereby obtained were measured using various Fragstats metrics including diversity metrics like Shannon and Simpson indices.

OTHER AIMS OF THE PROJECT

This project is an exercise in sustainable development: it aims to create new jobs andraise the living conditions of the local communities encouraging them to remain in the forest.

This project will also contribute to :

- environmental education and in particular to the view that protection and sustainable utilization of biodiversity has economic returns.
- establishing Leapfrog Technology (Computers, GIS, GPS, Internet) in Amazonia. Special efforts will be made to create Local Community friendly computer interfaces
- capacity building for bioprospectlng, believing that bioprospecting reserves will be the natural evolution of the "Extractive Reserves" developed by Chico Mendes and Mary Helena Allegretti.

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