A SELF-ORGANIZED MAP NEURAL NETWORK APPROACH FOR ECOREGIONS MAPPING AT BRAZILIAN AMAZON FOREST

Arimatea de Carvalho Ximenes[1]; Silvana Amaral[1]; Antônio Miguel Vieira Monteiro[1]; Dalton Morrison Valeriano[1]

[1]National Institute for Space Research (INPE), Earth Observation Directory, P.O. Box 515, 12245-970, São José dos Campos (SP), Brazil. Phone: +55 12 3945-6991 Fax number: +55 12 3945-6468. Corresponding to author: arimatea@dpi.inpe.br

Biotic and abiotic variables related to climate, hydrology, landforms, vegetation, and soil are usually employed in ecoregion mapping approaches. To Identify and delimitate homogeneous areas is very useful to assess and monitor natural resources as biodiversity, forest, water, etc. The computational developments on pattern recognition and classification algorithms have presented new possibilities for partially automation of the procedures for ecoregions detection e delineation. This paper presents a mapping methodology for the detection and mapping of the terrestrial ecoregions of the area of influence of the BR-163 road, also known as Cuiabá-Santarém road. This mapping process works at regional scale and it is based on a computational neural network approach for classification. The study is part of PIME Project (*Projeto Integrado de Modelagem da Cobertura da Terra no Pará*), where a group of researchers from several research institutes in Brazil are studying the impacts of a Forest District policy implementation over the natural sustainability along the area of influence of the BR-163 road.

We proposed here a methodological approach to map the ecoregions semi-automatically and the resulting mapping is presented and discussed. The ecoregions were identified based on a Self-Organizing Map (SOM) neural network that was initially configured to work over a set of 27 variables, including 19 bioclimatic variables, vegetation types (RADAM), altitude, slope, aspect, height above the nearest drainage (HAND), drainage density and geographical distance (latitude and longitude). To build up our model we have adopted a grid methodology. The study area was split in regular grid with [3x3] km sized cells. It was necessary 32.805 cells for covering up the whole region. Information was extract from a database contains 27 layers of environmental and climatic variables stored in a GIS environment. A GIS-based set of operations was used to fill-up each one of the cells on the grid with a value for the respective variable represented as an GIS layer. Once we had all the cells filled up with the variables we have chosen a neighborhood gaussian function, an hexagonal grid, an linear initialization and the batch training algorithm as the parameters for the SOM computing platform. The batch training algorithm is an iterative one, but instead of using a single data vector at a time, the whole data set is presented to the SOM before any adjustments are made. In order to identify the clusters a pos-processing procedure was taken by using a k-means algorithm. The Davies-Bouldin index was used for the assessment of the k-means generated clusters.

The final ecoregion map resulted from a smaller set of variables: altitude, slope, drainage density, latitude and vegetation. The methodological approach was consistent and can be reproduced over different areas. The variables of latitude and altitude can be considered proxies of climatic variables, offering better spatial resolution and definition for the

ecoregion limits. Compared to the WWF ecoregion mapping of the same area, our final model has presented higher heterogeneity, using a smaller number of environmental variables. The environmental diversity was finally mapped with 13 ecoregions. We intend to extend and improve this methodology in order to have an initial mapping of the environmental heterogeneity for the Brazilian Legal Amazonia as whole.