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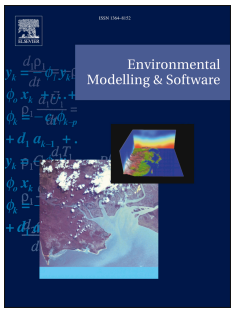

Prognostics of forest recovery with *r.recovery* GRASS-GIS module: An open-source forest growth simulation model based on the diffusive-logistic equation

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Prognostics of forest recovery with *r.recovery* GRASS-GIS module: an open-source forest growth simulation model based on the diffusive-logistic equation

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Abstract

We present an open-source computational tool for the 2D simulation of the Diffusive-Logistic Growth (DLG) model. The r.recovery module offers a complete environment for the simulation of forestry regeneration in conservation areas and includes a built-in tool for calibration and validation of the model parameters through the use of standard and freely available satellite imagery. It was implemented as an add-on to the GRASS software, a largely applied open-source Geographic Information System (GIS). To illustrate its application, we present a complete case study of forest regeneration carried out in the Espigão Alto State Park (EASP), Brazil, from which we assess typical values of forest diffusion and growth rate parameters, along with the prognostics of forest density status for the coming decades. We observe that the r.recovery tool can be advantageously applied by forestry managers and policy-makers as a form of acquiring technical and scientifically-based information for strategy development and decision-making.

Keywords: forest growth, diffusive-logistic growth model, environmental conservation, GRASS module.

Availability

Program name: r.recovery.
Developer: L.A. Richit.
Contact address: luizaugustorichit@gmail.com.
Year first available: 2018.
Software required: GRASS GIS 7.0 or later.
Program language: C.
Package size: 144 kB (source code).
Availability: `http://modelagemambientaluffs.blogspot.com.br/`.
Cost: free of charge.

1. Introduction

The activity of suppressing forested areas for agriculture, livestock and urbanization purpose is responsible for the loss of biodiversity, environmental quality, soil humidity, water quality and quantity, among others [31, 40, 61, 65]. Forest regeneration takes place by means of a recolonization process, which is begun by the remnants of the original forest. This process can vary according to the characteristics of the vegetation, the climatic conditions and the level of damage and degradation of the original forest[15, 18, 33, 63, 24]. Researchers have proposed different methods to estimate the amount of time required for a forest to fully recover after suffering degradation, while others have argued that the original environment cannot be achieved again. Nevertheless, there is a consensus regarding the forest recovery time, which requires anything from decades to centuries to stabilize should this be depending on the biome characteristics. [15].

Forest growth is described in the literature in numerous ways, most of which are based on qualitative features such as seed dispersion [6, 14, 22, 26], soil characteristics, elevation, humidity, species and successional stages of development [21, 35, 45, 54].