

## Short communication

## LANDISVIEW: A visualization tool for landscape modelling

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## ABSTRACT

A major challenge in landscape and environmental modelling is to effectively visualize large amounts of time-series simulation output, often in various Geographic Information System (GIS) formats. We developed a software tool (LANDISVIEW), to easily visualize and animate time-series of ERDAS \*.gis maps. The open source tool can also be used to generate batch files for FRAGSTATS, a widely used spatial analysis program.

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## Software availability

Software name: LANDISVIEW

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Year first available: 2006

Hardware required: IBM compatible PC

Software required: Windows 2000/XP/Vista, GDAL library

Program languages: C++

Availability: Software and supplementary material are downloadable free at: <http://sourceforge.net/projects/landisview/>, [http://landscape-restoration.tamu.edu/restoration\\_tools.jsp](http://landscape-restoration.tamu.edu/restoration_tools.jsp)

## 1. Introduction

LANDIS (LANdscape Disturbance and Succession) is a raster-based, spatially explicit computer model designed to simulate forest succession and disturbance (fire, wind, insect, and harvest) across broad spatial and temporal scales (Mladenoff, 2004). Since introduced in 1996, LANDIS has been widely used for evaluating forest dynamics, wildfire effects, and outcomes of various forest harvest scenarios (e.g., He et al., 2002). Recently, we have used LANDIS and LANDIS-II (e.g., Scheller et al., 2007) to study southern Appalachian Mountains to evaluate forest restoration strategies (e.g., Cairns et al., 2008; Xi et al., 2008, 2009a,b). However, one of the challenges of using LANDIS and interpreting its results is to

effectively visualize the large number of output files it produces. This difficulty arises because:

- 1) Output files consist of a large number of temporally indexed 8-bit/16-bit ERDAS (Earth Resources Data Acquisition Systems) \*.gis files. This format is not well-supported by commonly used commercial GIS software (Fiorucci et al., 2008).
- 2) Output files are large in size and need to be visualized both temporally (for example to determine changes in the abundance of a species through time) and spatially (for example to determine the spatial configuration of the landscape at a point in time).

As a result, the post-processing work involved with comprehensive landscape model LANDIS is time consuming.

We developed LANDISVIEW to visualize and animate such GIS files produced by LANDIS. Although commercial software such as ArcGIS from ESRI (Environmental Systems Research Institute) and ENVI from ERDAS can be used to open and explore \*.gis files, we have found them inconvenient and ineffective for dealing with the volume of output from LANDIS. To counter this, the software we have developed serves as a tool to visualize and animate LANDIS outputs, and as a converter that creates batch files that can easily be used with other, existing spatial analysis tools. We here briefly highlight its features and discuss its applications.

## 2. Software features

LANDISVIEW is written in C++ program language for visualizing and animating 8-bit/16-bit ERDAS \*.gis format files from

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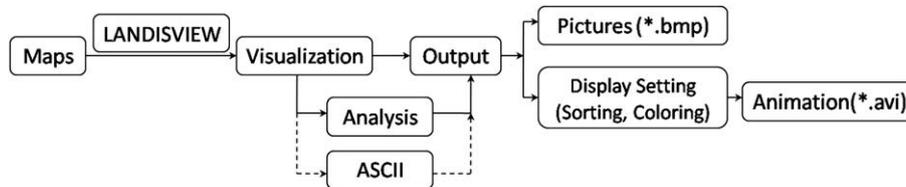


Fig. 1. Work flow of LANDISVIEW.

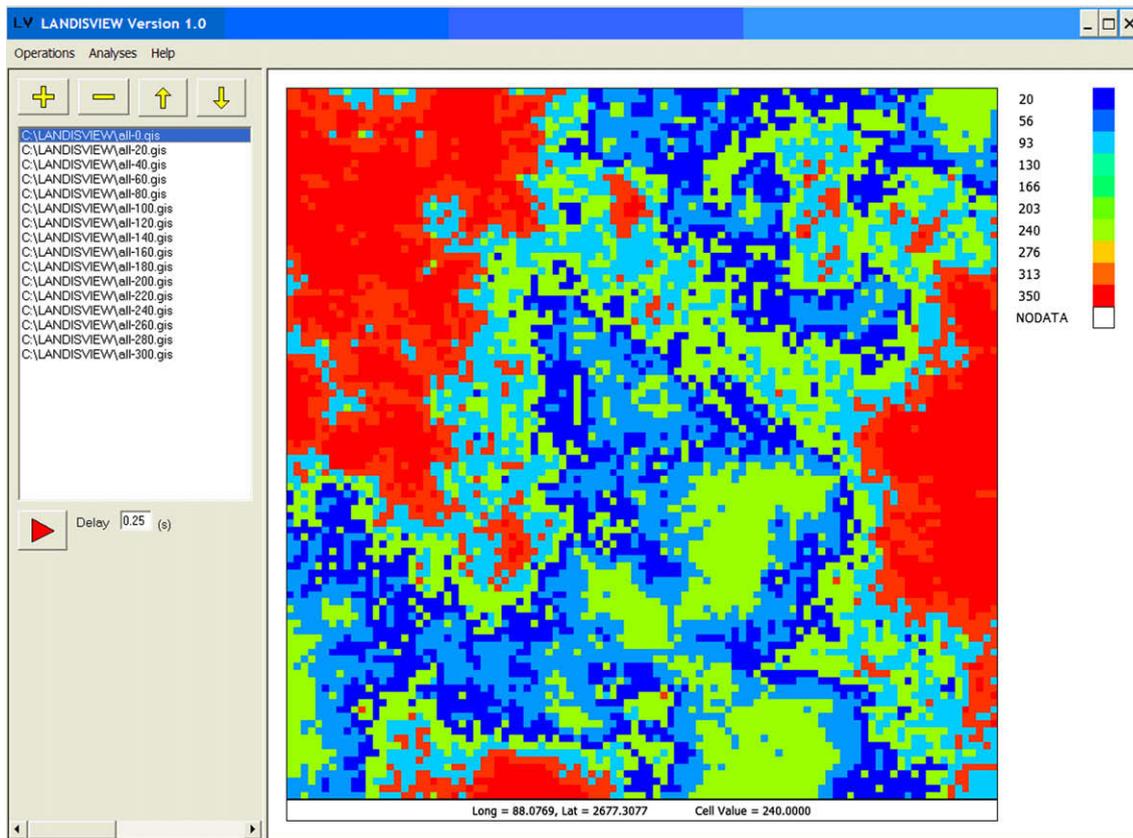


Fig. 2. An example of LANDISVIEW visualization function.

LANDIS simulation. It can also be used to convert GIS files as batch files for further spatial analyses. The basic work flow of LANDISVIEW is shown in Fig. 1. The software used the GDAL (Geospatial Data Abstraction Library) libraries developed by Frank Warmerdam (2000) as an open source project for handling raster files.

Notable features include

- View and animate large numbers of files using an adjustable time step. The user may load a large number of files and sort them into a temporal (or any other) sequence. The transition time between each file can be specified by users in the delay box (Fig. 2). A user can define a color palette with which to visualize all of the loaded files thus providing a consistent interpretation of the file contents.
- A user can save maps as pictures (e.g., \*.bmp) and animation video files (i.e., \*.avi). LANDISVIEW can convert ERDAS \*.gis files into ASCII grids for compatibility with other spatial analysis software such as FRAGSTATS, a widely used analysis tool for computing a wide variety of landscape metrics for categorical map patterns (McGarigal et al., 2002).

### 3. Concluding remarks

LANDISVIEW is an effective post-simulation processing tool to visualize and animate large, temporal sequences of GIS files from LANDIS simulations. It has generated wide interest since it was first made available for the public in 2006, and over 550 users from over 40 countries have used the tool for their work. LANDISVIEW is an open-source modular extendable software tool that allows users to develop their own functions or modules, thus should provide a useful alternative visualization tool and software temperate for landscape and environmental modelling.

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