

# MOLUSCE

An open source land use change analyst for QGIS

OVERSEAS OPERATIONS DIVISION Matteo Gismondi, Courage Kamusoko,  
Toru Furuya, Shunsuke Tomimura, Manabu Maya

## Introduction

Open source software platforms are becoming widely used in the public and private sectors. In GIS (Geographical Information System), open source software packages such as QGIS are actively being developed.

Asia Air Survey Co., Ltd. (AAS) started developing open source plugins, particularly for QGIS since 2012. Currently, AAS is developing MOLUSCE, a

user-friendly plugin for QGIS 2.0. More recently, ASS became the first QGIS gold sponsor worldwide (Figure 1).



Figure 1. QGIS's Gold sponsor Logo

## What is MOLUSCE?

MOLUSCE refers to **Modules for Land Use Change Evaluation**. The plugin was designed to analyse, model and simulate land use changes. MOLUSCE incorporates well-known algorithms, which can be used in land use/cover change analysis, urban analysis as well as forestry applications.

MOLUSCE is well suited to:

- analyse land use and forest cover changes;
- model land use transition potential or areas at risk of deforestation; and
- simulate future land use/cover and forest cover changes

MOLUSCE is computing land use/cover change analysis effectively.

## Functions

MOLUSCE offers a user-friendly and intuitive plugin, which makes it easier for users to perform modelling and simulation. The graphical user interface (GUI) is comprised of seven main components:

**(1) Inputs,**

**(2) Evaluation Correlation,**

**(1)Inputs**

The initial (time1) and final (time2) land use/cover maps as well as spatial variables such as elevation, slope, distance to roads, and population density are loaded in this panel. The land use/cover change information and the spatial variables will be

**(3) Area Changes,**

**(4) Transition Potential Modelling,**

**(5) Cellular Automata Simulation,**

**(6) Validation, and**

**(7) Messages**

The subsections below describe briefly the main functions.

used for modeling and simulating land use/cover changes. Note, a “Check geometry” function is also included in the “Inputs” tab in order to check if all the datasets have the same spatial geometry (*i.e.*, extent and spatial resolution).

### (2) Evaluation Correlation

This tab comprise three methods, namely the Pearson's correlation, Crammer's coefficient and Joint Information Uncertainty, which are used to check correlation among the spatial variables.

### (3) Area Change

In this tab, land use/cover area, changes and transition probabilities are computed (Figure 2). A land use/cover change map is also produced. The land use/cover area units can be expressed in square meters, square kilometers and hectares (ha).

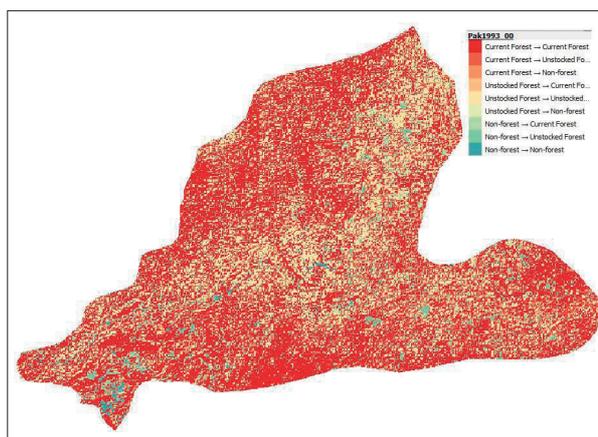


Figure 2. Area change map

### (4) Transition Potential Modelling

While many methods are available for computing transition potential maps, artificial neural networks (ANN), weights of evidence (WoE), logistic regression (LR), and Multi Criteria Evaluation (MCE) are available in this plugin (Figure 3). Each method uses land use/cover change information and the spatial variables as inputs for calibrating and modeling land use/cover changes.

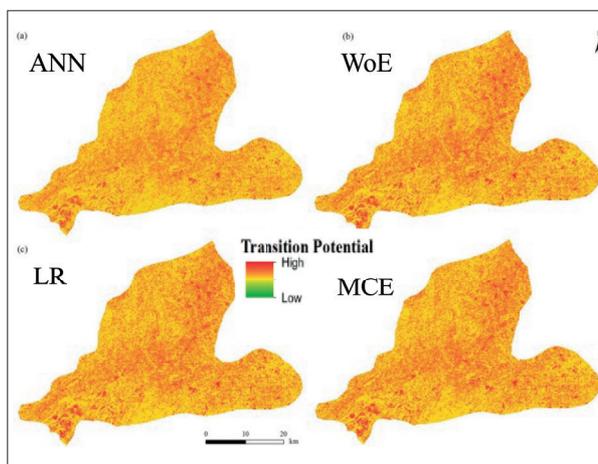


Figure 3. Transition Potential Modelling

### (5) Cellular Automata Simulation

Transition potential maps, certainty function, and simulated land use/cover maps are generated under this component (Figure 4). The cellular automata approach is based on Monte Carlo algorithm.

### (6) Validation

Validation computes kappa statistics (standard kappa, kappa histogram and kappa location) as well as the figure of merit that shows hits, misses and false alarms are produced under this component.

### (7) Messages

This tab presents the progress of the modelling or simulation, error message or warning to the user.

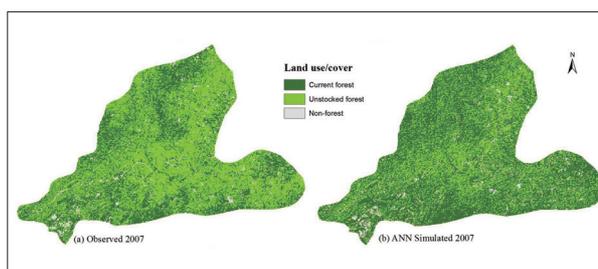


Figure 4. Observed 2007 and Simulation results of ANN simulated 2007

## Conclusion

The development of MOLUSCE is paving a new business model for AAS based on open source software. This is important because open source software products can be tailored to fit the needs of the client. This is in line with global trends, where

public and private sectors are moving towards open source solutions. Last but not least, AAS will offer complete technical support and training for the plugins.