Takenori Takada
Hokkaido University
e-mail: takada@ees.hokudai.ac.jp

Derivation of yearly transition matrix of land-use dynamics and its applications

Transition matrices have often been used in landscape ecology and GIS studies of land-use to quantitatively estimate the rate of change. When transition matrices for different observation periods are compared, the observation intervals often differ because satellite images or photographs of the research site taken at constant time intervals may not be available. For such calculation, several previous studies have utilized a linear algebra formula of the power root of matrices. However, three difficulties may arise when applying this formula to a practical dataset from photographs of a research site. We examined the first difficulty, namely that plural solutions could exist for a yearly transition matrix, which implies that there could be multiple scenarios for the same transition in land-use change. Using data for the Abukuma Mountains in Japan, we then looked at the second difficulty, in which we may obtain no positive Markovian matrix and only a matrix partially consisting of negative numbers. We propose a way to calibrate a matrix with some negative transition elements and to estimate the prediction error. Finally, we discuss the third difficulty that arises when a new land-use category appears at the end of the observation period and how to solve it. We developed a computer program to calculate and calibrate the yearly matrices and to estimate the prediction error.