

# GIS Congress 2019- Spatio-temporal Pattern of Land Use/Land Cover Change in the Neka basin of Mazandaran province in iran, using Random Forest classification in SAGA-GIS- Zahra sedighifar- Kharazmi University

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## Abstract

Land use and land cover (LU/LC) change is a key component of environmental change studies. LU/LC change is a major issue of concern with regards to change in the global environment. Geographic Information System (GIS) and Remote Sensing (RS) are now providing new tools for advance ecosystem management.. Random Forest classification in SAGA GIS was applied in this study to detect land use/land cover changes observed in NEKA basin using multispectral satellite data obtained from Landsat 5 (TM) and 8 (OLI) for the years 1988, 2002 and 2018, respectively. In this framework, the main objectives of the present paper was to gain a quantitative understanding of land use and land cover changes in NEKA basin of Mazandaran over the period 1988, 2002 and 2018. The NEKA basin was classified into five major LU/LC classes including: Built up areas, Forest land, Poor range, Good range and Agricultural land. Change detection analysis was performed to compare the quantities of land cover class conversions between time intervals. The results revealed both increase and decrease of the different LU/LC classes from 1988, 2002 and 2018.

**Key words:** land use/cover. Remote sensing. SAGA GIS. Random Forest classification. NEKA basin

## Introduction:

Land use and and land cover (LU/LC) change is a very important issue in environmental studies (Halimi, et al. 2018). This study comprehensively examines the spatiotemporal land use/land cover change. Approximately 36% of the Neka River catchment is covered by Hyrcanian forests. This is a valuable ecosystem, because it has critical wildlife habitat, soil protection, water permeability, clean air and social and economic impact that a serious problem in recent years has been the decline in these forests. Neka is ranked second in wheat production in Mazandaran province. It is therefore important to plan for future water resources management in the Neka River Basin with future climate change and vegetation changes.

## Case study watershed:

The Study area is located in Mazandaran province, In the northern Iran, between 53°17'30"–54°44'22"E longitude and

36°27'46"–36°41'8"N latitude (Fig. 1). The Neka River basin is one of the largest watersheds and It has an area of 1871 km<sup>2</sup>. The NEKA river basin contains city, forest, Agriculture land, pasture and bare land. Almost 36% of the Neka River basin is covered by Hyrcanian forests; this is a valuable ecosystem type because it provides important wildlife habitat, and has significant soil conservation, water permeability, clean air, and socioeconomic effects. A serious problem in recent years has been the decline of these forests.

## Materials and methods:

To analyze 30-years land use/cover change, 3 Landsat satellite images of 1988, 2002 and 2018 was downloaded from United States Geological Survey (USGS) official website (<https://earthexplorer.usgs.gov>). TM and OLI sensor data were taken in count for 1988, 2002 and 2018, Respectively.

## Random Forest Classification:

Random Forest classification is an Group learning algorithm based on the idea that a combination of bootstrap aggregated classifiers perform better than a single classifier (Breiman 2001). The bootstrap incorporator means that each individual tree is parameterized using a randomly sampled set of observations with substitution from the training data.

## Accuracy assessment

Accuracy assessment is very important for understanding the developed results and employing these results for decision-making. The accuracy of each algorithm was assessed using a number of metrics derived from an error matrix. These include Overall Accuracy (OA), Producer's Accuracy (PA), and User's Accuracy (UA).

## Result and dusscution:

After applying the classification techniques on All three satellite imageries, important changes in land use/- cover were found. The LU/LC classification map is shown for 1988, 2002 and 2018, respectively. The study area was defined to have five land use and land cover categories including: Built-up, Forest land, Poor range, Good range and Agricultural land. The result of this study showed that built up areas and Poorange increased from 27.7 and 54.58 km<sup>2</sup> in (1988) to 33.95 and

104.15 km<sup>2</sup> in (2002), and 61.19 km<sup>2</sup> and 187.25 km<sup>2</sup> in (2018), respectively. While, Forest land, Good range, and Agricultural land decreased from 554.82 km<sup>2</sup>, 651.11 km<sup>2</sup> and 637.59 km<sup>2</sup> in (1988) to 0, 117.165 and 3.6 km<sup>2</sup> in 2016, respectively 502.82 km<sup>2</sup> and 593.57 km<sup>2</sup> and 632.08 in (2002), and 428.57 km<sup>2</sup>, 509.89 km<sup>2</sup>, 542.47 km<sup>2</sup> in (2018).

Accuracy assessment for each class is 70 points. Accuracy assessment of the land use/cover classification results obtained showed an overall accuracy of 83.11 for 1988 and 86.24 for 2002 and 85.38 for 2018. The Kappa coefficients for 1988, 2002 and 2018 maps were 0.81 and 0.83 and 0.82, respectively.

**Conclusion:**

This study provided a detailed assessment of multi-temporal LULC changes in the NEKA basin of Mazandaran in Iran using Landsat data and advanced feature selection and classification technique- Random Forest. The results indicate that during the study period, built-up land and Poor range have increased while agriculture and Forest land and Good range have decreased. Information obtained from change detection of LU/LC can aid in providing optimal solutions for the selection, planning, implementation and monitoring of development schemes to meet the increasing demands of human needs in land management. Thus, these lu/lc change have very little direct influence on the state and change of land-cover in the NEKA catchment.