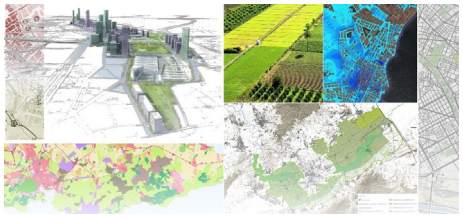


2nd International Conference on Future Challenges in Sustainable Urban Planning & Territorial Management

Title: Forecasting the Growth and Urban Development Patterns in Bojnourd City

Authors: Zahra Behrouzmoghadam [1]; Ali Maddahi [2].
Affiliations: [1] Guilan University; [2] Universitat Oberta de Catalunya

University of Guilan

• Abstract

In 2005, Bojnourd's designation as North Khorasan Province's center spurred urban growth due to rural migration and various center aggregations, necessitating urban development. The city expanded, converting agricultural lands for suburban land use. This study, analyzing Bojnourd's land use from 2011 to 2021 via remote sensing, artificial neural networks, and cellular automata, used multispectral Landsat images cross-verified with Google Earth. With over 85% classification accuracy, it estimated and predicted 2031 land use changes using a Markov chain, considering factors like topography and infrastructure. Predictions show increased urbanization and reduced agricultural land by 2031, guiding Bojnourd's development planning effectively.

• Methodology

The study compared Artificial Neural Networks and Support Vector Machines for urban growth analysis in Bojnurd City, favoring Artificial Neural Networks for land use classification. It employed a unique urban planning approach, using satellite images (2011-2021), topographic maps, and spatial data from various sources like the National Cartographic Center, Google Earth, and the Iranian National Cartographic Center.

– Image Acquisition and Preprocessing:
The study used Landsat satellites with OLI, ETM, and TIRS sensors to capture Earth's surface images. Preprocessing involved radiometric accuracy control, atmospheric correc-tions to mitigate errors, and geometric corrections to align images.

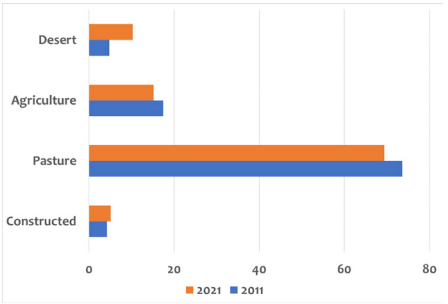
– Land Use Classification Process:
The study classified land use into four main classes: constructed areas, agriculture, pastures, and desert land. Data included spectral, feature boundaries, DEM, statistical, climatic, geological maps, and GIS. The Region of Interest (ROI) tool was used for sampling and training. Initially, both Multi-Layer Perceptron Artificial Neural Network and Support Vector Machine were used, but the latter was found more accurate using ENVI software.

– Data collection methods
To depict the spatiotemporal land use patterns in the study area, we utilized remote sensing archival data, specifically obtaining multispectral images from Landsat 7 (ETM+) and Landsat 8 (OLI) for Bojnurd (path 161, row 034). Detailed information regarding the Landsat data for the years 2011 and 2021 is provided in Table below.

Data Type	Data Acquisition Organization
Satellite Images, 2011-2021	Image data and Remote Sensing (30-meter resolution)
Topographic Maps of Bojnourd City and Plain	Surveying Organization of Iran
Remote Sensing Data and Digital Elevation Model	Geological Survey (USGS) and Surveying Organization of Iran
Spatial Data for the Region, Vector and Reference Land	Geological Survey (USGS) and Surveying Organization of Iran

• Results

– Analysis of Land Use Changes from 2011 to 2021:
The study analyzed land use changes in Bojnurd from 2011 to 2021, revealing a shift towards constructed and desert lands, decreased pasture, and slight agricultural changes.



– Modeling and Prediction of Land Use Changes:
The study used an artificial neural network model to predict land use changes in Bojnurd, revealing a significant shift from agricultural land to urban use, especially in the eastern part.

– Forecasting Land Use in 2031:
The Markov chain method forecasted land use in Bojnurd for 2031, showing an in-crease in built-up areas and a decrease in agricultural land. This trend, particularly in Bojnurd-Esfarayen, Bojnurd-Mashhad, and Bojnurd-Ashkhaneh, underscores the need for strategic urban planning to balance development and conservation.