

## Assessment of the Trends of Land Use and Climate Changes in Choghakhor Wetland Landscape Emphasizing on Environmental Impacts

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### Expanded Abstract

#### Introduction

Land use change and climate change are the major concerns in the global environment. Many environmental parameters affect the behavior of the earth's climate system and its terrestrial components. Effects of land use and land cover changes have direct influences on climate changes. Now, climate change is known widely as a global health problem that has adverse impacts on natural and man-made environments. Assessment of the trend of land use changes is a process that leads to understanding the interaction between humans and the environment. This problem is more important in the sensitive areas and spatially on wetlands. The hydrological and bio-geological functions of many wetlands depend on ground and surface water ecosystems as well as its place in landscape. Therefore, the development and changes in contiguous ecosystems particularly change in water flow can cause damage and even destroy the wetland. This study aims to identify and analyze the environmental changes and pressures on Choghakhor Wetland landscape. This wetland is located between 50° 52' to 50° 56'E and 31° 54' to 31° 56'N in height 2270 meters above mean sea level. Choghakhor Wetland located in Zagros Mountains, with area of 1600 hectares, has freshwater resources. It is located in non-protected area in prohibited hunting zone that 2500 ha proposed for refugee site.

#### Materials and Methods

In order to assess the trends of changes in this study, land use changes and Climate change parameters were investigated in a period of ten years. Then, by environmental pressures analysis, some strategies are presented to reduce environmental impacts. In Fig. 1 stages of the research are presented and described in the following.

- **Step 1.** Use of the Landsat-7 satellite images (ETM+) with suitable timely coincidence in 2003 and 2013 for land use/cover change assessment.
- **Step 2.** Application of the maximum likelihood classification and assessment of classification accuracy with kappa and overall accuracy in ENVI 4.7.
- **Step 3.** Evaluation of the trend of climate change factors such as, the average amount of annual precipitation and temperature. Characterizing the drought degrees with the Standardized Precipitation Index (SPI) by data of effective stations in the study area.
- **Step 4.** Analysis of the environmental changes and pressures by considering the results of climatic trend and land use changes.
- **Step 5.** Presenting management strategies to reduce environmental impacts of land use change and climate change on wetland landscape and its surrounding environment.

#### Results and Discussion

The aforementioned steps were performed for landscape of Choghakhor Wetland. Detecting the land use and land cover changes in 2003 and 2013 indicate five distinct classes, including: pasture and forest (cultivated and non-cultivated), bare land, man-made (settlements and roads) and water (snow and water) results (Fig. 2 and 3).

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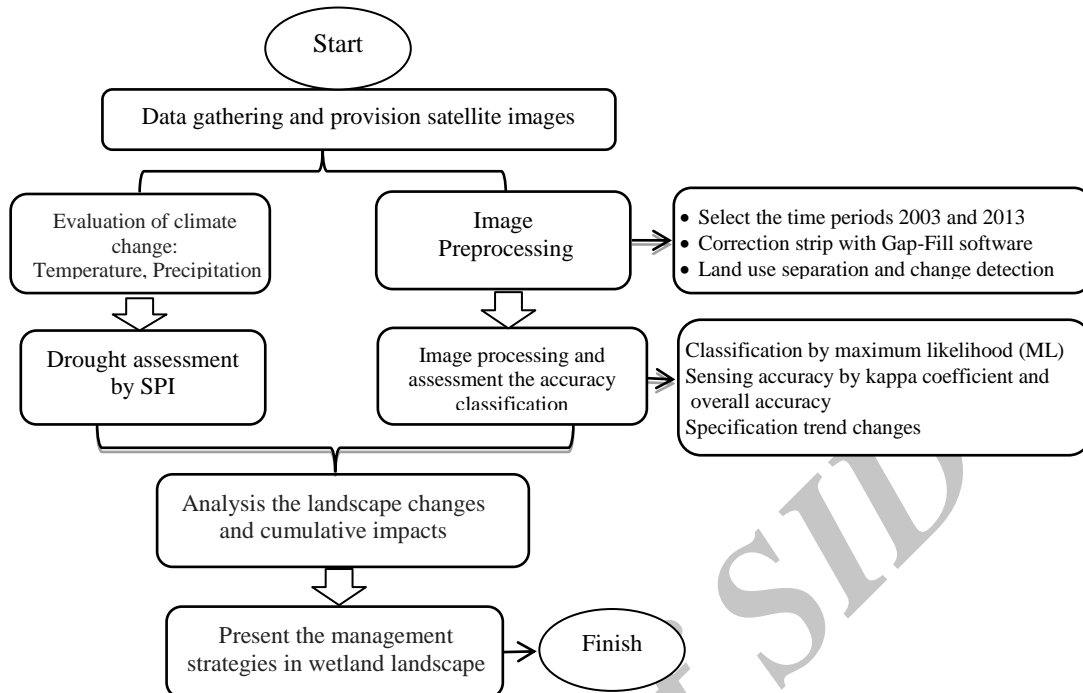


Fig. 1. Process of land use/cover and climate changes assessment in this study

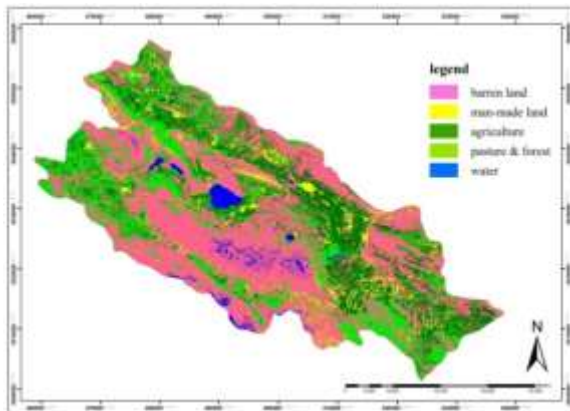


Fig. 2. Classified image of study area in 2003

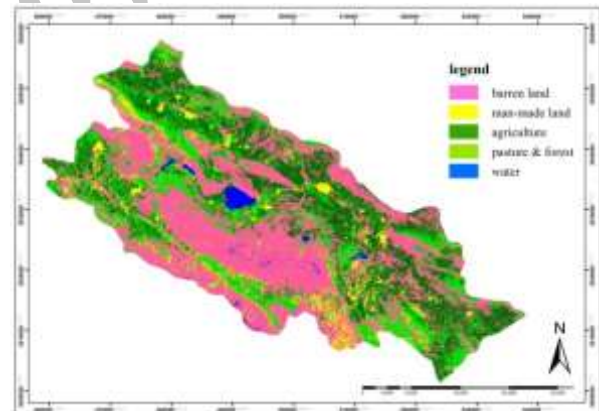


Fig. 3. Classified image of study area in 2013

The results of image classification and remote sensing process in 2003 and 2013 are presented in Table 1. Data processing in this period represent that increase in area of cultivated and man-made lands are 18 and 26.3 percent and decrease in water body, pasture and forest and bare lands are 51.4, 4.2, and 2 percent. The results of the classification accuracy measurement were estimated on 89% and 64% in 2003 and 93% and 68% in 2013 for overall accuracy and Kappa coefficient, respectively. The most effective meteorology data (Overgan Station records) in wetland area in 2012 illustrated that the amount of standard precipitation index is -0.89, which confirmed occurrence of a drought. The probability of drought occurrence is predicted by 41.7% which is in accordance with previous year records. The investigation on climatic change elements showed an increasing trend in average annual temperature with a sharp and irregular fluctuation of rainfall in the recent years.

## Conclusions

Investigation on the trend of thirty-year records of climatic elements and the obtained results by satellite monitoring of landscape illustrated 50% decline in water resources amount. Declining rainfalls, rise of a few degrees in the annual average temperatures in the region, and the recent drought, as confirmed by the remote sensing processing result, show water shortage is in expended trend. Despite, land use changes played an important role in the situation during water shortage period. The agriculture development has imposed an enormous environmental pressure by excessive consumption of water, fertilizers and pesticides. Then, drying of springs, reduction of groundwater level, increase in organic and inorganic contaminants, and finally enrichment

**Table 1. Results of image classification**

Land cover classes	2003		2013		Relative changes (growth rate)	
	Area (%)	Area (km <sup>2</sup> )	Area (%)	Area (km <sup>2</sup> )	Area (%)	Area (km <sup>2</sup> )
Pasture and forest	20.6	388.98	19.7	372.53	-4.2	-16.22
Agriculture	22.8	430.77	26.9	508.68	18	77.51
Barren land	47.5	898.98	43.84	829.01	-2	-69.6
Man-made land	6.6	125.00	8.35	157.90	26.3	32.94
Water	2.5	47.28	1.21	22.88	-51.24	-24.33
Total	100	1891	100	1891	-	-

and declining of dissolved oxygen in wetlands is a description of the occurred situation due to cascading effects of land use change simultaneously with the climate change which could be effective on ecosystem functions of wetland, such as water purification and regulation.

Increase in man-made areas in terms of urban settlements and tourist areas indicated that some pressures have led to decline in permeable surfaces and groundwater recharge, habitat loss, and reduction in control ability of hazardous pollution and detoxification could raise some disorders in exposition of this wetland ecosystem functions. While increasing pressure is occurred, climate change set regional water resources in critical condition and land use change add an irrational severity by such effects. According to adverse changes of Choghakhor wetland landscape, if the current situation trend continues, the wetland will be faced with some irreparable threats. In such a situation, it seems necessary to ponder to proper programs for logically exit from current crisis and preventing the environmental diminish. Leaning the performed analysis, the strategies to reduce environmental impacts and mitigation of drought in the study area are provided as follows:

- Developing the conservation plan and combining them with the integrated wetland management plan in National Development Plans in order to preserve wetland ecosystem functions,
- Modifying the cultivation methods, reducing the consumption of chemical fertilizers and pesticides and awareness about the proper way in their use, using the efficient irrigation systems, licensing the drilling and operation wells with accurate specialized measurements, and awareness about their environmental effects,
- Identifying the natural drainage paths and leaving open the permeable parts in residential areas, in order to reduce the probability of flooding in cities and preservation of hydrologic balance in the drainage basin,
- Dealing with drought losses and declining its effects by applying strategies such as optimum selection and land use change, modifying the culture alternation system, and groundwater levels control.

**Keywords:** Choghakhor Wetland, climate change, environmental pressures, land use change, remote sensing.