**Monitoring the trend of vegetation changes one of the most important indicators of land degradation (in Ilam province)**

Land degradation is an obstacle for sustainable development, which is due to its effect on the environment, food security, agricultural services, and livelihood services (UNCCD, 2015). In order to evaluate land degradation, remote sensing and geographic information system is used as one of the important tools for providing information layers such as vegetation mapping, soil mapping, or other information such as salinity, land use, etc. Consideration of the factors and processes that lead to the phenomenon of land degradation and desertification (such as vegetation and soil degradation, water and wind erosion, soil salinity, soil compaction, declined level of groundwater aquifers, etc.) plus its causes and factors is essential for the control and evaluation of desertification and land degradation. Observations on the satellite-derived vegetation fertility have a long history in the studies of global variations (Fensholt, 2012; Le, et al., 2012: Lambin, 1997). In the study of land degradation, certain indicators such as normalized difference vegetation index (NDVI) obtained from satellite data are widely used to estimate vegetation variations and its ability has been shown in different studies of land degradation (Vandandorj et al., 2015; Zhang et al., 2014; Diouf, 2001).

In this research, in order to study the trend of vegetation variations in Ilam Province for the statistical period of 17 years (2000-2016), the NDVI products of MODIS sensor of Terra satellite known as (MOD13Q1) were used. In this study, approximately 410 images (size of 2 TB) for the years 2000-2016 in Iran were downloaded from the website and, on average, 24 images were employed per year. After receiving the images, all of them were georeferenced for the studied area of mosaic using the sampling method of the nearest neighbor. Finally, these data were corrected, multiplied, and clipped on Gis, Envi, and Surfer software. After obtaining and preparing the images and creating a database, data extraction and configuration was the next stage of the work. In this stage, initially, all the 410 images after the mosaic and MRT stage were reduced to 200 images and 12 images were obtained for each year (one image per month). All of these images were converted into ASCII format and stored; ultimately, the mean of 12-month-old images was annually obtained and converted into an image and an ASCII, i.e. generally, an ASCII and a total of 17 ASCII files were used for the annual monitoring of vegetation variations. Given the spatial resolution of 250 m for each image, the total number of pixels for each image that were studied in the boundaries of the area was above 953552 pixels and, after the removal of negative and lost data, almost 328042 remaining pixels were analyzed. Eventually, through programming in software R, the NDVI index time series was prepared using the parametric statistics of classical linear regression for all the pixels for the entire 17-year statistical period (2000-2016) and the results were extracted. Finally, for verifying the results, the field observations as well as oral interviews with informed and old neighbors in the studied area were prepared.

The vegetation maps derived from the MODIS sensor image processing of the Terra satellite were prepared for 17 years from 2000 to 2016 for the studied area (Figure 3). In Figure 3, the vegetation maps are shown for the entire studied 17-year period. In these images, the dynamics of the vegetation can be seen in different years. According to these images, land degradation and vegetation degradation during the time interval were making progress throughout the studied area from west to east. As shown in the images, in the years 2009, 2010, 2011, and 2012, the vegetation degradation was more severe in the west, especially in the southwest, of the studied area in the sub-basins (eastern and western Dasht-e Abbas, Musian, Chenaneh) as well as the west, the sub-basins (Abdanan, Dehloran, Mehran and Saleh Abad), and the vegetation has reached its lowest level. Afterwards, the slope values of trends were prepared in the form of significance map of trend slope for spatial analysis. According to these maps, it is clearly determined that the highest trend of slope variations was in the west and southwest, as the low-rainfall and desert area of the province, but the review of significance of slope variations of the vegetation trend in the studied area showed that the significantly negative trend of vegetation (decreasing trend in NDVI index values) was focused on the southwest and northwest corners of Ilam Province. Moreover, several points in the slope variations of the trend were negative in the west of Ilam Province, which have been shown in red in the significance map. This indicates that vegetation degradation, and subsequently, land degradation is making progress in Ilam Province from the western boundaries towards the central and eastern areas of the province.

Overall, results of this study showed that the focus of the highest increasing changes was on the NDVI indicator in the northeast, east, and center of the studied area, which depended on higher rainfall and moisture content, increased agriculture owing to Seimare Dam and water-rich rivers of the region, as well as denser oak forests, as the consequence of proper height and humidity. However, the focus of the highest variations in the decreasing trend in the NDVI index could be seen in the west, southwest, and northwest of the region, which was compatible with desert and low-rainfall areas. Furthermore, the slope values of trends obtained in the significance map of trend slope would approve this claim. Analysis of significance of the slope trend of vegetation variations in the studied area indicated that the significantly negative trend of vegetation (decreasing trend in the NDVI index values) was focused in the southwest and northwest of Ilam Province. Besides, several points in the slope variations of the trend were negative in the west of Ilam Province, which have been shown in red in the significance map. In contrast, the significantly positive trend of slope variations of vegetation (increasing trends in the NDVI index values) in Ilam Province was focused in the center and east of the studied area, as represented in green in the significance map. Finally, the points without trend of slope variations are shown in white, so that in this section, the trend of slope variations of vegetation was neither increasing nor decreasing, but was a neutral and unchanged trend. Eventually, the field studies confirmed the findings of this study. In sum, these findings showed that the analysis of trend of NDVI time series was highly beneficial and practical to identify and indicate the areas of vegetation and to detect the land degradation and restoration.

**Key words:** Ilam, land degradation, trend, classical linear regression, MODIS, NDVI