



MONITORING OF FOREST AREAS BASED ON REMOTE SENSING IMAGES

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Abstract: Monitoring forest areas based on remote sensing technologies is very useful in the context of sustainable development and their efficient and safe management. This study aims to analyse and characterize the dynamics during 7 years of the Domogled National Park - Cerna Valley in Caras Severin County, based on GIS technologies and Landsat 8 images, vegetation indices and specialized programs. Domogled National Park - Cerna Valley is a naturally protected area located in the south-western part of Romania, on the territories of the Caraş - Severin, Mehedinţi and Gorj wetlands. Since 1932, the Domogled Mountain Floristic and Landscape Reserve has been established here, one of the 11 reservations in the current park. Over 58 years, in 1990, the area became Domogled - Valea Cernei National Park, which covers an area of over 61 thousand hectares. These secular beech forests must be preserved, in their current state, for their social and conservative value, and not for production. Secular beeches are part of a landscape of great cultural and natural value, in which the local community has offered us for hundreds of years an example of living in communion with nature and preserving the Romanian architecture and traditions in the Banat Mountain area, which ensures an exceptional value for the national park, attracting many tourists annually. Based on the spectral bands of the Landsat 8 system, NDMI, NDBR, NDVI, NDWI vegetation characterization indices were calculated. The values of the vegetation indices were analysed, from the aspect of statistical security, based on the appropriate statistical-mathematical methods (p, R², F-test), and to highlight a series of interdependence relations between certain indices, regression analyzes were used. The basis of which polynomial functions with related safety parameters have results. Based on the values of the correlation coefficient between the studied indices, interdependence relations were analysed in the case of indices with a good correlation. Thus, the NDVI variation relative to NDWI was described under conditions of R² = 0.981, p < 0.01, and the NBR variation relative to NDMI was described under conditions of R² = 0.854, p < 0.01.

• Introduction

- Monitoring forest areas based on remote sensing technologies is very useful in the context of sustainable development and efficient management and their safety. Remote sensing methods, techniques and technologies are increasingly used in the study and monitoring of agricultural land, forest, vegetation or urban areas. Spectral information is very useful and has a high precision in characterizing large areas of land. This study aims to analyse and characterize the dynamics over 7 years of Domogled National Park - Cerna Valley in Caras Severin County, based on GIS technologies and Landsat 8 images, vegetation indices and specialized programs. Domogled National Park - Cerna Valley is a protected natural area located in the southwestern part of Romania, on the territories of Caraş-Severin, Mehedinţi and Gorj counties.

• Material and method

- The main purpose of this research was to monitor the vegetation dynamics within the Domogled Valea Cernei National Park based on remote sensing images from the Landsat 8 system. Satellite images that were used to characterize the arboreal vegetation were taken from the portal www.planet.com si sunt din perioada 2013-2019.

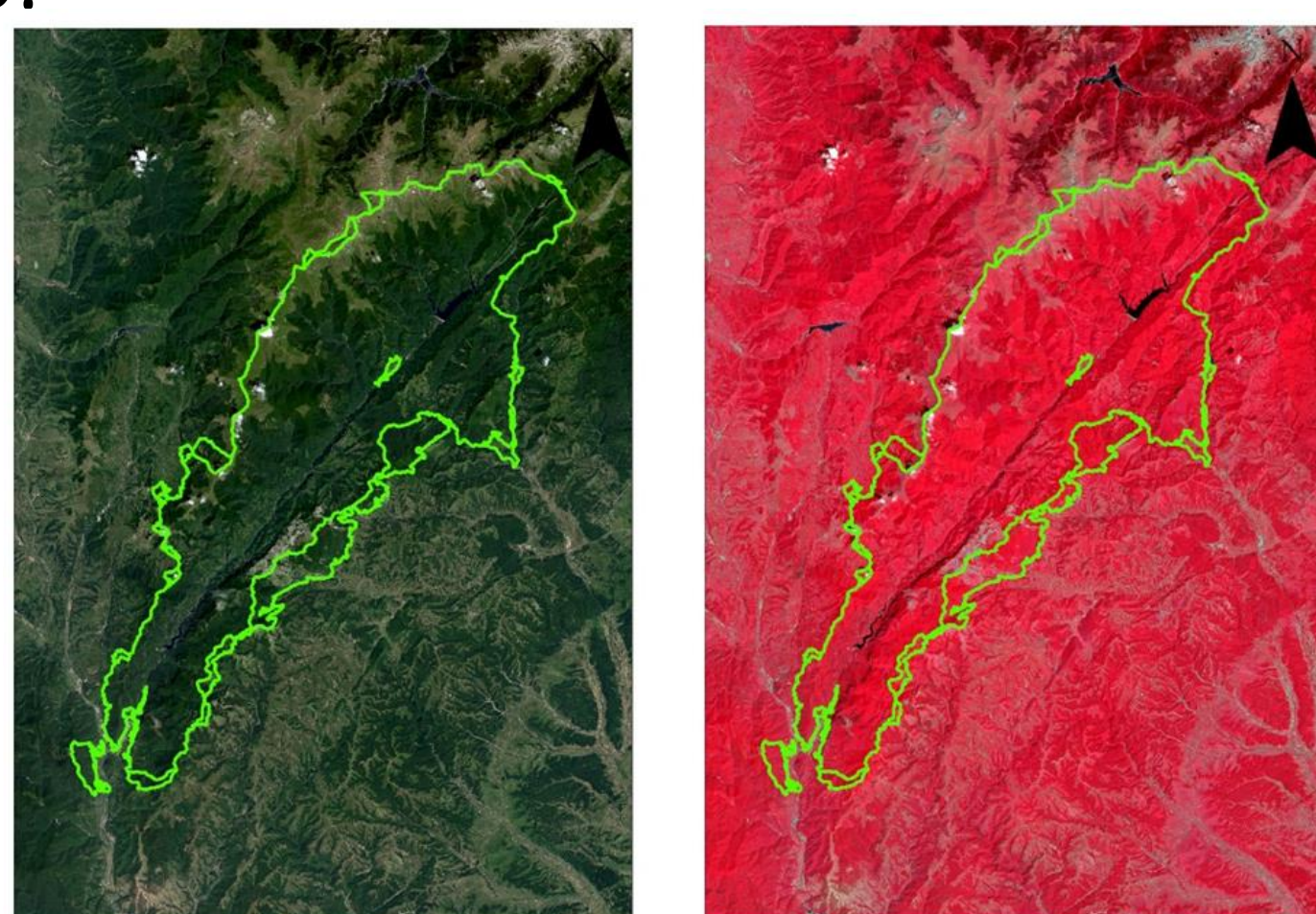


Figure 1. The combination of Red Green Blue and NIR Red Green for the studied area

• Results and discussions

Index values NBR, NDVI, NDMI, and NDWI				
	NDMI	NDWI	NDVI	NBR
2013	0.251914	-0.071367	0.338173	0.400253
2014	0.282347	-0.230127	0.538072	0.464052
2015	0.248629	-0.078151	0.341907	0.387522
2016	0.250638	-0.212170	0.488711	0.427921
2017	0.197611	-0.187132	0.412765	0.356372
2018	0.225787	-0.191454	0.447544	0.398582
2019	0.279154	-0.161429	0.338173	0.447412

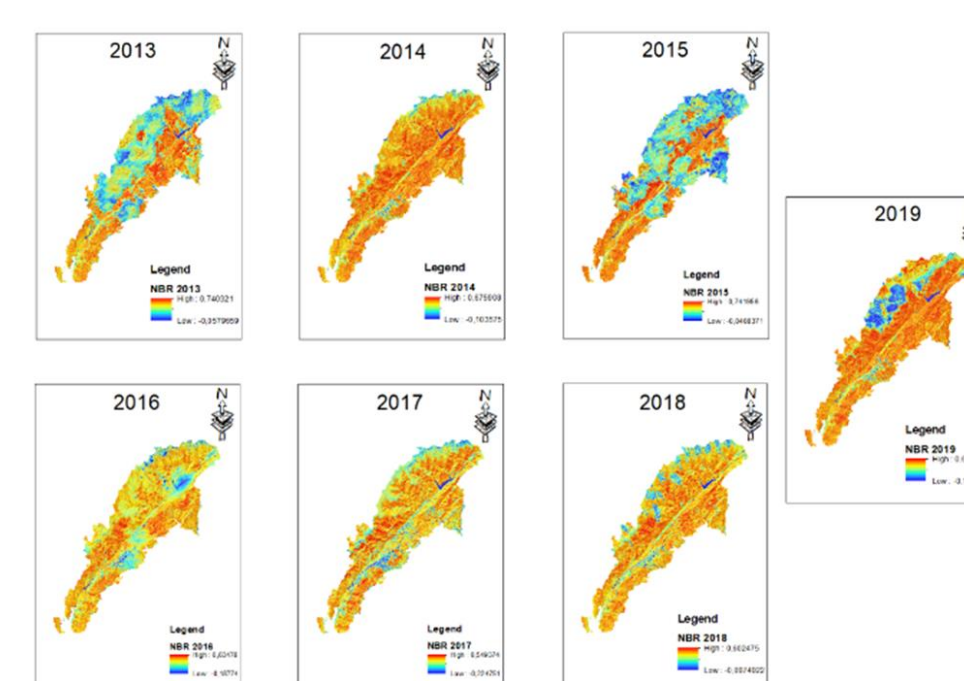


Figure 2. The Map of NBR index

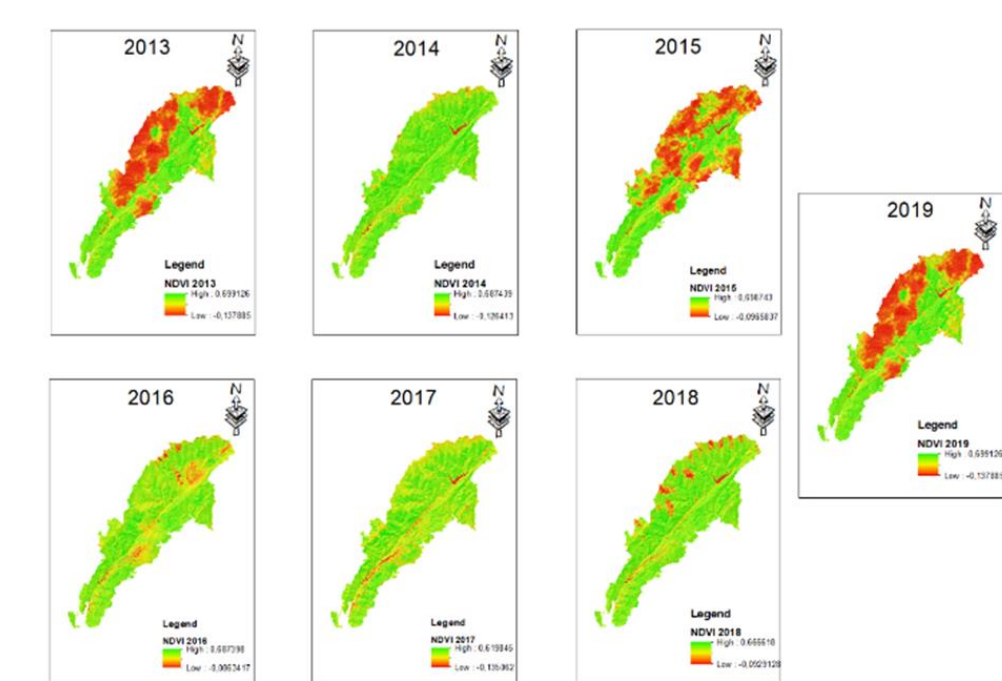


Figure 3. The Map of NDVI index

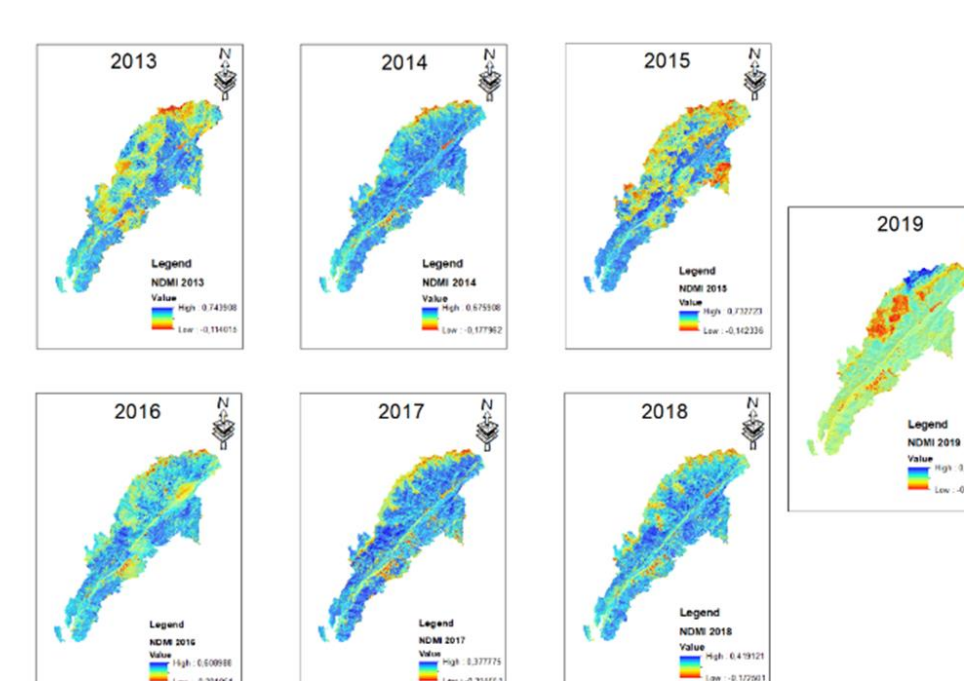


Figure 4. The Map of NDMI index

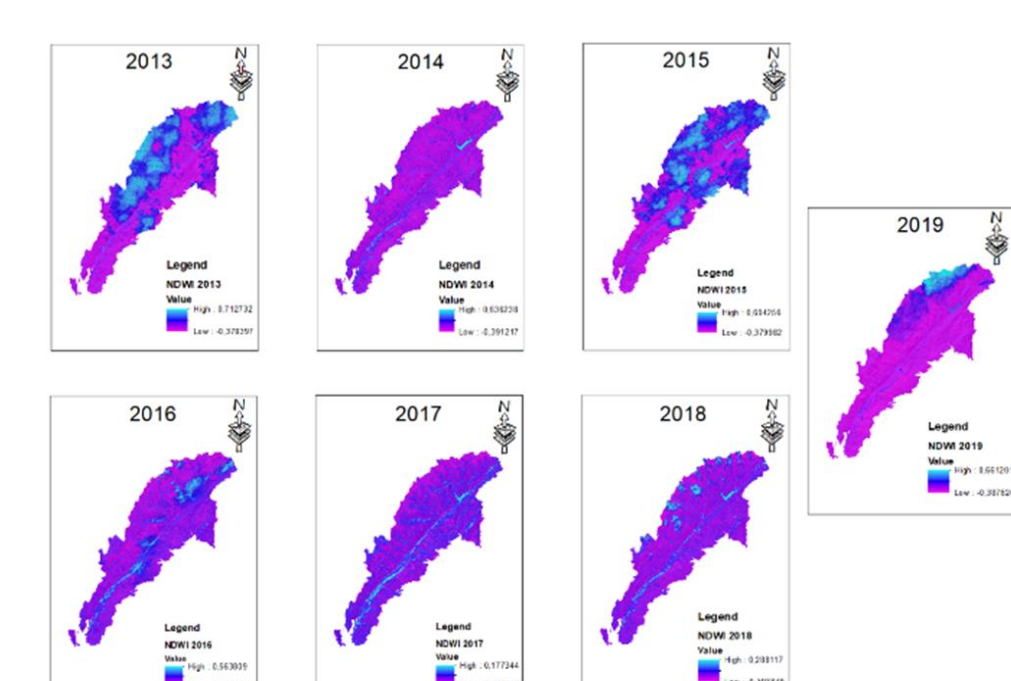


Figure 5. The Map of NDWI index

$$NDVI = 145.37x^3 + 85.087x^2 + 13.635x + 0.9428$$

$$NBR = 6.4303x^2 - 1.9578x + 0.497$$

• Conclusions

The main purpose of this study was to monitor for 7 years - 2013 -2019 - the Domogled Valea Cernei National Park based on remote sensing images from the Landsat 8 system.

Mathematical functions were found that expressed the interdependence between indices.

The PCA analysis facilitated the distribution and association of the years of the study period in relation to the values of the indices calculated based on the spectral data and explained the variant in the set of results.

The cluster analysis facilitated the grouping of the years from the study period, based on similarity in relation to the values of the studied indices and which reflected the condition of the vegetal carpet in the study area.

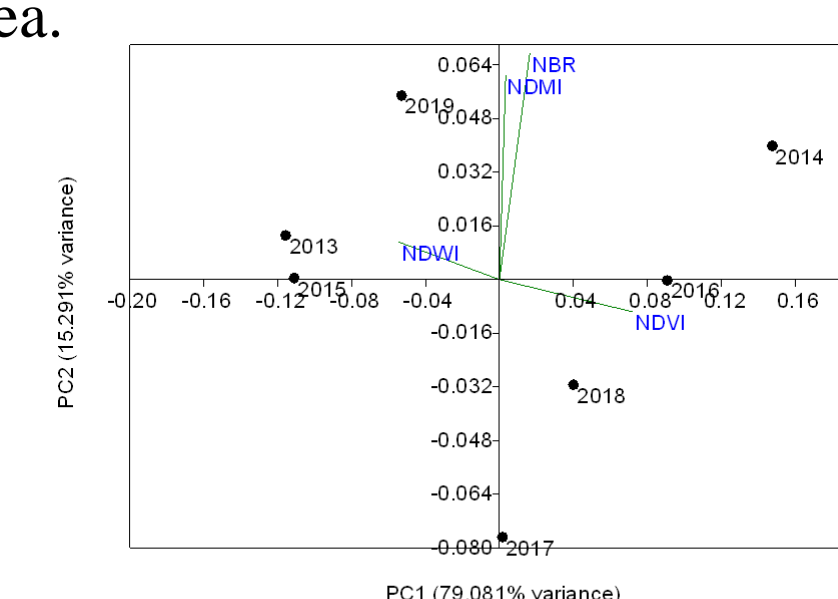


Figure 8. The graph of PCA analysis

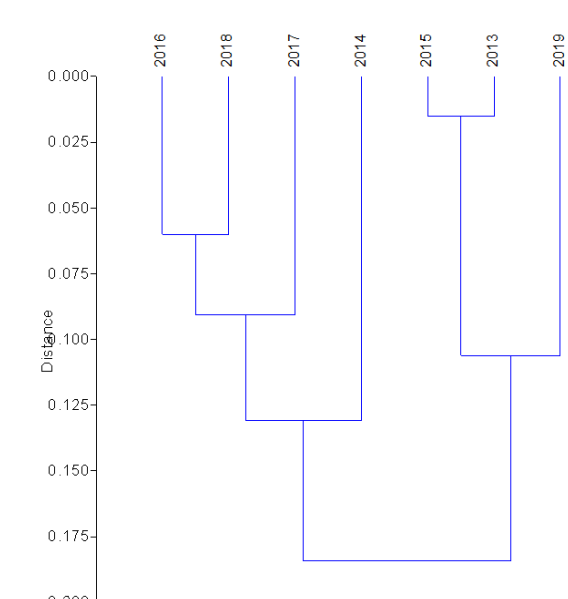


Figure 9. Cluster analysis chart