*Corresponding Author's Email: enkela.begu@fhf.edu.al
https://orcid.org/0009-0003-3484-4930
Proceedings of the International Conference on Research in Humanities and Social Sciences
Vol. 2, Issue. 1, 2025, pp. 78-85
DOI: https://doi.org/10.33422/icrhs.v2i1.1307

ISSN: 3030-0304 online

Diamond Scientific Publishing

Deforestation in Protected Areas: A Gis/Rs Based Study of National Park of Albanian Alps

Enkela Begu* and Xhulia Bygjymi
University of Tirana, Faculty of History and Philology, Department of Geography, Tirana, Albania

Abstract

Deforestation means the massive cutting down or damage of forests. When this occurs in protected areas such as national parks, the consequences are more profound due to the sensitivity of the ecosystems. Hence, deforestation in protected areas is a serious environmental problem, which contradicts the very purpose of these areas, like preserving biodiversity, protecting natural habitats, and ensuring ecological sustainability. This study focuses on identifying and analyzing the spatial-temporal patterns of deforestation in the National Park of Albanian Alps by making use of Geographic Information System (GIS) and Remote Sensing (RS) technology. Their combination provides tools to generate crucial information on where the forest cover has changed over time and to measure the rate of this change over a period of time. A series of thematic maps is prepared for this purpose, identifying areas of deforestation and providing a deeper understanding of the surrounding environment. The Albanian Alps, covering an area of 2,020km², constitute the most mountainous and interesting region of Albania, ranking it among the few countries in Europe with Alps.

Keywords: Alps; deforestation; GIS; spatial; visualization

1. Introduction

Deforestation is the process of removing or destroying forests, usually to use the land for other purposes, such as agricultural activities, building roads or cities, extraction of wood for fuel, construction, or industry etc. This process has serious consequences: loss of biodiversity, destruction of natural habitats of rare species, deterioration of soil and water quality, and increased greenhouse gas emissions. Knowing how and why forest area changes over time is important for managing forests sustainably because such changes may result in long-term losses, e.g., forest conversion to agriculture, or gains, e.g., afforestation (Food and Agriculture Organization [FAO], 2015). Forest conservation is linked to many aspects, such as environmental, economic, social, and government regulation (Fawzi et al., 2018). Protected Areas (PAs) are a key strategy for safeguarding global biodiversity and ecosystem

services (Wade et al., 2020). A protected area, as an approach to conserve biodiversity, is widely accepted worldwide, playing a critical role by protecting specific areas of land with ecological, natural, or even cultural values (Farhadur et al., 2021). As the formation of protected areas is targeted towards conserving forests, it is expected that this measure should influence an area's land-use conversion pattern, thus avoiding deforestation (Cuenca et al., 2016). The Government of Albania has established a representative system of protected areas, which currently covers 526,334.39 ha, or 18.31% of Albanian territory, comprising 17.88% terrestrial and 0.43% marine protected areas. Although the Republic of Albania is well known and highly ranked by its rich biodiversity, the network of protected areas coverage from 5.2% of the country's territory in 2005 has expanded to 16% in 2014 with continuous extension, mainly aimed at reaching a conservation status comparable to the EU member countries' level (National Agency for Protected Areas, 2019).

1.1 GIS, Remote Sensing, and Deforestation

GIS (Geographic Information System) and Remote Sensing (RS) are powerful tools for mapping, monitoring, and analyzing deforestation. Remote sensing is outlined because of the assortment of information regarding an associate object from a distance (Thangaperumal et al., 2019). Satellite imagery, which is the main output of this technology, provides image data to identify forest cover spatio-temporal changes, while GIS allows for spatial analysis and modeling of deforestation patterns. Remote Sensing provides a wide range of temporal and spatial information on land cover. Satellite images such as those from Landsat, Sentinel, or MODIS can be analyzed to detect changes in forest cover through specific indices such as NDVI (Normalized Difference Vegetation Index). These findings help to detect areas affected by deforestation, burning, or land conversion to agriculture or bare land. Comparing multi-temporal images allows mapping deforestation trends and identifying sources of pressure. GIS serves as a tool for analyzing, visualizing, and combining different geospatial data. It allows the integration of RS data with other layers such as road networks, protected area boundaries, land use, and socio-economic data. This helps in designing deforestation maps, to identify the location and extent of affected areas. At a time when resources for protected area management are often limited, the use of GIS and RS provides an efficient, sustainable and low-cost method for environmental monitoring (Farhadur et al., 2021). They help not only to identify illegality, but also to assess the effectiveness of protection policies, for example, under the Convention on Biological Diversity or the EU Habitats Directives.

2. Study Area

The Albanian Alps National Park is a national park in Albania, declared by the Council of Ministers' decision No. 59, dated 26 January 2022. This park includes the natural ecosystems known as the "Valbona Valley" and Thethi Park, declared a "national park" (category II), and the "Gashi Valley", declared a "strict nature reserve" (category I). This park has a surface of 844.65 ha and it is also where most of Albania's peaks over 2,000m are located, including the highest peak in the Alps, Jezerca (2,694m), second only to the peak of Korabi (2,751m) (AKZM, 2024).

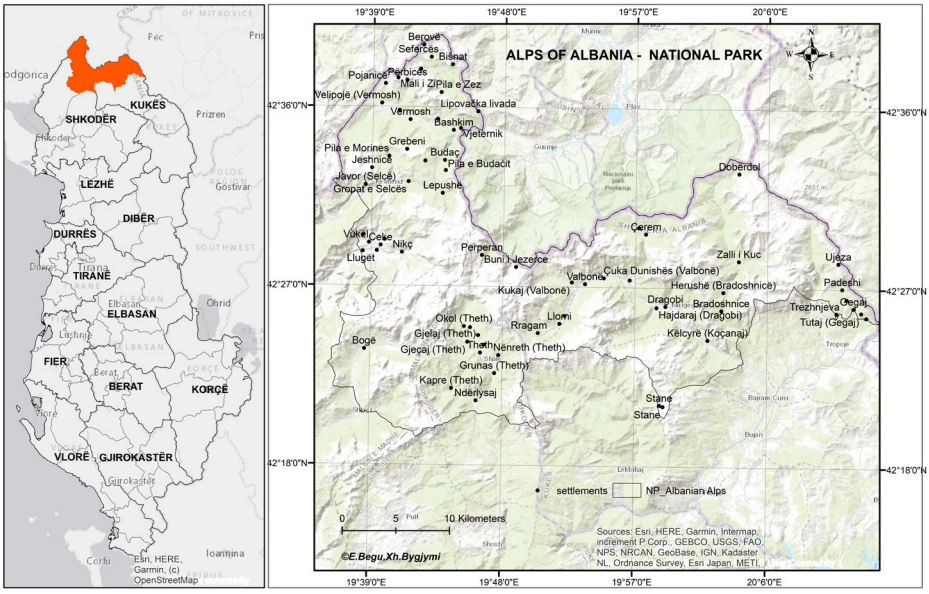


Figure 1. Study area;
Source: Authors' design

The relief has the shape of a large dome, while the mountain ridges and valleys have a radial distribution. Of particular value are the forms of karst and glacial relief. There are numerous large karst caves, reaching up to 5km in length. The glacial relict relief, with a greater spread than anywhere else in Albania, is associated with the high altitude, the northernmost position, and the most developed pre-glacial relief. The vegetation is distinguished by its richness, where forests occupy about 36% of the surface. Due to the general shape of the Alps, the plant belts gradually narrow from the outskirts towards their center, taking the form of concentric circles around the dome. The sudden rise in the height of the relief conditions the transition from the shrub belt to that of Beech, etc. In Theth, Valbona, etc., the inversion of the plant layers is observed, a consequence of cold air lakes. At medium altitudes and at its upper limit (900-1,000m to 1,800m), the Beech belt is often mixed with white spruce and Hormoq trees. The extremely isolated character of the Alps, the very high degree of fragmentation, and the great contrasts of their relief have created special and extremely diverse ecological and edaphic conditions, which are associated with the large number of endemic and subendemic plants.

3. Materials and Methodology

3.1 Database and Results

The bulk of primary data used for this study is based on the World Database of Protected Areas (WDPA), which contains polygons that specify the position, size, and shape of Albanian Alps National Park (WDPA,2024). With regards to forest area spatial distribution patterns CORINE Land Cover/Use vector database is utilised (Copernicus Land Monitoring Service, 2018).This digital database offers a pan-European land cover and land use inventory with 44 thematic classes, ranging from broad forested areas to individual vineyards. The product is updated with new status and changes layers every six years, with the most recent update made in 2018. The dataset has a Minimum Mapping Unit (MMU) of 5 hectares (ha) and is available as vector and as 100 m raster resolution data. In The Albanian Alps National Park during the study time 10 (ten) classes have been identified:1) forest -broadleaves, 2) forest -mix, 3) forest -coniferous, 4) bare rock, 5) pastures, 6) riverside beaches, 7) grassland

and shrubs, 8) complex agricuture patterns, 9) glaciers, perpetual snow, 10) water courses (Figure 2,3). The maps created for this purpose illustrate the spatial distribution of these classes.

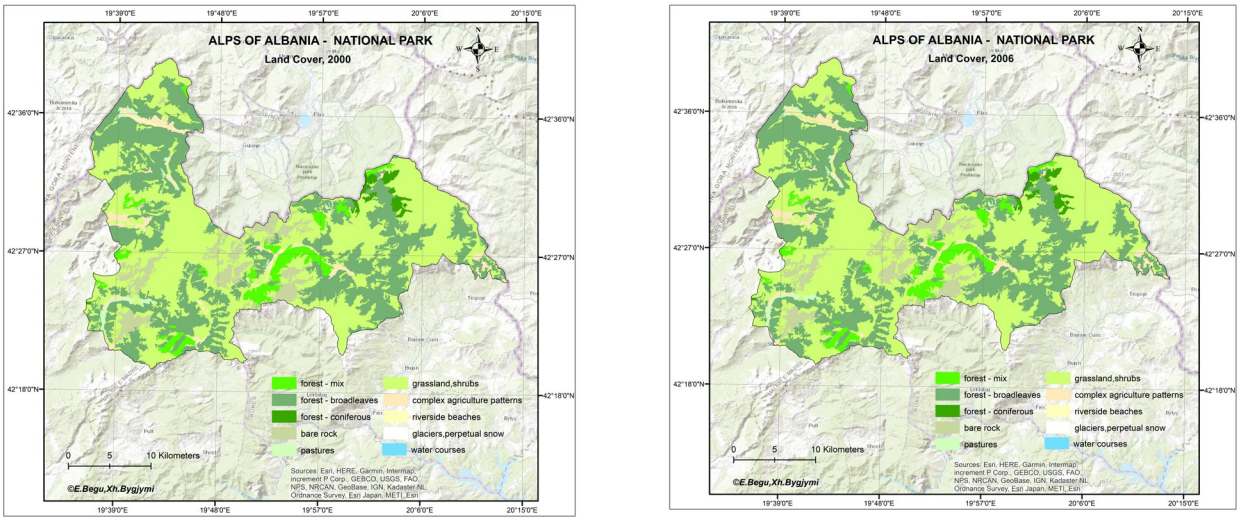


Figure 2. Spatial patterns of forest areas,2000-2006
Source: Authors' calculation

Table 1. Forest areas during 2000-2006 Source: Authors' calculation

Forest type	**2000**		**2006**	
	Ha	*%*	*Ha*	*%*
forest -broadleaves	29.776	35.95	29.720	35.89
forest - coniferous	10.29	1.24	10.01	1.20
forest - mix	3841	4.63	3776	4.56

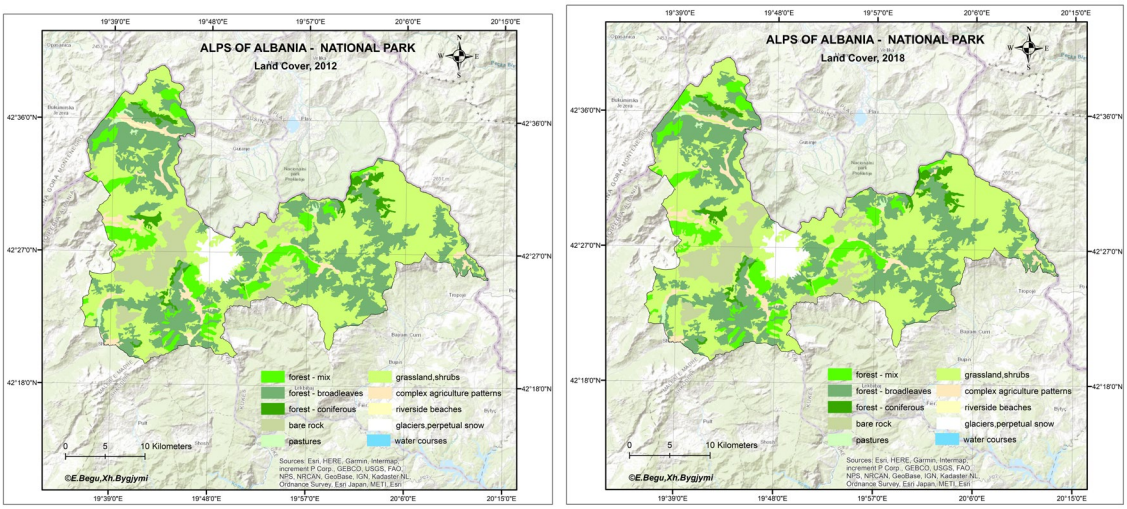


Figure 3. Spatial patterns of forest areas,2012-2018
Source: Authors' calculation

Table 2. Forest areas during 2012-2018

Forest type	**2012**		**2018**	
	Ha	*%*	*Ha*	*%*
forest -broadleaves	25.514	30.81	25.294	30.57
forest - coniferous	2075	2.50	2074	2.50
forest - mix	6918	8.36	6893	8.33

Source: Authors' calculation

Since the focus of this study is to address the deforestation status in the Albanian Alps National Park data with regards to forest types are extracted in presented in Tables 1 and 2. With this regard, the most notable changes can be outlined as follows:

- From 2000 to 2006, a decrease in the percentage of broadleaf forest and an increase in mixed forest is seen.
- In 2012, mixed forest increases further, while broadleaf is less present in percentage, possibly as a result of human intervention or climate change.
- In 2018, mixed forest accounts for more than half of the forest cover, showing a clear trend towards a mixture of species, which may be the result of restorations or natural changes in forest composition.

3.2 Discussions

Maps presented in Figure 4 identifies areas of changes with regards to forest. This form of visualization is very useful to understand that some forest areas in 2006 have turned into pastures or shrubs in 2012. This type of transition is common in cases of deforestation for grazing purposes or natural degradation. The changes are seen in small, concentrated areas, mainly in the western and southwestern parts of the Alps. This suggests that deforestation or land-use transformation has occurred on a limited, rather than massive, scale. However, since this is a national protected area, changes in forest cover are particularly concerning. They may signal human interference such as logging for firewood, intensive grazing, or informal construction. Regarding the period 2012-2018 it can be noticed that the changes are concentrated in the west and southwest of the map, in some mountainous areas of the Malësia e Madhe region. These areas coincide with territories that are difficult to reach, but vulnerable to fires, deforestation for pastures, or informal human activity. Although the changes are not widespread throughout the park, their concentration in a few areas makes the ecological impact significant. Two main changes can be noticed: transformation from forest to grassland and shrubs has occurred in several large areas, where previously there were mixed or broadleaf forests; from forest to burned area, possibly caused by natural or anthropogenic factors. Although not alarming, this degradation, especially in broadleaf forest areas, poses a threat to biodiversity, soil erosion, and the protective function of forests.

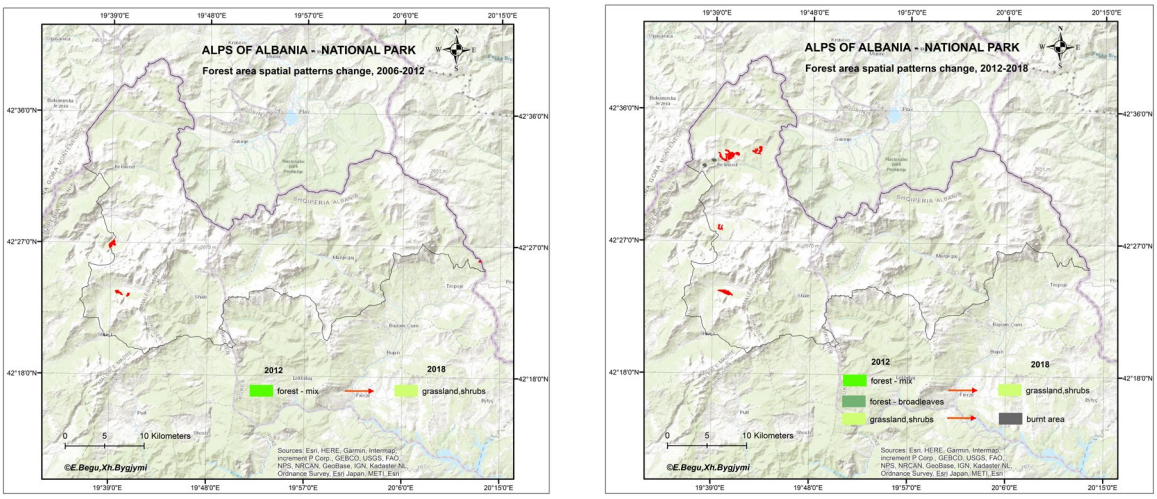


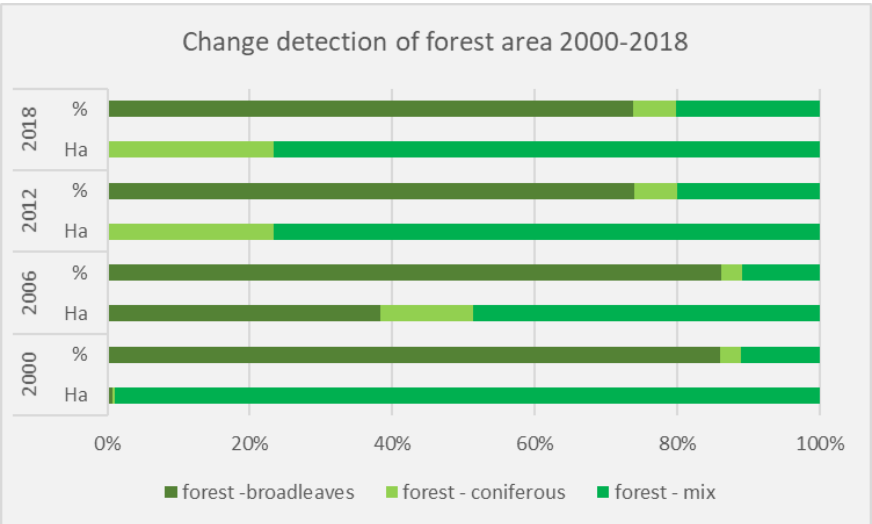
Figure 4. Change detection of forest areas,2000-2018
Source: Authors' calculation

Table 3. Forest change detection during 2012-2018 (% towards total forest area)

Forest type	**2000-2006**		**2012-2018**	
	Ha	*%*	*Ha*	*%*
forest –mix to grassland, shrubs	**106.8**	**0.30**	**264.54**	**0.77**
forest – broadleaves to grassland, shrubs	n/a	n/a		

Source: Authors' calculation

The following graph 1 shows changes in forest cover by forest type during 2000–2018, using percentage (%) and area (Ha) as units of measurement. It divides forest cover into three categories: broadleaves, coniferous and mixed. The graph reflects a clear dynamic in the forest structure, where the mixed type dominates in growth, while broadleaf shows fluctuations.



Graph 1 Change detection of forest areas,2000-2018 Source: Authors' calculation

As an overall trend of forest areas dynamics during 2000–2018, it can be concluded that:

- mixed forest (forest - mix) dominates significantly throughout the period, with a significant increase in both percentage and area from 2000 to 2018.
- broadleaved forest had a moderate decline until 2006, but then marked a slight increase in percentage in 2018
- coniferous forest appears stable but with a relatively low percentage and small fluctuations.

The increase in mixed forests is a sign of change that has occurred in forest biodiversity, mainly due to reforestation policies, deliberate interventions, or natural changes in forest structure. Meanwhile, the decrease in the percentage of broadleaf forest in some years is be related to selective deforestation and degradation of certain species.

4. Conclusions

The study presents the changes in the structure of forest cover for the period 2000–2018 in The National Park of Albanian Alps. This is done by using GIS and RS technologies that provides important database to conduct this kind of analysis. The findings highlight the evolution of forest types: broadleaf, coniferous and mixed. It is noted that mixed forest has experienced a significant increase in both percentage and area, clearly dominating in 2018. On the other hand, broadleaf forest has decreased in several periods, with slight fluctuations in percentage, while coniferous forest remains stable, but with a more limited extent. These changes may be related to factors such as human interventions, reforestation policies or natural changes in forest biodiversity. The increase in mixed forest suggests a transformation in the ecological composition of forests, which may be the result of a mixture of species for greater sustainability or in response to environmental pressures. As indicated by maps the period 2006–2018 has brought negative impacts on the forest cover of the Albanian Alps, including the conversion of forests to pastures and the emergence of burned areas. This reflects the increased pressure on natural ecosystems even within protected areas. Such data is vital for the design of conservation policies, as well as for immediate interventions in endangered areas. Moreover, these types of analysis are essential for understanding the impact of natural and anthropogenic processes on forests, especially in protected areas, and help decision makers involved in building sustainable management policies.

References

Copernicus Land Monitoring Service. (2018). *CORINE Land Cover* [Data set]. https://land.copernicus.eu/en/products/corine-land-cover

Cuenca, P., Arriagada, R., & Echeverría, C. (2016). How much deforestation do protected areas avoid in tropical Andean landscapes? *Environmental Science & Policy, 56*, 56–66. https://doi.org/10.1016/j.envsci.2015.10.014

Farhadur, R., Rana, P., & Rana, M. M. (2021). Effectiveness of protected areas in reducing deforestation and forest fragmentation in Bangladesh. *Journal of Environmental Management, 280*, 111711. https://doi.org/10.1016/j.jenvman.2020.111711

Fawzi, N. I., Soewardi, K., & Nurjaya, I. W. (2018). Measuring deforestation using remote sensing and its implications for conservation in Gunung Palung National Park, West Kalimantan, Indonesia. *IOP Conference Series: Earth and Environmental Science, 149*, 012040. https://doi.org/10.1088/1755-1315/149/1/012040

Food and Agriculture Organization of the United Nations. (2015). *Global forest resources assessment 2015*. FAO Forestry. http://www.fao.org/3/a-i4808e.pdf

National Agency for Protected Areas. (2019). *Strategic plan 2019–2023*.

Thangaperumal, S., Prabaharan, N., & Palanivel, S. (2019). Deforestation: A quantitative analysis using remote sensing and GIS. *International Journal of Advanced Research, Ideas and Innovations in Technology, 5*(2), 608–612.

Wade, C. M., Austin, K. G., Cajka, J., Lapidus, D., Everett, K. H., Galperin, D., Maynard, R., & Sobel, A. (2020). What is threatening forests in protected areas? A global assessment of deforestation in protected areas, 2001–2018. *Forests, 11*(5), 539. https://doi.org/10.3390/f11050539