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Forest Land Use Dynamics in Greece: Insights from the LUCAS Database

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Abstract SUS-SOIL is a four-year multidisciplinary project aimed at developing 15 living laboratories to document, analyze, and benchmark various agroecological management practices and subsoil uses. These labs will evaluate the spatial dynamics and changes in subsoil conditions to identify optimal combinations of practices for both rural and urban areas worldwide. Site selection and soil characteristic data collection will be carried out through the LUCAS program. This study focused on identifying forest land use changes in Greece over the past decade using LUCAS points. The findings reveal significant shifts in land use, with the greatest changes observed in broadleaved areas and the least in coniferous zones. These results provide a valuable foundation for informing future forest policy guidelines.

Keywords: forests, soil characteristics, living labs, management

1. Introduction

The European Union (EU) consists of a wide range of landscapes: it is home to a wide variety of flora and fauna and includes some of the most and least populated areas of the world. According to the EU Soil Strategy, around 60-70% of EU soil suffer from severe degradation processes. Soil biodegradation processes are linked to biodiversity losses caused by inadequate soil treatment, fertilization and pollution and depletion of soil organic matter caused by poor management. Soil degradation processes include salinization (most of the time caused by saline irrigation water or tree cover removal and acidification due to pollution and intensive soil practices. The impact of soil degradation processes on ecosystem services caused by poor management is further exacerbated by climate change, which poses a serious threat to soil productivity and therefore to the EU economy.

SUS-SOIL, is a four-year project that will develop an agroecological subsoil management network (ASMN), that will include a network of 15 living laboratories (LL). The aim of the project is to carry out extensive subsoil sampling across Europe in each LL based on CORINE and LUCAS database points to identify long-term managed sampling points associated with agricultural, forest and urban land use, where extensive soil samplings will be conducted. For this, all LUCAS points that had the same land use in the inventories of 2012 and 2022 were identified.

The aim of this article is to present the results obtained from the LUCAS database in Greece, which will serve as a foundation for identifying sampling points in the SUS-SOIL project. In particular, the study focuses on comparing land use changes since 2012.

2. Methodology

This article presents an analysis of land use changes at specific locations in Greece, based on data from the Land Use/Cover Area Frame Survey (LUCAS), a European field survey coordinated by Eurostat. For this study, LUCAS data from the years 2012, 2015, 2018, and 2022 were used. The analysis focused on identifying points with consistent land use between 2015 and 2022, comparing them to their land use status in 2012, and highlighting the land use categories that experienced the most significant changes.

3. Results

A total of 1,146 LUCAS points were found to have the same land use classification in both 2012 and 2022. Among the land use categories, the greatest change was observed in areas classified as broadleaved forest (see Table 1). In contrast, permanent grasslands showed a high degree of stability, with 84.96% of the points maintaining the same classification over the decade.

Of the total 305 permanent grasslands, information is provided only for the 58.

Table 1. Number of land uses over the last decate

Same landuse from 2012 to 2022 %

Broadleaves	18.85
Scrublands-heathlands	23.47
Conifers	36.40
Permanent grasslands	84.96
Points with the same landuse (total)	13.29

A random sample of broadleaved points was selected for further investigation regarding their current land use. Most points previously classified as "Scrublands–Heathlands" in earlier years were identified as "Broadleaves" in 2022, indicating a successional shift of the phytosociological composition toward a climax stage, where environmental conditions permitted. This transition, along with the relatively low rate of change observed in permanent grasslands, may reflect a decrease in grazing pressure from livestock.

Conversely, a separate random assessment of points initially classified as broadleaved revealed a shift toward other land use types, suggesting a regression from the climax phytosociety. However, a more detailed analysis of these transitions is necessary to draw reliable and robust conclusions.

4. Discussion and conclusions

The analysis of LUCAS data over the period 2012–2022 highlights notable trends in land use dynamics across Greece. One of the key findings is the overall stability of permanent grasslands, with 84.96% of sampled points maintaining the same land use classification over the decade. This stability suggests limited changes in grazing practices or land conversion in these areas. However, it may also reflect reduced agricultural pressure or decreased livestock populations, trends that are commonly associated with rural depopulation and abandonment.

In contrast, forested areas—particularly broadleaved forests—exhibited significant changes, both in terms of internal succession and shifts toward or away from other land uses. A notable number of points previously classified as "Scrublands–Heathlands" evolved into broadleaved forest by 2022, indicating a natural successional progression toward climax vegetation, especially in areas where anthropogenic pressure has decreased. This may further support the hypothesis of land abandonment, allowing ecological succession to proceed in the absence of grazing, logging, or cultivation.

On the other hand, some areas originally classified as broadleaved forests transitioned to other land use categories, suggesting localized disturbances or land management changes that may involve clearing, infrastructure development, or agricultural reclamation. This apparent bidirectional trend—succession in some areas and regression in others—points to heterogeneous land use pressures across the Greek landscape, possibly influenced by socio-economic, environmental, and policy factors.

The LUCAS database has proven to be a valuable tool in this context, offering standardized, georeferenced data that enable spatial and temporal comparisons at a national scale. Its ease of use and broad coverage make it suitable for both preliminary assessments and more detailed, site-specific investigations.

Moving forward, more granular analyses are needed to understand the drivers behind these observed patterns. Incorporating additional datasets—such as population statistics, grazing records, forest management plans, or satellite imagery—could enhance interpretation and help clarify the role of policy, climate, and socio-economic shifts in shaping land use changes. Furthermore, as the SUS-SOIL project develops its living laboratories, the integration of LUCAS-derived insights will be critical for selecting representative sampling sites and understanding the broader landscape context of subsoil and agroecological management strategies.

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References

EU 2000 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Land_use_-_cover_area_frame_survey_(LUCAS)&action=statexp-seat&lang=el

IUCN, Members' Assembly (2016). Resolution 6.069: Defining Nature-based Solutions, WCC 2016 Res 069. https://portals.iucn.org/library/node/46486 .

IUCN (2020a). Global Standard for Nature-based Solutions: a user-friendly framework for the verification, design and scaling up of NbS (1st ed.). Gland, Switzerland: IUCN. : https://doi.org/10.2305/IUCN.CH.2020.08.en

MacKinnon, K., Sobrevila, C., & Hickey, V. (2008). Biodiversity, climate change, and adaptation: nature-based solutions from the World Bank portfolio (Report No. 46726). Washington, USA: The World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/149141468320661795/

Demozzi, T., Oberč, B.P., Prieto López, A., Larbodière, L., Borges, M.A., (2024). Sustainable agriculture and Nature-based Solutions. Arroyo Schnell, A. (ed.). IUCN Common Ground on Food and Agricultural Systems Series No. **1** Gland, Switzerland: IUCN, 81p.