INCREASING THE SUSTAINABILITY OF AGRO-TOURISM ACTIVITIES WITHIN THE AGROECOLOGY CONCEPT THROUGH GIS TECHNOLOGIES

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Abstract
The sustainability of agro-tourism activities may strongly benefit from an analysis conducted within the Agroecology concept at landscape level. This approach could expand sustainable farming beyond individual fields, to entire ecosystems, optimizing biodiversity and ecological connectivity. Such an integrated analysis could be favourably performed through the implementation of GIS technologies, that would allow the view of the territory no longer as a simple static map, but as a dynamic ecosystem, where sustainable agricultural production and public recreation influence each other. Indeed, the use of GIS in this field would connect geospatial data (*i.e.*: slopes; land use; biodiversity; *etc.*) cross-referenced with socio-economic variables (*e.g.*: tourist flows; presence of agritourism facilities; *etc.*). This article presents the initial results obtained through the implementation of GIS tools, to perform a Land Suitability Analysis on a study area in Southern Italy (Basilicata Region), in which agroecology and tourism can suitably coexist. In this context, a mapping of ecosystem services was obtained, together with the planning of some excursion networks and "*Food tours*". These results, enabled an analysis of landscape fragmentation, together with an assessment of climate change resilience, which ultimately led to the creation of tools useful to help operators into diversifying their tourism offer.

Key words: Rural landscape; agro-tourism; biodiversity preservation; ecological connectivity; *Food tours*.

Introduction

In recent years, the increasing pressure of climate change, biodiversity loss, and the growing demand for sustainable rural development, have highlighted the need for innovative approaches to land management. In this context, agro-tourism has emerged as a strategic tool to support the multi-functionality of agricultural systems, combining food production, environmental conservation, and recreational activities (Picuno P., 2022). However, the sustainability of agro-tourism initiatives cannot be effectively addressed at the single-farm scale alone, as it inherently depends on broader landscape dynamics and ecological interactions (Bianchi et al., 2006).
Agroecology offers a valuable conceptual framework to address these challenges, promoting a systemic vision that integrates agricultural practices within ecological processes and territorial planning (Puglisi et al., 2024). By extending the analysis from individual farms to the landscape level, agroecology enables the enhancement of ecosystem services, the preservation of biodiversity, and the strengthening of ecological connectivity, all of which are essential for long-term sustainability (Cillis et al., 2021; Diantini, 2022).
In parallel, the advancement of Geographic Information Systems (GIS) has provided powerful tools for the spatial analysis and management of complex agro-environmental systems (Rettore et al., 2023; Statuto et al., 2016). GIS technologies allow the integration and visualization of heterogeneous datasets, combining biophysical variables—such as topography, land use, and ecological indicators—with socio-economic factors, including tourism flows and the distribution of rural infrastructures. This integrated approach transforms the territory into a dynamic system, where agricultural production and tourism activities may interact and co-evolve (Moore et al., 2018; Yu, 2025).
This study explores the integration of agroecology and sustainable tourism in a study area – the whole Basilicata Region (Southern Italy) - through the application of GIS-based spatial analysis. The aim is to identify territorial patterns and support the planning of agro-tourism activities, consistent with landscape conservation, ecological connectivity, and local cultural heritage.

Material and methods

The analysis was carried out in the Basilicata Region (Southern Italy), where territorial diversity, agricultural traditions of rural communities and natural resources, offer suitable conditions for the integration of agroecology and tourism. By applying spatial analysis in a GIS environment, the present study sought to identify homogeneous geographical areas and support the planning of agro-tourism

activities, consistent with landscape protection and local development. Agro-tourism - often referred to as “farm holidays” - has by now become a cultural phenomenon that is spreading to many countries in the world, particularly in Europe, thanks to the great attraction the countryside holds for an increasingly urbanized society. By applying land suitability analysis and ecosystem services mapping in this study area, the present analysis seeks to provide decision-support tools for improving territorial planning and enhancing the diversification strategies for agro-tourism operators.
For this purpose, the territory of the Basilicata region has been analyzed as divided into the following four geographical areas, characterized by similar physical and cultural features:

- The ***Valdagri-Lagonegrese area***, a intensively forested area, which preserves an archaeological heritage, telling of successive settlements in the area dating back to the Iron Age and the archaic era;
- The geographic region of ***Metapontino***, which preserves in its name its founding by the Greeks, and which is currently known as the “*California* of Southern Italy”, for its flourishing agriculture (extensive vegetable cultivation);
- The area of the ***mountains and hills of Matera***, in which agriculture remains the principal productive sector, with a prevalence of arable crops (mainly barley), olive cultivation, and sheep, goat, pig and cattle breeding. The rural identity of this area is even embodied in its particular farm building style;
- The geographic area of ***Potentino-Vulture***, consisting of the „Vulture“ area, which presents an exceptional natural heritage, protected by parks and nature reserves, containing rare and interesting flora and distinctive plant species, along with fauna noted for its wide variety of birds.

Results

A GIS tool (QGIS) aimed to analyzing and emphasizing the restoration of biodiversity has been here used to implement the Agroecology concept. In this way, the main ecological corridors which intersect with public recreation areas have been mapped and designed. Fragmentation of habitat has been so analyzed, to determine where hedgerows, buffer strips, or agroforestry plots should be placed, to connect isolated patches of wilderness. The management of buffer zones is therefore possible, enabling to establish "soft" boundaries between sensitive protected areas and recreational paths, ensuring that human activity (hiking, biking) does not disturb pollination reservoirs or nesting sites. This, creates a "*working landscape*" that protects native species, while providing a scenic backdrop for public enjoyment. Finally, by integrating statistical data (ISTAT, 2024), thematic maps have been also generated, to illustrate the relationship between the distinctive characteristics of the four identified areas (Fig. 1) and the spatial distribution of agritourism accommodations.

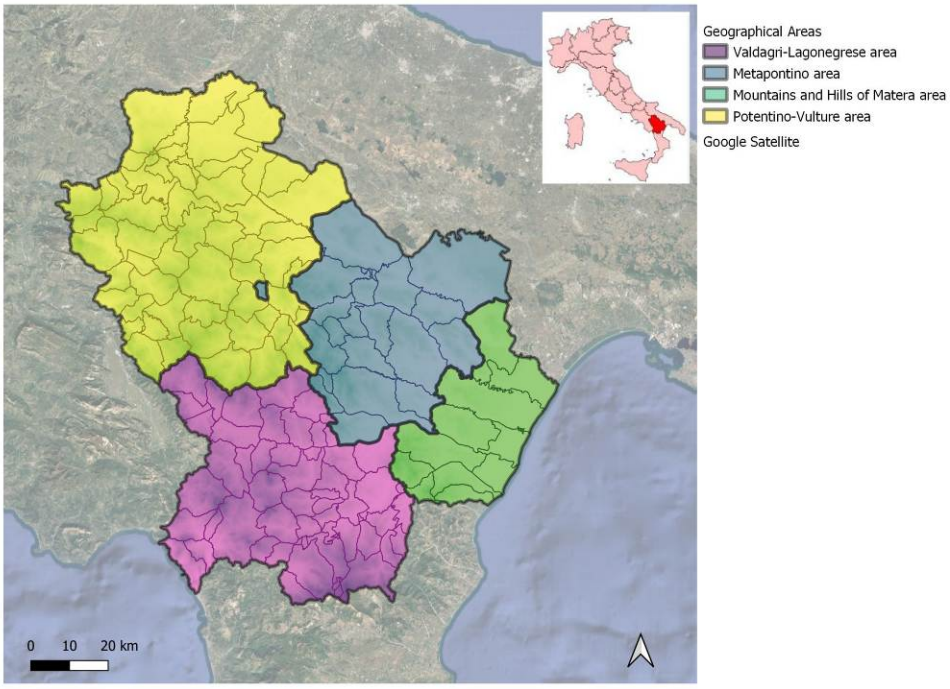

Fig. 1: Identification of the main geographical areas of the Basilicata Region considered in the GIS-based analysis

As it shown in Figure 2, the greatest concentration of agro-tourism facilities is located in the Mountain and hills of Matera, along the Ionian coast and in Pollino area (Valdagri-Lagonegrese area). The area surrounding the UNESCO Site of Matera mostly shows a strong potential for the integration of agritourism, trekking, and cultural heritage, even due to the presence of the „Murgia Materana“ natural Park, the „Sassi“ districts, and a well-recognized rural identity. These features make this area particularly suitable for the development of landscape-based and food-related tourism activities.

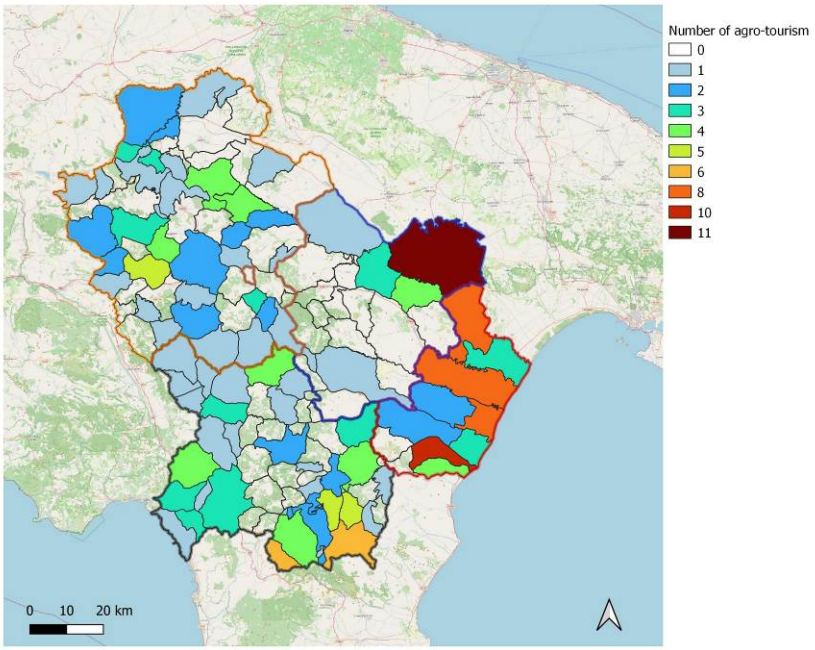

Fig. 2: Distribution of agro-tourism facilities by Municipality in Basilicata Region, based on ISTAT 2024 data

Discussion

Landscape protection is influenced by human perceptions of beauty. GIS technologies facilitate objective modeling of subjective aesthetic values, aiding in viewshed analysis and *Landscape Character Assessment* (LCA), to preserve the countryside's "visual integrity." This protection supports ecotourism and enhances visitors' psychological well-being. Agroecology promotes public engagement with food sources, while GIS aids in creating „*Agri-Recreational*“ networks through Optimized Path Routing, ensuring trails which enhance visitor experience, by showcasing diverse crop cycles and avoiding sensitive areas. It also facilitates „*Service Infrastructure Placement*“ for educational signs and visitor centers, based on environmental factors, and converts farms into "*open-air classrooms*" to enhance awareness of sustainable food systems. The potential of combining agroecology and GIS-based spatial analysis to support the sustainable development of agro-tourism in Basilicata has also revealed as the spatial distribution of agritourism facilities is closely related to the environmental, cultural, and agricultural identity of the different geographical areas. In particular, the Matera area, the Metapontino plain, and the mountainous areas of Pollino and Val d'Agri appear as particularly relevant contexts for the diversification of rural tourism activities. Although preliminary, the proposed approach confirms the usefulness of GIS tools for identifying territorial patterns and supporting agro-tourism planning at landscape level. Spatial Multi-Criteria Evaluation (SMCE) through GIS addresses also user conflicts in public recreation, by balancing the needs of agricultural machinery, wildlife, and tourists. GIS enables prioritization of factors like biodiversity protection and recreational access, resulting in Zoning Maps, that designate areas for active recreation and "*quiet zones*" for agroecological practices. This proactive planning fosters social sustainability between local farmers and visitors. GIS serves also as a monitoring tool to assess landscape resilience, integrating remote-sensed data to track agroecosystem health and recreational use, allowing for adaptive management to mitigate issues like soil compaction and erosion.

Conclusion

GIS has revealed as a powerful tool, able to transform the goals of agroecology into a tangible spatial strategy. By layering environmental health, visual beauty, and human accessibility, GIS ensures that landscape protection is not just about "*keeping people out*", rather about inviting them into a resilient,

productive, and beautiful ecosystem. Through these tools, public recreation becomes a catalyst for supporting agroecological transitions, rather than a threat to them. The integration of statistical data within a GIS environment proved to be a vital decision-support tool for territorial planning and identifying strategic clusters. By mapping ecosystem services and using iterative geodesign, this research demonstrated how rural communities can achieve adaptive resilience. In conclusion, balancing economic gains with environmental conservation through spatial analysis allows agro-tourism to evolve into a multifunctional system, that preserves biodiversity while offering authentic, sustainable visitor experiences.

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Souhrn

Propojení agroekologie s technologií GIS umožňuje udržitelný rozvoj agroturistiky prostřednictvím analýzy krajiny jako dynamického ekosystému, jak dokládá případová studie z italské Basilicaty. Tento přístup umožňuje určit vhodnost půdy, zmapovat ekosystémové služby a poskytuje nástroje pro odolnost vůči klimatickým změnám a diverzifikaci turistické nabídky. Zmapováním ekosystémových služeb a uplatněním iterativního geodesignu tento výzkum ukazuje, jak mohou venkovské komunity dosáhnout adaptivní odolnosti. Studie dochází k závěru, že vyvážení ekonomického růstu s ochranou životního prostředí prostřednictvím prostorové analýzy umožňuje agroturistice fungovat jako udržitelný systém, který zachovává biologickou rozmanitost a zároveň nabízí autentické zážitky pro návštěvníky.

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