Identifying spatial and temporal changes in forest connectivity in Sicily (1990–2018) for conservation actions

Maria Petrillo[1], Emilio Badalamenti[1,2]

[1]Dipartimento di Scienze Agrarie, Alimentari e Forestali, Università degli Studi di Palermo
[2]NBFC - National Biodiversity Future Center, Palermo, Italy

Introduction

Sicily's forest cover has been shaped by a complex interplay of wildfires, land degradation, climate change, and human land use (Brandolini et al., 2018). Sicily, a Mediterranean **biodiversity hotspot**, faces increasing anthropogenic pressures that threaten its ecological integrity. **Assessing spatial and temporal variations in forest connectivity** provides crucial insights for biodiversity conservation and landscape restoration.

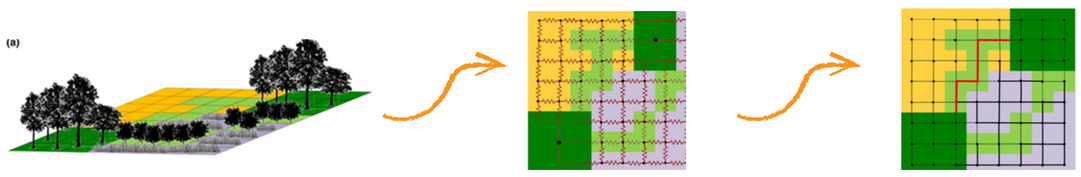
Ecological connectivity describes the capacity of a landscape to facilitate the movement of organisms, matter and energy. Reduced connectivity limits dispersal and migration, thereby increasing the risk of extinction. It is therefore essential to maintain connectivity in order to **sustain biodiversity and key ecological processes**, including pollination, seed dispersal, gene flow, migration and predator–prey interactions (Taylor et al., 1993).

This study evaluates changes in forest connectivity across Sicily between 1990 and 2018 to identify degraded areas, connectivity bottlenecks, and priority zones for reforestation and protection.

Methods

1 STUDY AREA

Land cover reclassification of Corine Land Cover 1990 & 2018 based on ecological similarity.



2 CONNECTIVITY MODELLING

Circuit theory implemented via Omniscape (Julia 1.8; Landau et al. (2021).

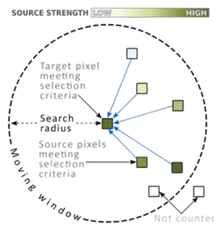
Model variables

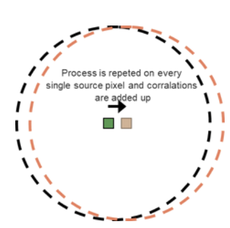
Resistance surface

Combining resistance value

Forests				Artificial areas
1	..	..	..	100

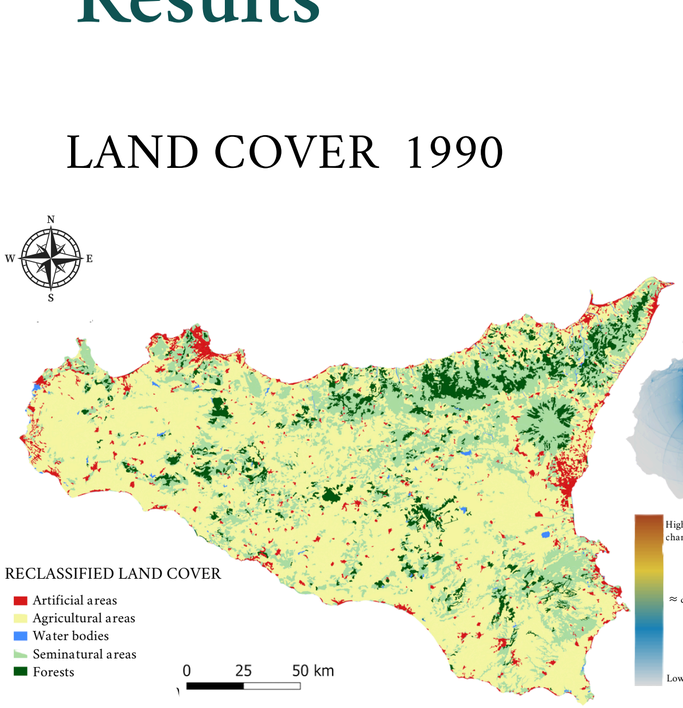
Radius
- 15 km
- 30 km
- 45km

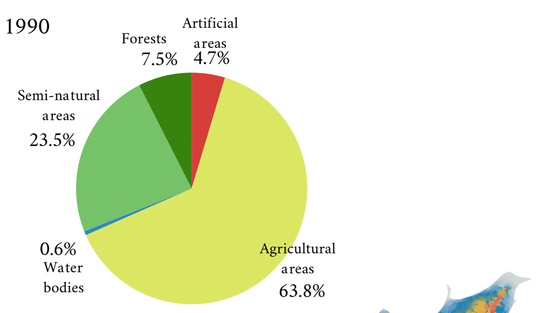


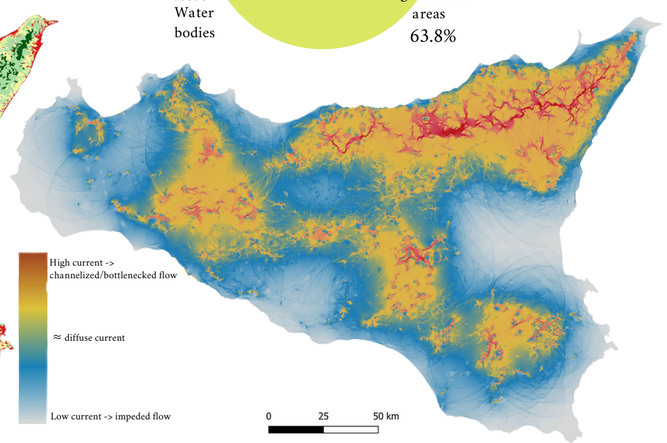


Results

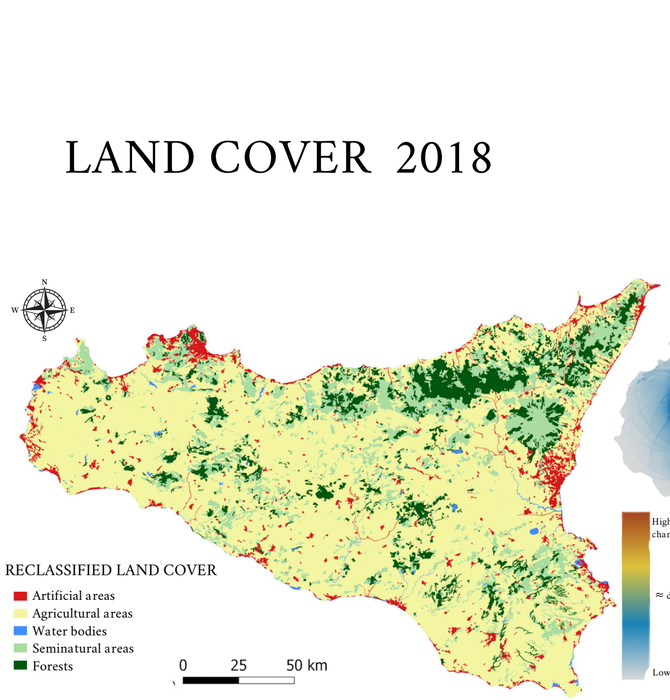
LAND COVER 1990

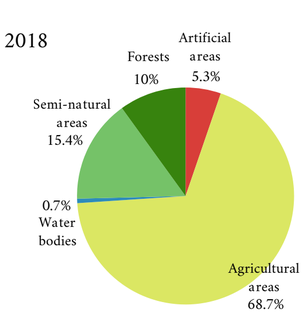


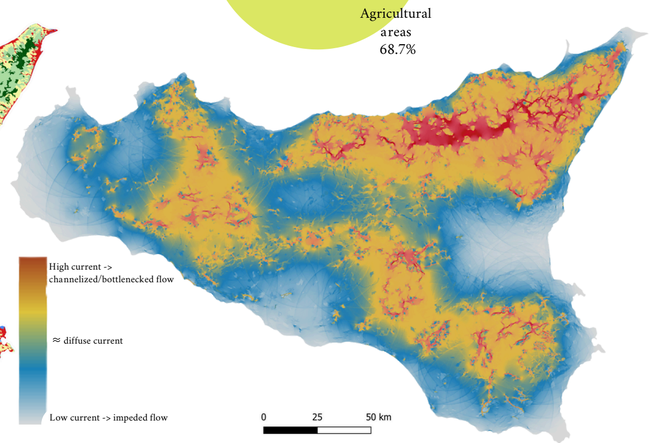




LAND COVER 2018







Discussion and Conclusion

Forest connectivity across Sicily increased by 21% between 1990 and 2018, linked to a 3% rise in regional forest cover.
Greatest improvements occurred in the Nebrodi and Madonie Mountains, driven by reforestation programs and the expansion of the Natura 2000 network.
Lowland and coastal zones showed decreased or locally concentrated current densities, indicating connectivity bottlenecks caused by urban expansion and agricultural intensification.

Emerging corridors connected major forest nuclei in central and northern Sicily, suggesting partial recovery of ecological flow.
Results highlight dual landscape dynamics: restoration in mountain areas vs. ongoing fragmentation in human-dominated lowlands.
Integrating connectivity metrics into spatial and conservation planning helps identify vulnerable zones and prioritize restoration actions.

References

- Brandolini, P., Pepe, G., Capolongo, D., Cappadonia, C., Cevasco, A., Conoscenti, C., ... & Del Monte, M. (2018). Hillslope degradation in representative Italian areas: Just soil erosion risk or opportunity for development? Land Degradation & Development, 29(9), 3050-3068.
- Landau, V.A., V.B. Shah, R. Anantharaman, and K.R. Hall. 2021. Omniscape.jl: Software to compute omnidirectional landscape connectivity. Journal of Open Source Software, 6(57), 2829.
- Taylor, P. D., Fahrig, L., Henein, K., & Merriam, G. (1993). Connectivity Is a Vital Element of Landscape Structure. Oikos, 68(3), 571. https://doi.org/10.2307/3544927

2nd International Symposium on Biodiversity and Ecosystem Functions under Global Change
12 – 14 November 2025
Alghero (Sardinia – Italy)