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Flames and Fragility: The Impact of Wildfires on Butterfly Biodiversity in Southern Italy

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Abstract:

Introduction Fire influences species abundance, community composition and structure, and ecosystem functions in Mediterranean ecosystems. In Italy, the incidence of wildfires has markedly increased, yet the ecological responses—particularly regarding biodiversity and invertebrate species—remain largely unknown. In July 2023, severe wildfires devastated natural reserve areas near Palermo, Italy, which are part of the Natura 2000 network. Between 2010 and 2015, a monitoring initiative focused on the butterfly biodiversity in these areas. After the catastrophic fires of 2023, research aimed to evaluate the impact on Lepidoptera biodiversity at the same sites and transects that were established eight years earlier.

Methods Three habitats affected by 2023 fires were selected: 1) F5.53: Ampelodesmos mauritanica-dominated garrigue areas - SCI ITA020023; 2) F5.5: Thermo-Mediterranean scrub - SCI ITA020023; and 3) F5.5: Coastal Thermo-Mediterranean scrub - SCI ITA020006. Data from bi-weekly butterfly surveys conducted from June 2010 to December 2015 were compared with data collected from September 2023 to December 2024. For each habitat, monitoring transects were established, and all data were included in a database to analyze the species occurrence patterns and flight periods. Butterflies' responses to fire were assessed by comparing specific biodiversity indices, including the abundance and species richness. A statistical analysis of the monthly species abundance was conducted to evaluate the effects of fires on the community structure.

Results The overall effect of the fires on the abundance and richness of butterflies was negative across all habitats, which was particularly pronounced in the early post-fire communities for some species. The taxonomic resolution influenced the observed impact. Analyses at the species/genus and family levels revealed significant effects. The Lepidoptera abundance showed a notable negative response in the coastal Thermo-Mediterranean scrub.

Conclusions Although some research suggests that butterflies tend to recover after wildfires, our findings highlight the negative impact of fires on lepidopteran populations, particularly in specific habitats. Monitoring post-fire butterfly dynamics is essential, as changing global fire regimes significantly influence lepidopteran community dynamics.

Keywords: Biodiversity; Butterflies; Fire; Endemic species; Recovery; Resilience

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