Submitted Abstract

ID IMC22-FSAbstr- 418

First Author First Name Last Name	 Déborah (1) Birre
Submitting Author First Name Last Name	 Déborah Birre
Correspondence	deborah.birre@univ-paris13.fr
Co-Authors >> E-Mails will be not listed	Feuillet, Thierry (2); Lagalis, Roman (3); Milian, Johan (2); Serrano-Notivoli, Roberto (4); Sheeren, David (5); Alexandre, Frédéric (1)
Organisations	1: Université Sorbonne Paris Nord, Pléiade, UR 7338, France 2: Université Paris 8 Vincennes - Saint Denis, LADYSS, UMR 7533, France 3: Université de Paris, France 4: Universidad Autonoma de Madrid, Spain 5: Institut National Polytechnique de Toulouse, DYNAFOR, France
Country	France
Region	Western Europe
Title	Quantifying Changes In Alpine Treeline Ecotone Spatial Patterns In The Pyrenees: Proposal For A Standardized Methodological Protocol.
Keywords	Alpine Tree Line, Spatial Dynamics, Spatial Patterns, Landscape Metrics
Type	List Of Focus Session
Focus Session ID	05

Abstract

Alpine treeline ecotones are particularly sensitive to environmental changes. In the absence of other disturbances, this ecotone is controlled by climatic constraints. It should thus respond, theoretically, to the current rise in temperatures by an elevational shift of the subalpine forest. Nevertheless, various studies indicate that these elevational changes are not systematic, somewhere regressive or stagnant, reflecting the complexity of the mechanisms at work1. In addition, the ecotone spatial dynamics can be characterized by processes other than elevational change, such as the tree population densification without elevational shift, or changes in spatial pattern. These structures characterize the ecotone's shape in plan: rectilinear, diffuse, islands, etc. Recently, Bader et al2 proposed a typology of these structures and associated them with underlying ecological processes such as natural or anthropogenic disturbances (grazing, fire, etc.).

Thus, these spatial dynamics inform us about how the ecotone responds to different forcings. Therefore, quantifying this shape pattern change and then relating it to potential determinants is a meaningful contribution to treeline studies. However, such a quantification also raises some methodological issues that need to be addressed. The aim of the present study is to propose a methodological protocol for quantifying this change in shape in a multidimensional space, applied to the eastern part of the French Pyrenees. After mapping the treeline at two dates (1953 and 2015) from historical and current orthophotographs, we characterized its shape within 648 plots using 19 landscape metrics computed using the R package landscapemetrics3. We then applied a PCA incorporating the 1953 metrics and obtained a factor space defined by the first two components. The observational plots (each characterized by a specific factorial score in 1953 and in 2015) could then be projected into this space, thus forming a map of the 648 pairs of points. Finally, the distance between the points of each pair was estimated, then considered as the dependent variable of a subsequent correlative model including climatic, anthropogenic and topo-geomorphological exogeneous variables.

References

[1] Feuillet et al. (2020). Spatial dynamics of alpine tree lines under global warming: What explains the mismatch between tree densification and elevational upward shifts at the tree line ecotone?. Journal of Biogeography, 47(5), 1056-1068.

[2] Bader et al. (2021). A global framework for linking alpine-treeline ecotone patterns to underlying processes. Ecography, 44(2), 265-292.

[3] Hesselbarth et al. 2019. landscapemetrics: an open-source R tool to calculate landscape metrics. - Ecography 42:1648-1657.