Wild boars as geomorphologic agent: a conceptual framework

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Abstract

The wild boar (*Sus scrofa*) is the most responsible of soil degradation in Europe among the main invasive species. At the same time, the stable presence of this species in agricultural areas has induced a conflict with human causing economic losses and environmental degradation, as well as social issues. A clear quantification of the potential damages (in term of soil bioturbation) of this species at large scale is however still unknown. The purpose of our research is to delineate a conceptual framework on the role of wild boar as geomorphologic agent. Firstly, many wild boar' s damages typologies are presented and their possible interaction with hydro-geomorphogical processes described. Then, a pilot case study is proposed on mapping and quantifying of wild boar damages in an agricultural hilly landscape located in northeast Italy. The wild boar damages were geolocalized through GPS in two years of field campaign among agricultural fields interested by wild boars' damaging activities. For each interested area (total 406) several measures of soil erosion depth were taken and the surface involved in degradation processes was mapped for a total of 10.150 measures. The volume of removed soil was then estimated considering the average depth of damages previously recorded. Finally, the Connectivity Index was applied in order to classify the considered damages based on their connection to both river and road network. The results indicate that the ongoing uncontrolled wild boars expansion may not affect only crops or be a risk for people, but can also result in an increasing of soil erosion, with potential connection to the hydrographic networks and human infrastructures.

Introduction

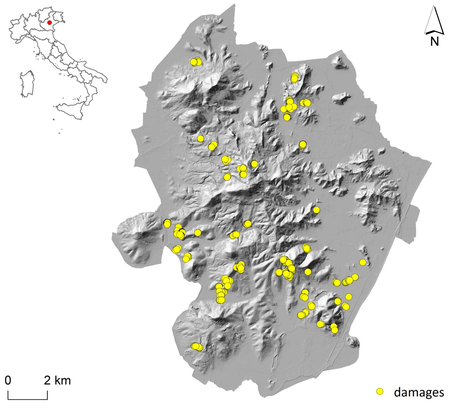
Soil degradation is a serious problem on permanent pastures, forests, woodlands and cultivated lands (Oldeman et al., 1991; Panagos et al., 2015). One land degradation factor in agriculture stand for the impact of wildlife on cropland system. Wildlife has been also recognized as driving forces for land degradation processes leading to environmental, economic and social conflicts, with particular regard to agroecosystems (Amici et al., 2012; Ficetola et al., 2014; Sofia et al., 2017).

Research Objectives

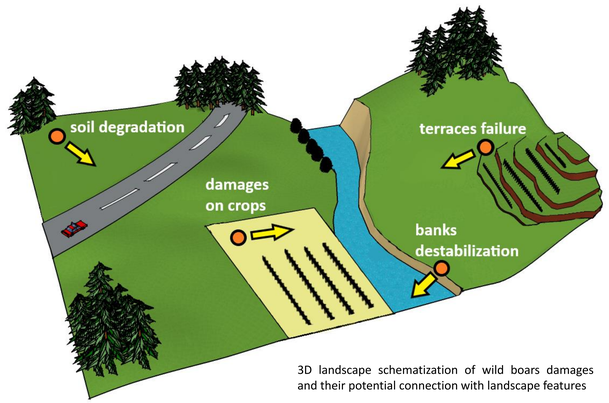
The aim of this research is to analyze the geomorphic impact of wild boars, creating maps regarding the distribution of damages. Then, considering damages as potential sediment hotspot, the research aimed to provide a classification of degraded zones regarding their connection to rivers and roads network.

Methods

The GPS position of damages was registered in order to elaborate the distribution maps. For each degraded zone, 25 measures of soil depth were taken, over than the damaged surface and the average volume of soil removed. The Cluster and Outliers analysis was applied calculating the Anselin Local Moran's I statistic and the Index of Connectivity (IC) was calculated and classified into classes.

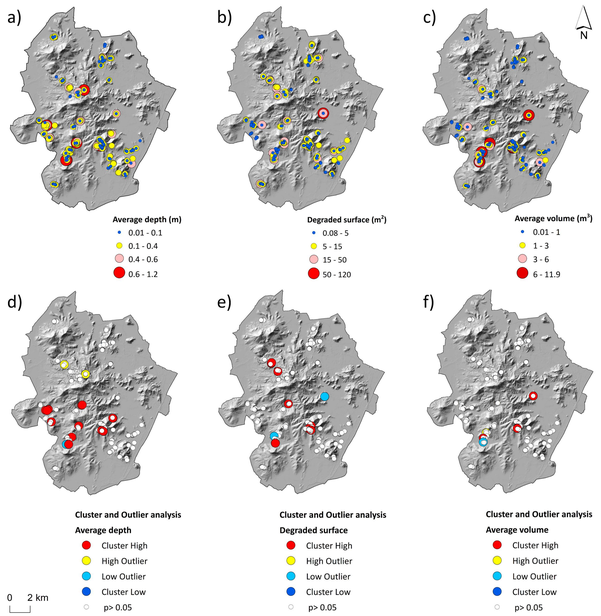


Distribution of damages recorded during data acquisition in fields. The distribution map was elaborated starting from GPS location of each damage detected

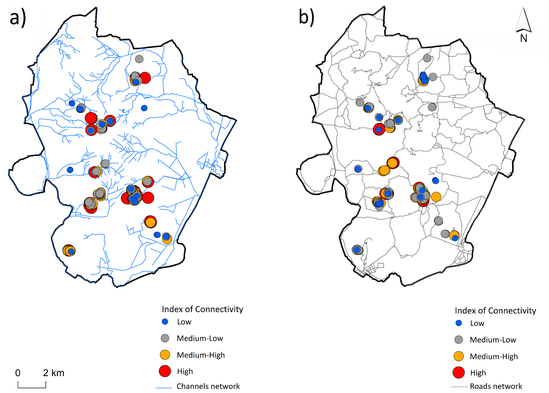


3D landscape schematization of wild boars damages and their potential connection with landscape features

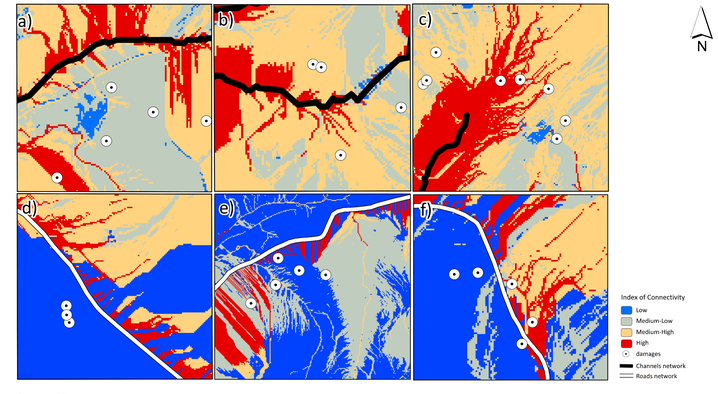
Results & Analysis



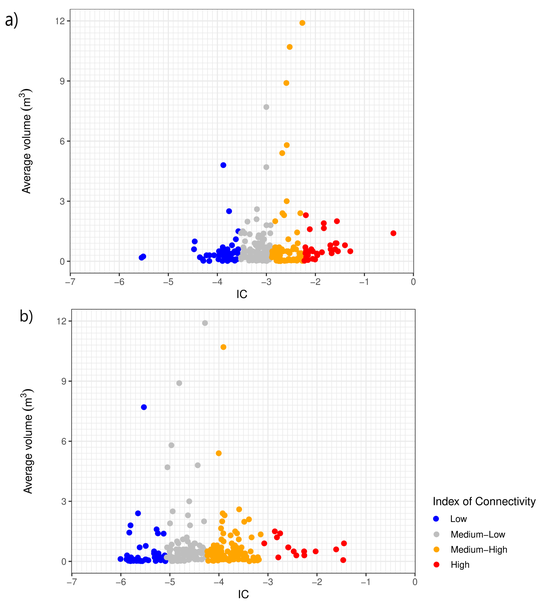
Maps of the distribution of damages regarding the medium deep of excavated soil (m) (a), degraded surface (m^2) (b) and average soil volume removed (m^3) (c). The figure also shows clusters and outliers' maps for the average depth of excavated soil (m) (d), degraded surface (m^2) (e) and the average volume of soil removed (m^3) (f)



IC maps representing the potential connection of sediment activated from wild boars' damages to channels (a) and roads network (b)



IC for the study area. The figure shows the connectivity related to the potential connection of sediment activated from damages toward channels (a, b and c) and roads (d, e and f) network



Scatterplots of IC values regarding channels (a) and roads (b) network, and the related average volume of soil removed from each damage

Final Remarks

- A conceptual framework of wild boar sediment source hotspots and connectivity is presented.
- Wild boars' damages are widespread in the whole study area; the southern part of it is particularly affected by severe damages.
- IC shows wild boars' damages location as a possible source of sediments, potentially delivered to rivers and roads network.
- Cluster and Outlier analysis underlines the zones of the study area where a spatial aggregation of "high" damages (in terms of depth, surface and volume removed) is mainly located. In conclusion the analysis, the methodology and the framework presented could serve as a useful guideline for more in-depth analysis of sediments activated by wild boar activities at catchment scale.

References

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