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Land Degradation vs. Fire: a Spiral Process?

Sofia Bajocco (1), Luca Salvati (2), and Carlo Ricotta (3)

(1) Council for Research in Agriculture – Unit of Climatology and Meteorology applied to Agriculture (CRA-CMA), Rome, Italy (sofia.bajocco@entecra.it), (2) University of Rome "La Sapienza". Department of Geographical, Statistical, Historical and Linguistic Studies applied to Regional Analysis, Rome, Italy , (3) University of Rome "La Sapienza", Department of Plant Biology, Rome, Italy

The international definition of the United Nations Convention to Combat Desertification describes 'land' as a "terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system", and its 'degradation' as a "reduction or loss of the biological and economic productivity" resulting from land uses (mismanagement), or combination of processes, such as soil erosion, deterioration of soil properties, and long-term loss of natural vegetation. Land Degradation (LD) is hence an interactive process involving multiple factors, among which climate variability and land use play a significant role. In the Mediterranean regions, the biophysical, socio-economic and historical aspects represent the main LD components; the interaction between climate, human activities and land condition is extremely complex and results in typical LD patterns that directly affect the vulnerability of these ecosystems. Based on these considerations, the working hypothesis of this paper is that LD, determining the sensitivity level of an area, directly influences disturbance dynamics, and that the spatio-temporal distribution of areas with different degrees of LD determines different propagation patterns of the disturbance. In turn, LD is strongly affected by the disturbance occurrence regime, that alters the status quality of a given territory. This mutual interaction between disturbance regimes and landscape structure may become complex, resulting in dynamic patterns through time. In the Mediterranean areas, fire represents one of the main disturbance sources; in these regions more than the 90% of fires are lit by humans, some through arson, carelessness, prescribed burns, but the majority of ignition sources are linked to population increase, land management systems and traditional silvo-pastoral practices. Furthermore, the strong seasonality, with wet periods, which allow fuel to accumulate, and dry periods, providing favourable 'risk' conditions, increases the fire-proneness. Recent work has shown that in addition to its known ecological dimensions, fire is also an important land use tool, a growing global hazard and a factor involved in landscape processes with feedbacks on land degradation. Depending on climate, topography and other factors, fire can lead to LD; but under certain conditions, land degradation too may create conducive conditions for fire to thrive, setting the interested area into a LD-fire cycle. This entails that changes in LD patterns are likely to modify the susceptibility to fire of an area; viceversa changes in fire regimes may alter its degradation status. This paper aims at highlighting the link between fire incidence and LD and their potential feedbacks: on one hand, to quantify how LD influences fire incidence patterns in space and time; on the other hand, to verify to what extent the frequent burning of an area is linked with its land degradation trend. To analyze the relationship between fire and LD, we used the fire history of Sardinia (Italy), a typically Mediterranean region, during two 4-years intervals, 1995-98 and 2005-08, relating them with LD sensitivity maps that refer the land quality status of Sardinia over two reference periods, 1990 and 2000.