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Using Landscape metrics to analyze the landscape evolution under land abandonment

Raffaele Pelorosso (1), Stefano Della Chiesa (2), Federica Gobattoni (1), and Antonio Leone (1)

(1) Department of Environment and Forestry, University of Tuscia, Viterbo, Italy (pelorosso@unitus.it), (2) Institute for Alpine Environment, EURAC, I-39100 Bozen/Bolzano, Italy (stefano.dellachiesa@eurac.edu)

The human actions and the human-linked land use changes are the main responsible of the present landscapes and vegetation patterns (Antrop, 2005; Pelorosso et al., 2009). Hence, revised concept of potential natural vegetation has been developed in landscape ecology. In fact, it cannot more be considered as the optimum for a certain landscape, but only as a general indication never widely reached. In particular Ingegnoli and Pignatti (2007) introduced the concept of fittest vegetation as "the most suitable or suited vegetation for the specific climate and geomorphic conditions, in a limited period of time and in a certain defined place with a particular range of incorporable disturbances (including man's) under natural or not natural conditions". Anthropic exploitation of land and its resources to obtain goods and services (Willemen et al, 2008) can be considered therefore the main cause of landscape change as an integrant part of nature, not external.

The abandon of the land by farmers or other users it is one of the more felt problems for the marginal territories of Mediterranean basin. It is therefore caused by socio-economic changes of last decades and cause several impact on biodiversity (Geri et al. 2010) and hydro-geological assessment. A mountain landscape has however the capacity to provide goods like timber and services like aesthetic pleasure or regulation of water system. The necessity of a conservation strategy and the development of sustainable socio-economic management plan play a very important role in governing land and quality of life for people and ecosystems also for marginal territory.

After a land abandonment, soil conditions and several climatic and orographic characteristic plus human disturbance affect the length of time required by secondary succession, throwing the establishment of vegetation with different association, structure and composition until a (stable or meta-stable) equilibrium is reached (Ingegnoli and Pignatti, 2007). In this view, therefore, not all the abandoned land will be covered by woods also after a reasonable time (e.g 20-30 years); open areas patches can resist over time as a consequence of different (more o less natural) disturbances, pointing out a landscape mosaic and vegetation pattern almost never completely homogeneous.

This spatial and temporal differentiation of landscape pattern, therefore, require both the individuation of disturbances and their effect on land abandonment process to be analyzed for each different landscape. Many types of analysis and models were developed and used to understand the reason of abandonment, its evolution, likelihood future landscape scenarios and the leading consequences on environment and population in order to establish right land-uses to obtain suitable and sustainable goods and services from landscape itself. One of these analysis recurs to landscape metrics.

Landscape metrics have been widely applied in ecology and landscape ecology (Rainis, 2003; Romero-Calcerrada and Perry, 2004 ; Narumalani et al., 2004; Rocchini et al., 2006) because they allow an objective description of the temporal pattern of landscape change and a comparison with other landscapes (Turner et al., 2001). Furthermore, a description of the shape, size and spatial arrangement of patches of vegetation can be used to link the observed pattern with the ecological processes that may have generated it (Rocchini et al., 2006). So these metrics can be used to see how an abandoned landscape can evolve under the effects of different constrictions that, also if not completely knew, have been affecting the present assessment.

Through historical and recent aerial photos (1954-1985-1999) and several landscape metrics, the evolution of marginal municipality of central Apennine under abandonment is presented here. Temporal evolution of landscape metrics was discussed to underline the importance of such descriptors of vegetation pattern dynamics and the key role played by these useful tools for the evaluation of reachable future vegetation pattern equilibriums.