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Sommario	The conservation of biodiversity is one of the primary concerns when dealing with agro-ecosystems, which other than providing food and fodder resources, can benefit of high levels of ecological functioning. The multifunctionality of agro-ecosystems has to be assessed in a multidisciplinary way and new methodologies should be developed to tackle it, at different spatial and temporal scales. The multi-scale approach is useful to delineate an overall view of the ecosystem and productive services of agricultural areas. This manuscript presents three researches dealing with the conservation of biodiversity, with a view to agricultural production, that were carried out in three different contexts of interest. Such a choice was intended to permit the application of new techniques and to adapt existing ones to different spatial and temporal scales. The first context was chosen to delineate a new methodology for conserving semi-natural water resources in an highly fragmented landscape scenario, the district of Milan. In particular, one of the key elements of the territory is that of fontanili, semi-natural plain springs that represent both strong water resources for agriculture and the remnants of ancient green zones, but are more and more affected by urbanization rates and intensification of agricultural practices. They are listed as habitats for

some endangered species, mainly aquatic, and conservation strategies are needed to preserve their ecosystem services. We chose to rely on landscape ecology analyses, which are able to assess how ecological corridors are structured between sources and sinks of biodiversity, represented by fontanili. We developed a new indicator, called Fuzzy Functionality Index (FFI), that for the first time collimates two of the more common types of analysis: the structural analysis of landscape fragmentation, and the assessment of species-specific permeability to movement. The index, resulting from a participative process, was at the basis of the spatial assessment of ecological corridors between fontanili and has proven to be highly effective and very flexible. It permits one to assemble geographic data, the knowledge of a multidisciplinary team and open source software to obtain a simple-to-read, mapped index at virtually no cost, eliding the issues of the traditional methods. The second context is that of a rural livestock farming district at high altitudes, in the Alps of Northern Italy. Alpine meadows have been exposed to profound management shifts in modern times: changes in plant species composition and biodiversity losses are widespread issues. The aim of the work was to inspect how the variability of meadows could be explainable by the environment they depend on and by the management strategies applied. We analyzed the plant species composition, biodiversity and forage value of meadows in the context and their relationships with environmental and management variables, collected among the farmers. The management variables explained a small amount of variance: only the number of cuts per year remarkably explained the plant species composition and biodiversity. The number of cattle and the field applied nitrogen only described the most intensively managed communities. The environmental variables better described the variability of responses: in particular, an increase of the Landolt Nutrient Index was associated with an increase of the forage value opposite to a decrease of the Shannon Index. The negative correlation between the two responses highlights a known dilemma referring to high altitude meadow communities, which are subjected to important environmental constraints. Some taxa as Anthriscus sylvestris, Heracleum sphondylium, Rumex acetosa and Polygonum bistorta were found to critically unbalance the species composition thus the overall biodiversity. This is certainly the most critical finding, explainable by the late first cuts commonly adopted and by long-term intensive management choices. Homologated management strategies could not explain the wide ecological variability investigated, but indeed they made possible to understand how the system should be deeply revised, in respect to limiting environmental constraints and fodder capabilities at high altitudes. The third context is that of an agronomic field experiment carried out over a long period. The work compares biomass, Milk Feed Units (MFU) and Crude Proteins (CP) yields, over a period of 21 years (1986-2006), referring to five fodder cropping systems: (i) a one-year double-crop rotation (R1) of autumn-sown Italian ryegrass + spring-sown silage maize; (ii) a three-year rotation (R3) of grain maize (first year), autumn-sown barley + silage maize (second year), and Italian ryegrass + silage maize (third year); (iii) a six-year rotation (R6) of Italian ryegrass + silage maize (years 1,2,3) + mixed meadow of white clover and tall fescue (years 4,5,6); (iv) a continuous grain maize (CM); and (v) a permanent meadow (PM). All cropping systems were subjected to two levels of agronomic inputs: high (A), indicating the amounts of fertilizers and herbicides normally applied by farmers

	in the region, and low (B) consisting in reduced amounts of fertilizers (-30%) and herbicide rates (-25%) compared to A. We found R1 > R3 > R6 > PM > CM in terms of biomass yields, with a slightly different trend for MFU yields, whereas R6 > R1 > PM > R3 > CM regarding CP yields. The two treatments always resulted A > B. The five cropping systems significantly varied between the 21 years of experiment: all of them showed decreasing performances except for PM, improving in biomass, MFU and CP over time. The three rotations (R1, R3, R6) appeared the most stable cropping systems over time. These findings suggest the importance of complex cropping systems, which could provide high quality of fodder besides guaranteeing a remarkable agricultural diversification.
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