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Review

Don't think local! Scale in conservation, parochialism, dogmatic bureaucracy and the implementing of the European Directives

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ABSTRACT

The strictly target-based approach promoted by the European Community Directives (Bird 79/409 and 147/2009; Habitat 92/43/CE) is strategic allowing the conservation of targets in real contexts (i.e. the sites of conservation comprising the Natura 2000 network). Nevertheless the site-specific Standard Data Forms (SDFs), reporting lists of conservation targets (species and habitat types), although often incomplete, are regularly utilized by conservation practitioners of Public Agencies in an uncritical and bureaucratic way. We think that a lack of awareness on how populations, communities and ecosystems work may induce a parochialism and a consequent ineffectiveness of the conservation actions. In this commentary we would suggest some fundamental concepts in ecology that may have strong implications on the procedures carried out in conservation measures, synthesizing all in a conceptual framework. In particular, when approaching to develop site-specific conservation measures, practitioners should critically work to complete the lists of targets reported in SDFs verifying: (i) the target relevance in a wider context (spatial scale of target populations), also compared to other co-occurring common species; (ii) the type of target rarity (if deterministic or stochastic); (iii) the target role (*per se* or as indicator); (iv) the coherence between historical/geographic context and conservation measures developed. Finally they should be aware of the hierarchic relationships among different ecological levels interested (individuals, populations, communities, ecosystems).

Introduction

Scale is one of the unifying concepts in ecology (Van Dobben & Lowe-McDonnel 1975; Webb 2012). Scale is hierarchical and it is widely recognized that ecological processes are spatial, temporal and organizational scale dependent (Noss 1992). Indeed each organizational level (individuals, populations, communities and ecosystems) have different properties and develop specific cycles and processes at different spatial scales, from site to landscape, in different time spans (Farina 1998). Conservation policies should take into account this scale dependency. Indeed, conservation and wildlife management measures at the local scale (as restoration projects) are effective only if they are framed in the broader context of the upper hierarchical levels and have a long term perspective (Louette et al. 2011, 2015; Soulé 1986; Žalakevičiusa et al. 2009).

The 92/43 Habitats Directive (together with the 2009/147/EC Birds Directive; hereafter European Community Directives or EDs) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species and habitat protection. Both the EDs protect over 1000 animals and plant species and over 200 so called "habitat types", which are of European importance (EU 2014a,b; Lang 1982).

These EDs recognize that habitat loss and degradation are the most serious threats to the conservation of a large set of habitat types and species. It therefore places great emphasis on the protection of specific sites, especially through the establishment of a coherent network of Sites of Community Importance (SCI) (Habitat Directive) and Special Protection Areas (SPAs; Bird Directive) (hereafter named "sites") (European Commission 2000).

For each site, a set of targets (i.e. habitat types and/or species) were listed on site-specific files (Standard Data Form; SDF) and a specific procedure has been adopted when a target has been reported for a site. The purpose of site designation include conservation measures taken pursuant to these EDs shall be designed

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to maintain and restore, at a favourable conservation status the targets of Community interest (European Commission 2000).

The site designation should also make clear the obligation to apply the necessary conservation measures on each site defining a set of target-declined conservation actions (sensu Salafsky et al. 2008) included in site-specific management plans. These actions may include many different conservation interventions and, among them, specific restoration projects that may locally change the structure and function of ecosystems, often heavily affecting patterns and processes in vegetation and disturbance regimes (i.e. their duration, frequency, intensity and magnitude; Sousa 1984). Therefore, since they may imply strong effects on a large number of other plant and animal species, communities and processes not included among targets, these types of measures should be carried out with a cautionary and critical approach.

The strictly site- and target-based approach promoted by the EDs is certainly strategic allowing the conservation of targets in real contexts and evidence of strong effectiveness is available in international literature (e.g. Albuquerque et al. 2013). Nevertheless we think that a lack of awareness in some ecological issues may induce mistakes and ineffectiveness in conservation strategies and actions promoted at the local (site) level by territorial Agencies (Regions, Provinces, etc). Particularly with regard to the spatial and temporal scales, the hierarchical levels interested, the role of commonness *vs*. rarity characterization of species and the historical/geographic contexts where the projects occur may be considered the main findings that should be focused upon by practitioners. Moreover, at least in some European contexts, the procedures starting with the local specific SDFs have been largely incomplete because there were compiled by researchers over short periods, inducing equivoques in the target selection. Here below we would suggest some main remarks on this sensitive topic in conservation and wildlife management with the aim of increasing awareness on some fundamental concepts of ecology. To synthesize and clarify all these concepts we reported some examples and developed a synthetic conceptual framework.

The spatial scale

Although, the primary importance of biotic connectivity based through dispersal mechanisms at landscape/regional scale has been widely recognized (Crooks & Sanjayan 2006; Lindenmayer & Fisher 2006), traditional conservation approaches (i.e. management plans and restoration projects promoted by EDs) are largely based on the myopic preservation of isolated population species or habitats in isolated sites (Amezaga et al. 2002).

When conservation measures for specific targets (species or habitat types) were defined in management plans they are generally addressed at a local scale in single sites (SPAs or SCIs). Restoration projects oriented on these targets will be developed because they were listed in the relative site-specific SDFs. This pragmatism allows the development of concrete actions in isolated and delimited contexts. Nevertheless, conservation practitioners should be aware that the relevance and effectiveness of actions at a very local scale on the viability of focal targets is not automatically obtained (Gilpin & Soulé 1986). For example, it is widely recognized that the long-term viability of populations strongly depends on their spatial structure at larger scales (Godet et al. 2007; Hanski 1994, 1998).

Sites of limited area may host only a limited number of individuals of a rare target species. Such small sites, are in many cases unsuited for the viability of species at medium-long term. Indeed, at least for sedentary and less vagile species, some individuals may occur in SPAs but not represent a true demographic population. These individuals have limited (or absent) value for conservation purposes. For example, waders and other water-related birds are highly vagile migrant species with small breeding and declining true populations occurring in sites of conservation concern (e.g. in southern Europe: Calvo 1994; Goutner et al. 2005). Due to their high vagility, individuals of these species may be irregularly sampled as sporadic vagrants also in a further larger number of sites, outside their migratory routes (Moreau 1972). Therefore their presence may be reported in SDFs of a large number of sites where these targets occasionally occur. The conservation practitioners should have a critical approach when selecting targets from SDF lists. Indeed, the effectiveness of conservation measures on these populations is strictly dependent from their type of occurrence in the sites (breeders or vagrants). Therefore, especially in a large part of European and Mediterranean highly fragmented landscapes or in specific habitat types (e.g. wetlands), it is strategic to know how the individuals of this species are organized in space (Blondel & Lebreton 1996; Burkey 1995; Davies et al. 2001; Fahrig & Merriam 1994).

A critical approach to management should analyze if individuals build up a population that is viable in the medium-long term. In particular they may: (i) belong to a true population or a sub-population of a larger population (occurring at larger scale: e.g. at landscape scale as a meta-population) or; (ii) simply represents isolated specimens affected by stochastic events and with a lack of conservation relevance. More specifically, in this framework it is necessary to know if the species have a structure of (i) separate population, (ii) patchy population, or (iii) meta-population (see Hanski 1994, 1998; Thomas et al. 2000) and how this structure matches to the network of sites where the target species occur, so defining the correspondence between scale of the ED sites and scale and structure of the target populations.

We think that defining the relevance (and role) of a target at a wider scale when compared to the single site is a strategic step. For example, a small-medium sized site including targets species as large carnivores, vagrant (and highly vagile) vertebrate (bats, birds) and invertebrates may probably host only few individuals and more rarely true populations. So, conservation measures limited to these targets in single isolated sites may show a low effectiveness, lacking a strategy at the wider scale. Methods that allow to identify the best potential new sites to be included in the network, to reach target population sizes and so to test whether a network extension is realistic and effective or not available yet (e.g. Godet et al. 2007).

Other than at target species level, this is true also at habitat level. Many ecosystems include key habitats ecologically connected with processes occurring over a much wider territory. For example, the Thero-Brachypodietea sub-steppes and garigues with *Ampelodesmos mauretanicus* (6220 prioritary habitat type) are vegetation types strongly related to the fire regimes at regional scale (Blasi et al. 1999). Analogously, pasture and grazing regimes at large scale drive the structure of vegetation associations, also of conservation concern (Papanastasis 2009). Finally, the water meteo-climatic regime at the scale of hydrographical basin (and other) is a strong driving force explaining the presence, structure and dynamic of macrophyte communities (e.g. 3120, 3130, 3140 habitat types, Riis & Biggs 2003; Testi et al. 2009).

The temporal scale and historical-geographical context

When a restoring project is defined, a critical and not dogmatic approach should consider the geographical context and the human-driven history of the sites (Swetnam et al. 1999): i.e. should check the coherence between general objectives of conservation measures and local context. Have conservation practitioners and managers considered the recent and past history of the site? Are the local (and specific) history and patterns of the disturbance regimes (e.g. water cycle, fire and grazing regimes) well known? In some contexts there is the tendency to restore optimal habitats for target