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MONOGRAPH

The use of flora, vegetation and habitats in the studies of Environmental Impact Assessment

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ABSTRACT The paper examines local flora, vegetation and habitats in order to highlight the plant component's role as not only an indicator of the quality and state of the environment, but also as an extremely useful element in restoration activities required by environmental impact studies. Some methodological proposals have been done as objective criteria in the assessment procedures.

KEY WORDS local flora; biodiversity; indicators; restoration.

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INTRODUCTION

In the studies of environmental impact, the biotic component as a whole (and which includes man) is normally the cornerstone on which the impact generated from plans and projects is assessed. This paper examines the plant component (limited to the vascular flora and plant communities) in order to highlight the way it plays a key role as indicator of the quality and state of the environment, as an accurate sensor of the impacts but also as an extremely useful element in restoration activities required or proposed by environmental impact studies. It also intends to make a few methodological proposals for the use of objective criteria in the assessment procedures.

MATERIAL AND METHODS

The paper is a brief methodological review, resulting from experience gained on several impact assessments developed in recent years on the island of Sicily, which is representative of the Mediterranean region. These assessments have allowed salient features of plant biodiversity to be recognized and taken into account in an impact assessment study in order to minimize the effects of exploitation of plant biodiversity in favour of conservation policies.

INDICATORS OF THE QUALITY AND STATE OF THE ENVIRONMENT

The assessment of the quality or the degree of naturalness of a study area is crucial in making a considered judgment on the quality and intensity of the impact that the implementation of a plan or project leads to. Plants species and plant communities fully comply with these requirements.

Plant species are, in fact, indicators of the quality and state of the environment since each taxon of the flora of a study area is placed into specific habitats. The narrow endemic species, or otherwise rare or included in the national or regional red lists, are usually associated with the most natural and

sensitive habitats effected by human actions. In this way, they indicate the presence of important habitats to be protected. Furthermore, these plants are the preferred subjects for appropriate impact assessments (Rossi et al., 2014). In contrast, the most trivial synanthropic species are present in habitats with predominantly anthropogenic determinism such as farmland, edges of the road, landfills, etc. and therefore they are not very useful in the context of environmental assessments or, at the very least, they indicate the lack of floristic elements to be protected. In this case traditional agricultural landscape as a whole, rather than the natural one, will be focused on for the impact assessment (Barbera & Cullotta 2012).

Plant communities, better than single species, are very fine and accurate indicators of the type, quality and state of the environment since they are an expression of ecological factors such as climate, soil, and anthropogenic influence which allows them to exist within the framework of the vegetation series (1), where discrete units (with statistically uniform floristic composition) can usually be recognized (Pott, 2011). Plant communities are also the most characteristic and diagnostic element of habitat, which is considered as a uniform parts of the ecosystem and is almost always detectable in large to small scale on cartography.

In most cases, their identification is easier than a single species whose presence may be due to chance. For this reason, plant communities are the driving elements for impact assessments as they may have different value in the conservation policies and different sensitivity to human actions. The spatial mosaic of habitats is also useful in assessing the potential fauna of an area and therefore, it allows an opinion on the ecosystem as a whole to be expressed (Sabella, 2015).

A topic generally not highlighted for environmental impact studies is the great local diversity of the indicators mentioned above. In Italy, for example, it is possible to recognize at least three biomes, Mediterranean, Alpine and Temperate. There are also significant differences in the flora and vegetation which exist in smaller territories as highlighted by several authors (Greuter, 2010; Blasi et al., 2010; Blasi & Frondoni, 2011). Due to this fact and although the method of investigation and assessment may be the same, the contribution of regional specialists who can better understand or highlight floristic and vegetational peculiarities is required. With regard to the assessment methodologies and to be able to converse with other specialists, it is necessary to use objective and quantifiable criteria as much as possible. One of these is the "floristic vegetational value" for plant species with endemism, rarity, and/or endangered taxa, while for plant communities and habitat the evaluation depends on vegetation series position and biogeographical significance. A proper scale of values, to be assigned to these biotic elements, must be compared with the induced changes by a plan or project, allowing more calibrated matrices to be created.

As explained regarding indicators, the botanist works on two main levels: plant species and plant communities, recognizable as habitats. A third level, the landscape, and in particular plant landscape, should be considered but this competence is to be shared with other specialists such as agronomists, geologists and architects. However, if we consider the natural plant landscape for which the recognition of vegetation series is key, the environmental analyst with a botanical background remains the only acceptable specialist.

The sources for plant species are the national and regional floras, the red lists, and the lists of protected species by laws and directives. However, these lists are often deficient because they ignore many important species. The most striking case is that of Annex 2 of the European Directive 92/43 in which many rare endemic species are not mentioned. A likely reason is that in the 1990s the specialists involved in making up this list did not fully understand its importance. At the level of plant communities, the list of habitats of Community interest is very useful (listed in Annex 1 of the above mentioned directive) where the deficiencies seem fairly small. As highlighted above, the need to know the vegetation series of each area is of great importance in order to safeguard and properly assess any mature stages if present. In Italy, a reference element is Blasi (2010a, 2010b) who indicates,

(1) A series of vegetation is made up of all the plant communities related by dynamic relationships that could occur in a ecologically homogeneous space with the same potential vegetation, having the same physical conditions (i.e. meso-climate, soil type, geomorphology). It is dependent on processes of vegetational succession, management and extreme events (e.g. fire, storm damage, volcanic eruption).

based on the collaboration of many regional specialists, all the vegetation series of the national territory. Also in this case, the general pattern must be checked and adjusted for each individual case study.

ENVIRONMENTAL COMPENSATIONS

The main purpose of providing environmental compensation for the damage caused to nature through building and construction projects is to maintain the quality of the environment (Persson, 2013). This approach has been used to a large extent in Germany and the USA since the 1970s, and the EU has adopted several directives dealing with environmental compensation. Therefore, if environmental impact assessments show even a modest loss to the habitats or ecosystems, this gives the analyst the opportunity to propose compensatory actions that should result in the recovery of damaged habitats or improvement of neighbouring ones not directly affected by the plan or project. These compensatory activities, when related to environmental restoration, cannot be wasted or nullified by the planting of species that are not relevant to the site but they require a highly skilled design as will be explained in the following paragraph.

RESTORATION ACTIVITIES

The use of plant species for environmental restoration is an opportunity, not only to mitigate or compensate the impact of construction or infrastructure work but also to trigger or facilitate the recovery of habitats often in decline. This assertion is valid only if the restoration activities are set in a rigorous way, i.e. taking into account the vegetation series and local potential vegetation. Once again, the local plant diversity is the driving element of the interventions. These assumptions are widely accepted in northern Europe and North America (Persson, 2013), but it is hard for them to be established in the Mediterranean region, and in Italy in particular.

At present, most of the infrastructure work (especially linear ones such as roads and railways) are marked by sometimes alien invasive plants. The presences of these alien plants are, in many cases, a legacy of the past (i.e. work created decades ago) but in recent cases, such as the Catania-Siracusa highway completed in 2009, on the slopes, potentially invasive species such as *Cortaderia selloana* have been planted with some native plants (Basnou, 2009; Domènech et al., 2005).

Nevertheless, there are some pioneering activities developed in Sicily, which are following the new direction of environmental restoration (La Mantia et al., 2012; Barbera et al., 2013) and bodes well for the future.

CONCLUSIONS

With the present paper, an attempt to highlight what the salient points in an environmental impact assessment regarding the flora and vegetation has been carried out. The outlined framework emphasizes the importance of taking into account the above-mentioned elements (species, communities, habitats) in all evaluations and proposal steps of a work as they are the perfect sensors of any positive/negative impact, the indicators of environmental quality, and the main protagonists in environmental restoration and mitigation activities.

On these basis, the environmental analyst must be able to better guide or mitigate the project's actions, considering that, in spite of any attempt to contain the rate of destruction or alteration of natural resources, the transforming activity of man and its resulting impacts on the biosphere, both large and small-scale, will never end.

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