

## Infrastructures and landscape

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### 1 ABSTRACT

This paper briefly examines three study cases on the assessment of the impact of infrastructures on landscape. Starting from their different and more or less integrated approaches, it points out the importance of using different methods at the same time: participatory processes, land-use surveys, intervisibility studies. These methods vary in objectivity, but need to be integrated in order to assign suitable values to such an elusive issue as landscape sensitivity, and to give more effectiveness to such a complex process as the Strategic Environmental Assessment.

### 2 INTRODUCTION

Recently, different attempts have been made to define methods and tools suitable for analysing and assessing cultural landscape sensitivity values. Whereas there are many tested methods for assessing the ecological landscape, the same cannot be said for cultural landscape; the cultural aspect, as stressed also by the European Landscape Convention, is another important element of landscape besides the natural one, but is more difficult to “catch” by means of suitable methods and indicators.

This paper will briefly illustrate three researches on the assessment of the impact of infrastructures on landscape, pointing out their different approaches, both qualitative and quantitative, and the necessity to integrate all of them in a more complete method.

### 3 THE SSTILE PROJECT

The “SSTILE” Sub-project was part of the Interreg IIIC “ProgreSDEC” Regional Framework Operation, followed by the Department of Urban Studies. It brought together five European partners (mostly Provinces) who experimented approaches to the Strategic Environmental Assessment of road infrastructures, paying special attention to the theme of landscape and its sensitiveness to certain alterations. Two of the cases (Province of Vercelli and Province of Palermo) are rather interesting, as they provide quite different approaches to similar issues. Vercelli made a greater use of a visual and participatory approach, whereas Palermo gave more importance to a land-use approach. The former could be defined as the *insider’s* qualitative approach (the insider *belongs* to the landscape), the latter could be said the *outsider’s* quantitative approach (the outsider *observes* the landscape) (*UrbanistiCalabria, 2007*).

#### 3.1 Province of Vercelli: a participatory approach

The Province of Vercelli had to face the assessment of a road passing through a territory of considerable value, and, after having identified, through a land use survey, the most valuable landscape features, made use of a perceptual approach with simple graphic views, each of them representing a scenario, useful for the stakeholders’ participation (though carried out only at institutional level, mainly with the mayors and councillors of the involved municipalities).

Scenario evaluations carried out through participation are of course the most subjective among all, but are important in the cultural approach to landscape assessment; they also take into account the definition of landscape given by the European Landscape Convention, where landscape is considered something *as perceived by people*. When making use of a participatory approach, an essential task is to provide images which can be easily readable, and these can be of different kinds. In this case, the graphic sketches have the advantage of being easily accessible and readable by everyone; on the other hand, they tend to lack in concreteness, and are an extreme simplification of reality. Other means can be artists’ renderings, maps, plans, GIS-based models, even photorealistic visualisations; each have of course their pros and cons (*Tress et al., 2003*). Probably, the use of photorealistic visualisations would have guaranteed a better outcome, being less subject to personal interpretations.

### 3.2 Province of Palermo: a land-use approach

The Province of Palermo worked on the landscape assessment of some portions of its territory, where a provincial road is most likely to be built. An evaluation matrix was set up, making use of quantitative statistical data about land use, quality of cultivations, denominations of origin, etc. These indicators were collected taking into account the tendency over the last fifteen years, in order to study also the evolution of landscape. Only afterwards, a qualitative perceptual study was carried out too, using digital terrain models.

This kind of approach tries to find a more objective and scientific way to assess landscape values, but of course is less suitable to be disseminated and used for participation. It gave more importance to land use as an indicator, and it also made use of GIS technologies and digital terrain models. Indeed, land use seems to be a very important criterion in assessing landscape (*Lee et al., 1999*), as it is a very familiar aspect that can be easily interpreted, it can be considered the “sum” of geological, morphological and climatic characteristics, it has important connections with ecological factors, and it links them with the aesthetic appeal of the landscape itself. It is important to study the present land use (by means of remote sensing tools, direct field survey, study of existing cartography, etc.), but it is also important, as in this case, to study the evolution of land use through time, using statistical and economic data, or old cadastral and topographic maps, historical series of aerial photographs, etc.: this leads to the identification of those features that haven't changed in time, thus being the most valuable in cultural terms; and is useful for making hypotheses on the possible future evolution of a certain landscape (*Bender et al., 2005*)

## 4 THE RESEARCH ON THE CISTERNA-VALMONTONE ROAD

This research, carried out by the Department of Urban Studies, was aimed at assessing the landscape compatibility of a road to be built in the Province of Latina, leading from Cisterna to Valmontone. The study, besides singling out the criticalities of the road layout and suggesting mitigation measures, experimented different kinds of territorial analysis for the definition of the sensitivity and vulnerability of the regional landscape. The proposed methodology has gone through five phases: definition and identification of landscapes, value assignment, definition of landscape quality objectives, definition of landscape vulnerability, intervention proposals.

### 4.1 Definition and identification of landscapes

Objective of this phase was the recognition and definition of the identities of the different natural and human landscape components: the present components, and the ones that have developed through the centuries. By overlaying and comparing maps of different times (Gregorian cadastral maps, military maps, regional technical maps, etc.) with the use of GIS technologies, it was possible to define the evolution of the human settlements through the centuries, and to assign higher values to those portions of territory being suitable to express the historical and natural identity of the area. GIS tools made it possible to analyse landscape data starting from the 17<sup>th</sup> century until today; moreover, it was possible to compare the land-use map of the years 1816-1821 (Gregorian Cadastre, the first modern cadastre of the Pontifical State) with the land-use map of 2001.

### 4.2 Value assignment

Objective of this phase was the assessment of landscape sensitivity, i.e. the capacity of landscape of “receiving” a new infrastructure without considerable alterations. Within this phase, three studies have been carried out: the first one is about values and resources of the ecological landscape, the second one concerns the values and resources of the cultural landscape, the third one is a perceptual study on intervisibility.

As for the ecological elements, a study was carried out on ecological networks. Given the objectives of the research, even if taking into consideration the high quantity of information which are necessary for a correct definition of the ecological network, the study was restricted to analysing the elements of environmental continuity which give shape to the territory; maps of environmental constraints, woods, watercourses and agricultural land uses were overlaid in order to get a first information on the areas being important parts of the ecological network. The necessary in-depth studies could be carried out by more specialised ecological studies. Anyhow, a *map of the elements of naturalness* was drafted from the overlaying of the areas constrained by the Regional Landscape Plan and the natural areas taken from the land-use map. By overlaying the road layout to this map, it was possible to highlight the areas where the road gives rise to

fragmentation, where there would be a conflict with the elements of naturalness, and where it will be necessary to intervene in order to reduce the negative impacts.

As regards the cultural landscape, landscape “values” were firstly singled out through quantitative “certified” data. This means that, in order to assign a value to the landscape, it was decided to choose an “official” and legal reference, such as the Regional Landscape Plan, which defines a certain number of regional “Landscape Systems”. Each Landscape System was assigned a value, taking into account its naturalness and vulnerability. At the same time, by studying and comparing the Landscape Plan which was currently in force and the one under approval, a number of *landscape assets* were identified. The presence of a landscape asset determined an increase in value. Then, through a simple map-overlay, the *map of cultural values* was drafted (fig. 1).

Another relevant work within this research was made on the *intervisibility map*. The premise of this methodology is that when an infrastructure is built, landscape suffers from a visual impact, besides an environmental one. Therefore, in order to define landscape sensitivity in relation to an infrastructure, landscape values have to be related also to the perception of the infrastructure itself. The objective was the definition of that portion of territory actually influenced by the new infrastructure (*intervisibility basin*).

A 3D model of the terrain was built, and the road was divided into 500-metre stretches, each having a viewpoint in the middle; then, five classes of *visibility strips* were buffered along the road, from the closest to the farthest; and the surrounding territory was divided into 100x100 metre cells. The sensitivity of each cell was directly connected to the number of road stretches visible from it (fig. 2 and 3). Then, it was also related to the visibility strips, by giving different weights to the respective combinations: in other words, the highest weight is given to the cells belonging to the closest strip, and the lowest to those belonging to the farthest, according to the principle that the visual impact decreases as moving away from the road. Different cross-checking procedures were followed for this task of weight assignment, since it appears to be the most subjective of the whole operation; but, since the most critical areas came out to be the same, it can be said that the method was fairly good. The result of this elaboration was the *map of perceptive values* (fig. 4).

In order to integrate the two different methods (evaluation of cultural values and intervisibility), the map of perceptive values was overlaid to the map of cultural values: the result was the *map of cultural landscape sensitivity* (fig. 5). The sensitivity so obtained allowed to identify the critical areas needing intervention strategies.

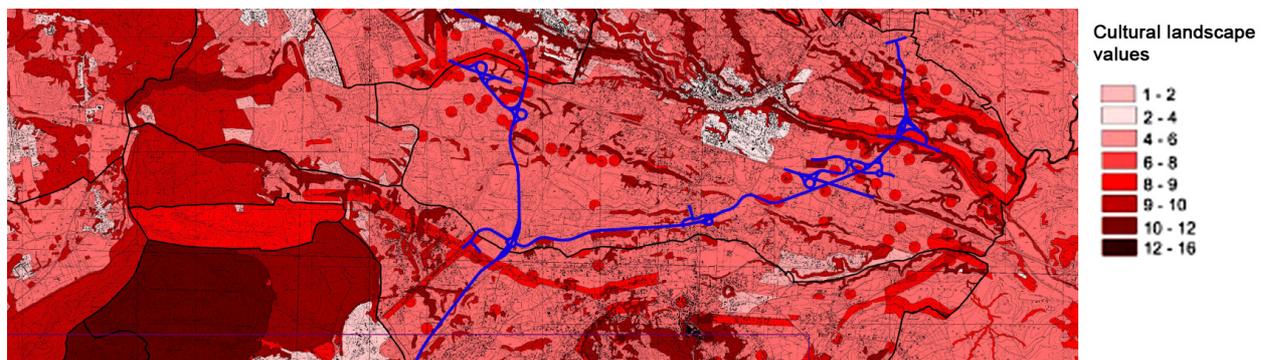


Fig. 1: map of cultural values

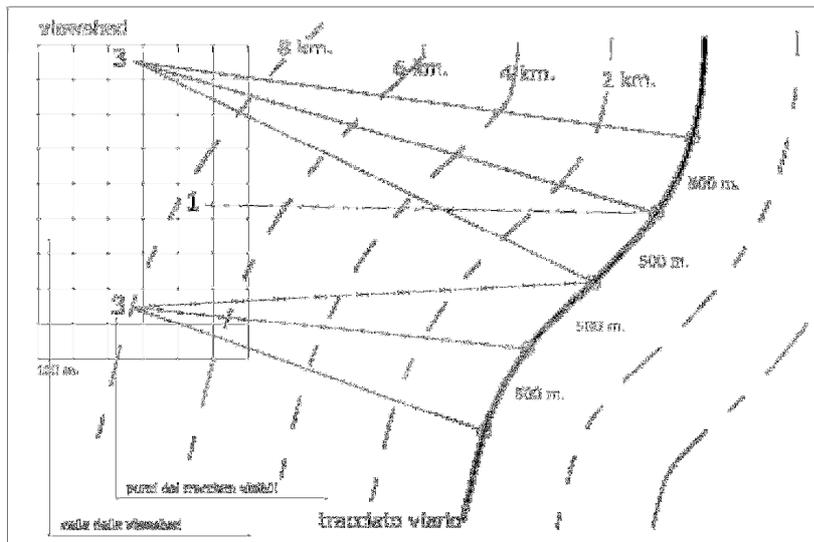


Fig. 2: road visibility from surrounding area

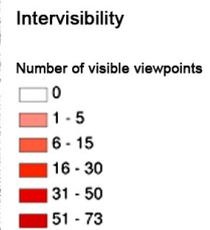
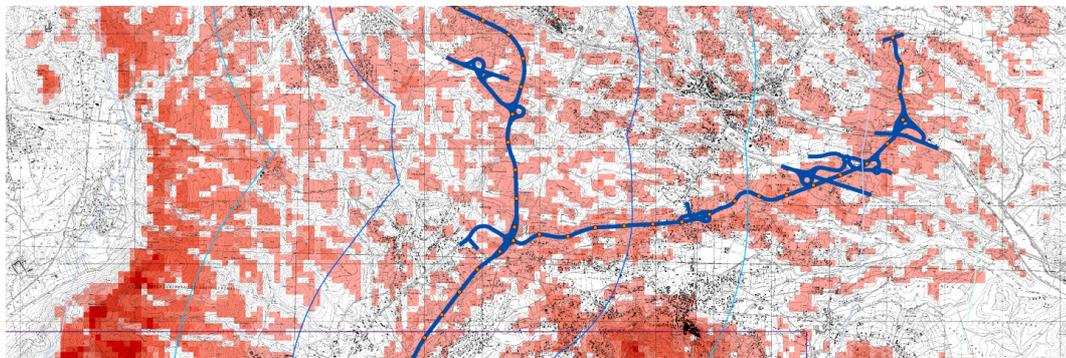


Fig. 3: map of intervisibility

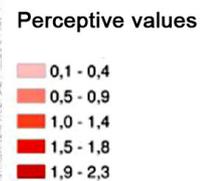
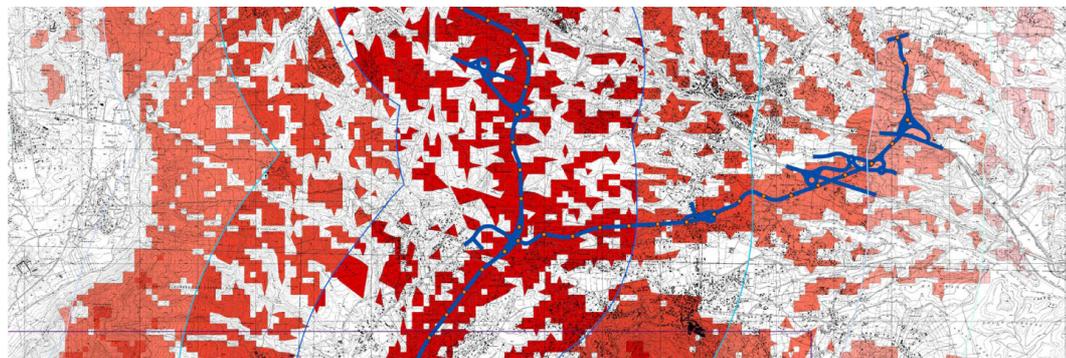


Fig. 4: map of perceptive values

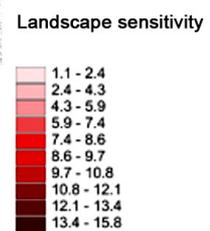
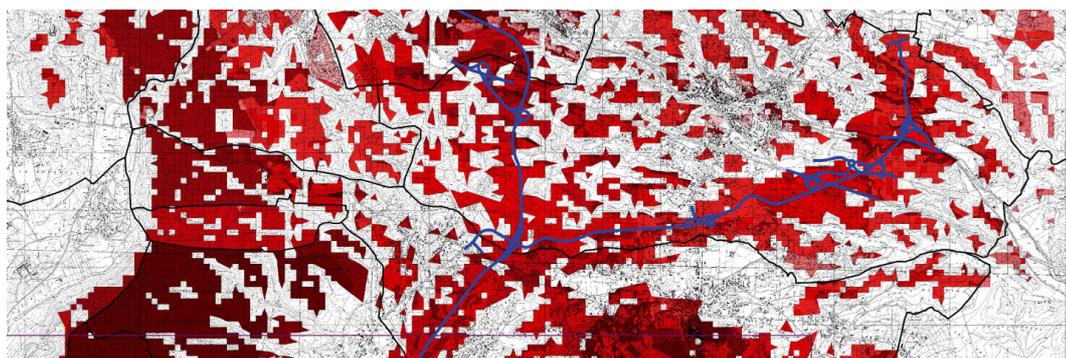


Fig. 5: map of cultural landscape sensitivity

### 4.3 Definition of landscape quality objectives

This phase was aimed at defining the quality objectives that the infrastructure plan has to respect as regards landscape sensitivity.

The first landscape quality objective identified is the safeguard of uniqueness and non-renewability of historical, ecological and perceptual elements; the second objective refers to the restoration of compromised or degraded areas, with the aim of re-integrating the pre-existing values, or setting up new values that are consistent with the traditional ones. The third objective regards the scenarios of future development being compatible with the different identified values.

### 4.4 Intervention proposals

On the basis of the final sensitivity-vulnerability assessment, and of the criticalities singled out, some suitable strategies for the requalification, safeguard and development were identified.

Suggested strategies are aimed at defining possible interventions on specific contexts (ecological networks, historical places, areas with particular perceptual values) acknowledged as strategical for landscape compatibility. These are: interventions for de-fragmenting and re-naturalising; interventions for mitigating; interventions for compensating and restoring, and interventions of environmental and landscape inclusion.

The study also allowed to detect the presence of environmentally degraded areas, being effect of the spatial and ecological fragmentation caused by the human settlements through time: for these areas, regardless of the building of the infrastructure, a long-term policy of environmental restoration could be pursued: the integrated planning dealing with compensation and mitigation measures should be able to be combined also with the town planning provisions for the involved areas.

### 4.5 Cisterna-Valmontone: an integrated approach

The interesting feature of the research on the Cisterna-Valmontone road is that an effort was made not only to face the evaluation from different points of view, and to make it as objective as possible, using data deriving from official planning instruments of different kinds and from the analysis of the historical permanence of certain landscape features; but also, these data were crossed with an intervisibility map, thus making use of an integrated method. Since perception is important when dealing with cultural landscape, we consider the studies on intervisibility to be particularly effective for its evaluation.

## 5 CONCLUSION

All three mentioned researches tried to approach landscape evaluation in different ways, but each tried to give more importance to a certain method, whether using simple graphic representations of the scenarios (Vercelli), a matrix derived from statistical data on land use (Palermo), or an intervisibility study (Cisterna-Valmontone). The added value of the last one can be found in the fact that an effort was made to connect the different methods. All of the researches, anyways, started from a land-use survey, which seems to be an essential criterion in assessing landscape, as mentioned in section 3.2.

None of the researches carried out a whole SEA procedure, but their more or less partial approaches have been pointed out to underline that attempts should be made to use different methods at the same time, when assessing landscape values, and, more generally, when making environmental assessments. Every method has different degrees of subjectivity: visual representations are the most subjective, but also important as perception regards the visual manifestation of all landscape components; land-use surveys have a certain degree of subjectivity, in the moment when the values are assigned to each land use; intervisibility studies are by far the most objective, as they make use of numerical elaborations.

Last but not least, only one of the researches made use of participation (even if it involved only institutional actors); it has to be remembered that a real and complete participation process is another essential element of the environmental assessment (as stated by the SEA Directive 2001/42/EC), especially when landscape takes an important role in it (as evident from the definition of landscape in the European Landscape Convention).

Participation should be another method of landscape assessment, and, though being purely subjective and qualitative<sup>1</sup>, it could help in the definition of landscape values, and integrate the quantitative approach.

As it is widely known, cultural landscape is not something that can be easily assessed by means of quantitative methods, like it can be done for ecological landscape. This doesn't mean that qualitative methods aren't important as well; rather, both have to be used in order to assign suitable values to such an elusive issue as landscape sensitivity, and to give more effectiveness to such a complex process as the Strategic Environmental Assessment.

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<sup>1</sup> Although there are also examples where participation has been used to obtain a quantitative economic landscape assessment starting from qualitative evaluations made by common people.