

## Strategic Environmental Assessment as a tool for limiting land consumption

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### ABSTRACT

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The value of "soil" is poorly taken into consideration in Italian SEA of urban and regional planning, reflecting the low awareness of the many functions and vital services to human activities and ecosystem survival, and the misconception of soil degradation impact on water, human health, climate change, nature, biodiversity, protection, and food safety. Recently enhanced planning practices account for soil protection objectives, but they are still not properly justified, assessed, and compared to different alternatives; and consequently not respected due to lack of adequate monitoring. The paper focuses on exploring the potential of SEA as an effective tool for improving urban and regional planning processes, in respect to land consumption, soil degradation and urban sprawl. Some SEA of Italian and foreign cases are presented, underlining how they were able to create more awareness of soil as a resource, and how this new awareness can lead to the integration of often neglected environmental considerations into the planning process.

### 1. The value of soil

Soil has a generally underestimated value in land use planning, and it should be considered as important as other resources in the pursuit of sustainable development.

Studies from the last 50 years have provided lots of references to the soil/land value as a "common", and its intrinsic fragility, bringing up the issue of a consequent need for protection.

Hardin's article is an example (Hardin, 1968): herders sharing a common parcel of land, with interest to put the next cows, even if the quality of the common is damaged through overgrazing, and the common is depleted or even destroyed, to the detriment of all.

Diamond wrote about how societies collapse because of the disregard for increasing environmental issues (Diamond, 2005), providing several examples of the contribution of environmental components, such as soil problems (erosion, salinization, and soil fertility losses).

In order to avoid "tragedy" or "collapse", soil should be acknowledged among the other commons to have a tremendous value for the community. It is a direct consequence the need of governing the commons, in order to save them and manage their use for the community; "governing the commons" in the sense as Ostrom masterfully presented on her book (Ostrom, 2006).

Soil clearly has a strong social and cultural value, but also from an environmental point of view it has

demonstrated a fundamental contribution to several functions:

- climate change/CO<sub>2</sub> sequestration,
- ecology system and biodiversity,
- groundwater recharge,
- food and agriculture,
- landscape.

Despite its value, soil and landscape have been poorly taken into consideration in Italian planning in recent decades, and more specifically by Italian citizens. In fact, as underlined by Settis, in the last decades "mountains, countryside, coasts, are being less and less taken into consideration as a treasure of the citizens, instead they are seen as an easy hunting reserve for who is cynically destroying the commons for their interest" (Settis, 2010).

### 2. Impact of land consumption

As currently defined<sup>1</sup>, soil is "the top layer of the earth's crust, formed by mineral particles, organic matter, water, air and living organisms. It is the interface between earth, air and water and hosts most of the biosphere"; for the purpose of this paper, soil can be referred to the rural land, not yet urbanized, and its intrinsic value. Land,

<sup>1</sup> ENVASSO Project: ENVironmental ASsessment of Soil for monitoring (www.envasso.com)

<sup>2</sup> Oxford dictionary, Oxford University Press, 2011

<sup>3</sup> OECD DAC SEA Guidance, 2006

<sup>4</sup> SEA Directive, 2001/42/EC

<sup>5</sup> In fact, in Italy soil sealing limits and targets, where existing, are usually defined at the

somehow confused with soil, instead is generally defined<sup>2</sup> as "the part of the earth's surface that is not covered by water"; for the purpose of this paper, land includes territorial and spatial dimensions, and it is considered as the object of land use planning. Furthermore in this paper, soil consumption refers to the concept of "land take", also known as "urbanization", "increase of artificial surfaces" and represents an increase of settlement areas (or artificial surfaces) over time, usually at the expense of rural areas; this process results in an increase of scattered settlements in rural regions or in an expansion of urban areas around an urban nucleus (urban sprawl).

Soil consumption has negative effects and impact on environmental, social, economic resources.

Soil is in fact an extremely complex, variable and living medium; the interface between the earth, the air and the water, soil is a non-renewable resource which performs many vital functions: food and other biomass production, storage, filtration and transformation of many substances including water, carbon, nitrogen. Soil has a role as a habitat and gene pool, serves as a platform for human activities, landscape and heritage and acts as a provider of raw materials (European Commission, 2006; EAA 2006; European JRC, 2008).

Soil should be seen as a public service, a public right, like other resources such as water and air.

Land use planning effects all soil threats and its impact need to be taken into account when planning the sustainable use of the land, such as impact on:

- soil sealing,
- soil erosion,
- decline in Soil Organic Matter (SOM),
- soil contamination,
- soil compaction,
- decline in soil biodiversity,
- soil salinization,
- landslides,
- desertification.

Many studies show that European soil degradation is accelerating, with a variety of negative effects on human health, natural ecosystems and climate change, as well as on the economy; individual ecosystem services that are affected by land use transition also include the production of food, regulation of energy and matter flows, water supply, supply of recreational space, biodiversity or natural aesthetic values (Nuijs et al. 2008).

<sup>2</sup> Oxford dictionary, Oxford University Press, 2011

### 3. The objective of soil protection

Given the evidence of the need for governing land consumption while preserving soil value, it has consequently made soil protection an increasingly important objective.

From this perspective, the European Commission adopted a "Soil Thematic Strategy" (COM 231, 2006) and a proposal for a "Soil Framework Directive" with the objective to protect soil across the EU, acknowledged its socio-economic as well as environmental importance for the community (COM 232, 2006).

### 4. Soil protection and SEA

Different European policies are contributing to soil protection (for instance on water, waste, chemicals, industrial pollution prevention, nature protection, pesticides, agriculture) but there is a lack of an integrated strategic policy. As these policies have other aims and scopes of action, they might not be sufficient to ensure an adequate level of protection for all soil in Europe.

Given the complexity of the soil consumption impact, an integrated policy and planning tool is needed to cope with soil protection issues.

Strategic Environmental Assessment (SEA) refers to a range of "analytical and participatory approaches that aim to integrate environmental considerations into policies, plans and programmes and evaluate the inter-linkages with economic and social considerations"<sup>3</sup>. According to SEA Directive<sup>4</sup>, competent planning authorities are obliged to accomplish a systematic assessment of all significant environmental impacts of regional land use plans (Art. 3 para. 2 SEA Directive).

The procedure of SEA suits the purpose of an integrated assessment of land use issues, and it can be effective being inextricably linked to decision-making. SEA, by law (SEA Directive):

- evaluates the likely significant effects on the environment, including issues such as soil, water, air, landscape;
- integrates environmental considerations and evaluates the inter-linkage with economic and social considerations (soil as a 'common');
- includes monitoring (i.e. on land consumption)

Additionally, the SEA report, being a decision-support instrument aimed at providing as detailed a picture as possible of the environmental impact related to the implementation of a land use plan, must contain sufficient information to assess the acceptability of the impact of soil consumption, and consequently to propose suitable

<sup>3</sup> OECD DAC SEA Guidance, 2006

<sup>4</sup> SEA Directive, 2001/42/EC

modifications and mitigations.

## 5. Land consumption in Italian SEA

In the last few decades in Italy, there has been massive urbanization disproportionate to the demographic increase, and mostly in the Po Valley (area including Regions Lombardy, Emilia Romagna, Veneto, Piedmont), where each day 200.000 m<sup>2</sup> are urbanized, “about 30 soccer fields” (Legambiente Report, 2011)

Italy, unlike most European countries, does not have a national spatial development plan, nor a definition of soil sealing limits and targets (like in Germany, UK, Austria).

Regional Territorial Plans are the planning tools that rule land use in Italy and therefore they have the most important role in limiting land consumption.

Emilia –Romagna and Lombardy, the two Regions that cover the main part of the Po Valley, recently approved their Territorial Plans.

### Regional Territorial Plan of Emilia Romagna (Italy), limitation of land consumption

The new Regional Territorial Plan (2010) of Emilia – Romagna<sup>i</sup>, includes an evident objective on the limitation of land consumption.

Starting from the analysis of the soil “artificialization” of the region territory (land consumption due to new urbanized areas, commercial areas, industrial areas, infrastructures, mining areas, landfills increased by 74% compared to thirty years ago, especially in the timeframe between 1994 and 2003), the Plan and its SEA explicitly reject the past developing model, and its consequent negative effects, such as the urban sprawl generated, that caused an exponential increase of public costs for infrastructures and management of the services needed.

One of the clear objectives of the Plan addresses the limitation of land consumption: “it is possible to consume new land only if there is no alternative deriving from the substitution of existing urbanized texture, or from its re-organization, re-zoning or regeneration”.

However, no target is fixed, due also to the fact that Italy, unlike most European countries, does not have a higher level spatial plan, such as a national spatial development plan, that would influence or govern the regional plans for a defined period<sup>5</sup>.

SEA includes information about the monitoring plan, that has the aim to control the Plan

<sup>5</sup> In fact, in Italy soil sealing limits and targets, where existing, are usually defined at the municipality level, unlike in other EU countries (Germany, UK, Austria, etc.). See EC, 2011.

application and effectiveness. Regarding the limitation of the land consumption objective, the monitoring plan includes indicators like:

- land fragmentation because of “artificialized” surface;
- land use, change in soil consumption, soil sealing.

The case study is interesting for its explicit acknowledgment of the problem of land take, and for the objective determined, but its SEA shows a lack of justification, assessment, and comparison of different alternatives, even if monitoring can help further action.

At a local level (Provinces and Municipalities) land consumption and its impact have been taken into consideration in all the recent spatial planning<sup>6</sup>; SEA of territorial plans like the PTCP<sup>ii</sup>, and their sectorial part (Water, PTA; Quarries, PIAE; Energy, etc.) include evaluation of land consumption, and propose its limitation through several compulsory regulations, such as:

- maximum amount of urbanization of new areas, while promoting urban renewal, brownfield redevelopment, etc.;
- further limitation (targets and threshold values) for new urbanization in “groundwater protection zones” (introduction of the “sealing balance”, etc.);
- limitation of new quarry sites while allowing only existing sites extension;
- limitation on setting new photovoltaic power plant on ground, while promoting roof systems.

Those examples show the importance of the integration of different sectorial policies in a common spatial plan (PTCP); SEA was the common field where different aims converged in a unique view that evaluated and consequently promoted the objective of limitation of land consumption. Monitoring will show the effectiveness of the planning process.

### Regional Territorial Plan of Lombardy (Italy), SEA and land use planning: lesson learned

The present scenario in Lombardy shows the strong reduction of open spaces and spread of urban areas increasing the ecological fragmentation and the habitat erosion. More tools and coordinated policies to discipline the urban growth are needed to limit land consumption. Even more urgent tools are needed to increase the awareness of policy makers and planners (Pileri, 2010).

SEA of the Regional Territorial Plan of Lombardy<sup>iii</sup> (2010) neglects some contributions given by the consultation phase (such as the need for a specific study on land consumption, and a

<sup>6</sup> See PTCP Reggio Emilia, PTCP Piacenza, PTCP Modena, PTCP Bologna<sup>ii</sup>

proposal about ecological compensation) while a general objective of “land consumption reduction and promotion of brownfields regeneration” is included.

More interesting cases of the effectiveness of SEA and soil protection in Lombardy can be found at a local level: some recent municipal plans have included assessment of land consumption, and their SEA have foreseen mitigations and compensation (i.e. Cernusco sul Naviglio<sup>IV</sup> 2010, etc.).

From the experience of SEA application in Emilia – Romagna (2000-2011) and Lombardy Region (2005-2011) some limits of its application in land use planning can be underlined:

- SEA process is not always taken into serious consideration by decision makers, and often SEA analysis, recommendations and information are neglected;
- some themes, such as land consumption, should be governed, evaluated and analyzed by external bodies removed from the municipal level (often closer to local interest instead of global environmental matters);
- land use change, and land take in particular, has many side effects that should be estimated and evaluated, as they involve several issues (sealing, erosion, etc.);
- in Lombardy, SEA is not required for “Piano delle Regole”, which is the component of a Municipality Plan that includes quantitative limitations and constraints (such as land consumption limitations);
- existing plans are often neglected, and their old decisions are hardly questioned and changed in a more sustainable point of view in the new plan.

## 6. Land consumption in foreign SEA

International case studies showed the same positive results for SEA as a tool for limiting land consumption. This section briefly highlights different case studies which demonstrate interesting results on:

- evidence of effectiveness of using SEA in land use planning, as importance of an independent SEA body (Victoria, Australia);
- proposal of reinforcing integration of SEA and “ecological” planning (Chengnan, China);
- need for the use of SEA in land use change of Brazilian sugarcane ethanol.
- examples of suitable indicators for SEA in regional land use planning (Germany);

### Victoria (Australia), land use planning and independent SEA body

The experience of SEA processes in Victoria has been somewhat different than within Australia,

with public land use assessment and planning having been informed by a series of independent bodies since 1970. These SEA bodies have played a major role in mediating environmental conflict over public land use, and have significantly contributed to the increased size and coverage of Victoria’s protected area system (from 205.000 ha in 1970 to 3.121.520 ha in 2005). It may reflect the high degree of consultation and analysis undertaken, with advices supported by clear processes and informed by assessments of social, economic, and environmental considerations (Coffey et al., 2010).

The SEA approach adopted is considered to be a systemic, transparent and long-lasting example of SEA, useful in managing land use conflict and promoting more ecologically sustainable land use (e.g. with the systematic establishment of a parks and reserves system). The case study remarks the importance of having an independent statutory body model for SEA of public land use planning, as it provides a robust and yet flexible approach by which to deliver independent advice to government on contentious matters.

### Chengnan New District of Jintan County, Jiangsu Province (China), integration of SEA and ecological planning

The Urban Conceptual Plan of Chengnan, New District of Jintan County, planned to be built as an eco-district with residential communities, administrative centers and entertainment areas; the planning organization invited environmentalists and SEA experts to guide construction activity, ensure protection of the ecological sensitive zone for urban sustainability, and meet requirements stipulated in environmental protection laws and regulations (He et al., 2010).

Under SEA frame, ecological principles guided urban planning and arguments between planners and SEA experts at an initiative stage; the concept and detailed plan were modified according to the findings of SEA, through which a preferred option to build eco-district was formed. The effectiveness of this process demonstrated that rather than separate ecological planning and land use planning, common objectives can merge into an integrated process. The “competitive” relationship between these two parts can be changed into a “collaborative” and “mutually supportive” one, regulated by the SEA process.

### Brazil land use change, need of a SEA approach

Brazil is not still experiencing SEA process in its policy and planning procedures; the following case study shows the limits of having individual assessments on projects that require land consumption, instead of a strategic assessment approach.

Brazil is experiencing a surge in planting of sugar

cane crops driven by internal markets and external policy drivers for biofuels. Despite the evidence of GHG savings, some global concerns have arisen from the net expansion of land use change affecting impact on biodiversity, and having implications encompassing economic, social and environmental impact (Figueireo Gallardo et al., 2011).

The analysis of environmental studies on sugar-cane crops (Environmental Impact Assessment, EIA Reports) showed that the main global concerns identified in the literature in relation to the expansion in this sector are not adequately addressed: global, synergistic, indirect and cumulative impacts are not appropriately considered and thus mitigated. EIA studies mainly address issues connected to localized and direct environmental impacts largely ignoring any socio-economic impacts or any strategic consideration typically involved in SEA processes.

#### Germany, indicators for SEA in regional land use planning

German Government set a national target of reduction of land consumption to 30 ha/day by year 2020 (on the basis of the newly consumed area in 1990); this objective has to be operationalized to the regional planning level, so that in the future, German regional planners will have to be responsible for an ever stricter land use management (Helbron et al., 2009).

Several studies presented examples of indicators for SEA in regional land use planning, like LUCCA project, elaborating indicators such as "land consumption" (soil abstraction, soil sealing, soil degradation/excavation) and "land use change" (change of function of the area without soil removal or sealing: e.g. afforestation, recreation). According to this study, SEA cannot guarantee an 'environmentally friendly planning' and 'appropriate decisions', but can make the region's potential for adaptation and 'adaptation-constraining decisions' transparent (Helbron et al., 2009).

### **7. SEA as a tool for limiting land consumptions**

Sustainable development has been highlighted as an essential principle in spatial planning, with increasing recognition that uncontrollable urbanization and land consumption give rise to various issues such as overexploitation of natural resources, ecosystem destruction, environmental pollution and large-scale climate change.

Case studies highlight some good results obtained from SEA methodology as a tool for improving urban and regional planning processes, in respect to land consumption, soil degradation

and urban sprawl. At the same time, especially within an Italian context, there is big space to improve the effectiveness of this tool, from different point of view.

#### Soil as a common

SEA and spatial planning have to consider land consumption as use of a common good, like water, air and forests, with consequent responsibility for protecting it. Soil is one of the non-renewable resources, and it needs to be saved and protected for the global sustainability of planning processes. It has to be seen as a fundamental common, that affects social, economic and environmental issues for the community.

#### Better awareness of soil value

In public participation and consultation of SEA processes, a better awareness of soil value must be carried out. Knowledge regarding the crucial role of soil in the ecosystem and its vulnerability is a prerequisite for responsible soil management.

#### Objective of land consumption limitation

The soil fulfills vital functions in the ecosystem. For this reason, only sustainable, careful and sparing use – in terms of surface area, quantity and quality – is permissible.

Soil protection and limitation on land consumption must be included in all planning processes and consequently in every SEA reports, with an effort in fixing specific targets.

#### Soil as the main resource, need of policy integration

SEA reports instead of studying plan effects on different separate sector (typically: air, water, waste, energy, biodiversity, etc.), should consider soil as the main resource and evaluate the effect of its transformation. Land use change should always be estimated and assessed with its effect on several sectorial activities, like agriculture, forestry, etc. There is a need of a convergence of different interests, and SEA should support the integration, cooperation and coherence of different policies involved.

#### SEA and assessment of land use change

SEA reports should include an assessment of land use change, its effect and impact in an environmental/ecological, social and economic point of view.

For this purpose, spatial GIS tools need to be an essential part of SEA report, because of their ability to encompass several multilayer information and for their capacity of considering the cumulative and synergistic impact of different land use change in a plan.

#### SEA and alternative land use options

SEA report, by law, includes assessment of different alternatives. Considering land consumption, SEA should encompass an assessment on different steps:

- evaluation of different land use options, and the soil loss; alternatives with less land

consumption must be always taken into consideration, besides the “business as usual” option, making an estimate of the value of preserving soil from urbanization (or other land transformation);

- impact prediction of the preferred option in alternative future scenarios (pessimist scenario, optimistic scenario, etc.);

In comparing alternatives, the consequent impact of the planned transformation can be assessed, in order to support the decision makers avoid a bias which usually undervalues soil concerns.

#### SEA and mitigation measures/compensation

Once impacts are assessed, SEA should be the proper place where technical measures to mitigate soil sealing should to be discussed and defined (in terms of best practice, legal requirements and incentives, etc.).

Moreover, in SEA processes, forms of compensation, if necessary, should be discussed and defined (such as compensation payments, compensation measures, trading systems, etc.).

#### Link between theoretical and practical land use planning

While at a more general formal level, land consumption concept has spread around academics, decision makers and planners, at a more practical level it seems to be neglected. This is reflected in the usually missing link between regional and urban planning: while recent territorial plans and their SEA all include objective of land consumption limitation, at a local scale they are hardly put in practice.

There is a need of a stronger link between the two planning level, and a deeper awareness of soil value at the urban scale.

#### Need of better quality SEA

Poor SEA usually reflects poor planning processes and vice versa; increased effectiveness of SEA is showed when it is transparent and it serves the community objectives. Detailed SEA report better helps decision makers, and when it is overseen by an external, third-party entity, this clearly increases its success.

#### Monitoring

As specified in the next paragraph, effective soil protection requires coordinated and to some extent long- term observation and monitoring of the soil. Appropriate indicators should be selected in SEA reports in order to monitor land change and calculate the matrix of transitions.

## **8. Monitoring land consumption in SEA**

The availability of data on soil/land consumption is the starting point for any further consideration and assessment on land use policy.

While land consumption is on the agenda of various European governments and integrated

data is available, in Italy there is neither a national framework nor a database on land use despite the high number of territorial IT systems (Pileri, 2009). The only data available is from the project Corine Land Cover (1990 and 2000).

SEA can help planning processes if data is available to evaluate the status quo on land consumption and make proposals for future development. An integrated system of information and data is necessary to understand the themes addressed by the territorial planning; land consumption data must be included, in order to reach a comprehensive evaluation of the strengths, weaknesses, opportunities and threats (the so called SWOT) involved in land use planning.

A methodological approach that should be used for the purpose mentioned above, is the collection of data on land use/land cover and the compiling of the table called “the transition matrix” (Pontius et al., 2004).

The matrix is based on flows in change in land use/land cover that a certain area had over a specific amount of time (from  $t_0$  to  $t_1$ ), bearing in mind the “triangle of transformation” (Pileri, 2009). The transition matrix makes it possible to organize data so that it produces an interpretation for evaluating the environmental effects as well as the planning strategies; some transformations have a different environmental impact than others.

The SEA Environmental Report, part of the Plan official documents, must include the “monitoring plan” (Article 10, SEA Directive<sup>7</sup>).

In order to have control on the potential effects of the Plan, including land consumption, evaluation indicators are needed. Among the others, the evaluation of the land use/cover transition can be represented by indicators that measure:

- land use at different times (i.e. every year);
- change of land use (different timeframe);
- land take
- rapidity of the transformation;
- the incidence of the transformation compared to the original land cover stock.

## **9. Conclusion**

It can be stated that SEA has the potential to be an effective tool for preserving land consumption; it is a fertile field that integrates different policies

<sup>7</sup> “Member States shall monitor the significant environmental effects of the implementation of plans and programmes in order, inter alia, to identify at an early stage unforeseen adverse effects, and to be able to undertake appropriate remedial action”.

and the right place to deal with social, economic and environmental issues. From this perspective, SEA can strengthen soil protection objectives thereby improving the sustainability of land use planning.

A future investigation in order to improve SEA effectiveness on planning process in the pursuit of soil protection could be the introduction of simplified methodology of estimating and assessing land use alternatives and their impact, together with the definition of a few appropriate indicators suitable for the monitoring plan.

Even if there are positive conclusions, what if these changes would not be enough? Some deeper concerns arise.

Do we maybe need new practical tools in spatial planning?

Or perhaps, do we need a new institutional framework, reforms in the legislative structure and change in land use regulations, with major importance to land consumption? Would the introduction of legal standards ensure soil integrity?

And finally, is it possible to think at a next step SEA of land use planning, with soil perceived as the main non-renewable resource?

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