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Soil: fragile ! Be careful !

The challenges to society from its over-consumption of land

by Simonetta ALBERICO & Ilario ABATE DAGA

The problem of the progress of artificial land surfaces related to urbanisation and economic activity has today become a major issue in sustainable development. The phenomenon has accelerated in recent years, particularly in the coastal areas around the “Latin” segment of the Mediterranean Rim. This has involved agricultural land and soils but, also, forested and natural areas. This article provides a description of a tool developed within the framework of the Med OSDDT project and designed for those responsible for the management of local and regional areas. This tool led to the refining of the indicators of the (over)consumption of land.

The using up of land is inherent in the urban growth which is a hallmark of our societies. Furthermore, the last thirty years have witnessed an extension of the land given over to housing, infrastructure and other activities such that the role played by agricultural land and forests in food production has been compromised for the future and the varied wealth of biodiversity in those ecological systems remaining still fairly unspoilt has been disturbed and even come under threat.

Counteraction depends on knowing how to measure the disappearance of land

Responding to questions such as:

- is the disappearance of land really a problem?
- how land has been used up?
- what kind of land are we losing?
- are we densifying human activity or, in fact, scattering it?

...involves an assessment of a quantitative type that is indispensable for relating urban transformations with issues in ecology and the structuring of landscapes. In such a perspective, this type of evaluation is a necessary tool for the management of localities, districts and regions.

What is the purpose of indicators of land use?

As quantitative tools, such indicators measure the state of soils and the evolution in their use, as well as providing information about previous dynamics and current tendencies. They are indispensable aids to decision-making for those who plan land use and improvement: they enable planners to adopt development criteria favourable to the conservation of land and which guarantee better results for the future reduction in its consumption; and they indicate what types of land and soil must absolutely be preserved.

How to design a system of indicators?

By definition, a good indicator is built up from data that identifies natural and artificially-modified areas. It emerges from the treatment of land registry data bases or satellite imagery available in the form of geo-localised mapping usable with a GIS. The reliability of the treatment determines the accuracy of the measurement of the specific evolution of urban sprawl.

Thus, choosing the relevant indicators for the design of a system for monitoring and evaluating the processes of land consumption and urban spread is a tricky challenge. To be effective, such a system must meet certain criteria and, in particular, foster a shared dynamic between the stakeholders in an area who may have different interests, integrate data relevant to defining reliable indicators and, also, have the capacity to analyse results in terms of strong points and

limitations. It is essential that the definition of an indicator remain unchanged from one survey to the next, as far as the parameters used are concerned, in order that the time frame reflects reality as closely as possible.

Finally, so that indicators be widely accepted and made public, they must be understandable and accepted by all concerned. To sum up, a monitoring system, to be effective, should be designed as an observatory of public interests.

The advantages for urban and country planning, of a system of indicators or observatory, of land consumption

Indicators of land consumption are fundamental to the measurement of this phenomenon because, in order to design and apply models for urban and country planning that are not land-hungry, it is indispensable to understand the origins of urban spread and the shrinkage of farmland, natural areas and forests. Also, foreseeing the need for indicators of the specific measurements needed downstream of the implementation of frugal models of land use and operational action in land management, then making such indicators available, makes it possible to assess their efficacy in practice, evaluating each one of them. Should anomalies occur, corrections and adjustments can be made.

Indicators in the form of quantitative results have the advantages of being quickly understood by decision-makers, appear more concrete, are even thought to reflect unchallengeable reality. Notwithstanding these pluses, to obtain a deep understand of the phenomenon requires a qualitative analysis which will amplify underlying aspects of the dynamics revealed by the measurements and colour the various points of view of the stakeholders concerning the (over)consumption of land. Put differently, the calculation revealing a dynamic is not necessarily capable of explaining it. Hence, in some cases data about qualities are needed to deepen understanding of a phenomenon.

In fact, the qualitative approach facilitates concertation amongst the stakeholders involved and raises general public awareness of the issues of land preservation and maintaining the functions of ecosystems.



A usable set of indicators for generalisation throughout Southern Europe

The experimentation and testing carried out within the framework of the OSDDT project have generated awareness that the indicators conceived for measuring the (over)consumption of land can be applied to various types of partner and public entities. Despite the wide range of local and national contexts as determined by legislation and land use data bases, the following governing bodies have used the arsenal of indicators which have indeed given the hoped-for results: the *Département* of the Hérault in France; the Provinces of Turin and Terni in Italy; the Murcia Region in Spain; the Crete Region in Greece; and the town of Pembroke in Malta. The overview of each partner entity made it possible to draw up a photograph of the present situation and to understand the issues and challenges confronting each one. In a European-wide comparison of land consumption in the different countries between 1990 and 2000, of the six countries belonging to the project, three figure amongst the four biggest European (over)consumers of land: after Germany, which accounts for over 20% of European land consumption, there follow France (14.5%), Spain (13%) and Italy (9%). Greece and Malta are far below.

Three main families of indicator for measuring and understanding the dynamics of land use management responsible for the (over)consumption of land

Within the framework of this project, the work of building up and identifying the indicators gave rise to three different families of indicator, all needed to obtain as comprehensive an interpretation as possible and to push further, beyond the basic quantitative measurements of the phenomenon, to the evaluation of the efficacy of the tools of land use management aimed at limiting the consumption of land.

The **first family of indicators** provides a **precise quantitative appreciation** of the land taken over within the given area. Its choice derives from the necessity for all the

local stakeholders to be able to measure the extent of the encroachment. It is true that the last decade has seen a growing awareness of the “problem of the (over)consumption of land” but such awareness has rarely been backed up by actual quantitative measurements at a local level.

Thus, it is necessary first of all to have available the instruments for obtaining a shared stock of knowledge facilitating an approach to the phenomenon and then a basic minimum of understanding in order to proceed to the survey of the fundamentals involved in land preservation (protecting natural areas, zoning preferential farmland). Local data must be available (land registry, maps, photos etc.) to permit the building up of indicators which, starting from a description of the *status quo ante*, will reveal the evolution of land consumption.

Over and above the quantification pure and simple of the land taken up between two given dates, some indicators in this first family also permit an understanding of the dynamics involved thanks to a more exact, though still quantitative, analysis of the area's specific features. Here it is a question of indicators that take into account the main preoccupations deriving from public demands. These include:

- the increased attention paid by stakeholders and the general public to the dangers linked to the ongoing shrinkage of territory which had previously been devoted to agriculture and forestry and is now being sold off for the development of residential or industrial estates;
- situations of risk arising from bad land use management which is now linked to the increase in accidents and “natural” catastrophes in urbanised areas (landslides, flooding, violent thunderstorms etc.).

The first family of indicators thus proposes different tools for measurement to determine when and how the phenomenon of the (over)consumption of land has affected areas that are vulnerable by virtue of their initial natural vocation.

This family should enable local elected representatives to realise the extent land has been used up in their area, along with the level of interaction and use of local unrenovable inherited resources (in agriculture, forest, the landscape, hydrography, biodiversity).

The **second family of indicators** is concerned with the **question of sprawl and scattering**.

This type of urban expansion, whose impact on a whole area and on landscapes can be locally very marked, contravenes the principles governing land use planning schemes. It is a limited form of urban growth though it underlies future disorder (if only through the doubt it causes in the minds of local stakeholders as to the effective agricultural use of the land involved). For this reason, it is vital to understand scattered sprawl via suitable indicators. This is the job of the second family.

Defining scattered sprawl is the first step required in applying the techniques of calculation in the light of data available locally. While all those involved in planning do not have the same technical definition of sprawl, everyone recognises that it includes all the new pockets of urban growth in low-density areas, meaning all construction in natural or agricultural areas and the invasion of permanent buildings in rural zones away from settlements (villages, towns, peri- or suburban areas). Such pockets in low-density areas are seen to be the launching pads for future urban expansion.

Taking into account the indicators of sprawl and integrating them into land use planning schemes facilitates the protection of priority areas for preservation.

Picture 1:
Scattered sprawl can have major impact on localities and landscape.



In fact, thanks to the indicators of sprawl and the ongoing measurement of the phenomenon, it becomes possible to understand the catastrophic and irreversible dynamic around urban centres entailing the deterioration in their capacity for agricultural production, and consequently to modify planning policies. These indicators should permit, in particular, notably the introduction of measures to safeguard and preserve natural, forested and agricultural areas, including peri-urban farming, in order to maintain the development potential and domestic food supply in European countries.

The **third family of indicators** focuses on **the forms of urban growth and on the fragmentation** of areas linked to such expansion. This is certainly an aspect specific to land use planning; however, the gaps caused in the continuous spatial matrix have a negative impact on ecosystems (ecological corridors, reserves of biodiversity, ecological continuums etc.) and natural landscapes.

The fragmentation of areas due to increasing urbanisation and infrastructure and the superposition of such systems of fragmentation endanger the role in ecosystems of space, of which soil and land area are one of the main elements.

Knowing the degree of fragmentation of an area makes it possible to comprehend a series of critical situations that arise from modifications to the basic structure of a territory. Knowing the ensuing effects should enable legislators and planning decision-makers to implement measures for the restoration and preservation of biodiversity incorporated into planning policy (cf. insert on next page : families of indicators).

To take action requires new management models

Within the framework of the OSDDT project, analysis was carried out of 29 initiatives and actions, all public policy aimed at limiting the impact of human activity on landholdings and natural areas. They were methods and instruments, applied or tested for a variety of reasons by the partners in the project, aimed at sustainable management of soil and land and, in particular, the protection of peri-urban land now severely affected by the urban sprawl of recent decades. The

FIRST FAMILY OF INDICATORS

Land consumption: level of consumption in the reference area
 Rate of land consumption: rise in consumption over time
 Average annual rate of the rise in consumption: average annual variation in the land consumed
 Consumption of fertile soil or usable land: measurement of altered (artificial) land compared to such soils
 Consumption by altitude: land consumed as a function of altitude
 Consumption per inhabitant: ratio of land consumed and the resident population
 Consumption per extra inhabitant: ratio of land consumed between two dates and the increase in population
 Average annual rate of the rise in land consumption
 Pressure from tourism: ratio of the theoretical maximum tourist population and the resident population
 Environmental protection: land consumed in areas benefiting from environmental protection measures
 Installations at risk: land consumed in areas classified as potentially at risk from natural occurrences
 Technological risk: land consumed in areas classified as potentially exposed to technological risk

SECOND FAMILY OF INDICATORS

Indicator of scattered building: area of the land consumed in non-built-up areas
 Incidence of scattered sprawl: the contribution to the overall spread of artificial surfaces of new core urban settlements in non-built-up areas

THIRD FAMILY OF INDICATORS

Indicator of urban fragmentation: degree of fragmentation in a locality or region due to the rise in built-up plots
 Indicator of fragmentation from infrastructure: degree of fragmentation in a locality or region due to the expansion of road infrastructure
 Indicator of compactness: degree of total fragmentation in the reference area due to the combined effects of urban and infrastructure fragmentation and which provides a coefficient of compactness

implementation of diverse and varied measures, from local village up to regional levels, reflects the growing awareness of the issues and challenges arising from the (over)consumption of land along with its increasing impermeability.

A broad spectrum of types of intervention has generated assorted tools ranging from regulatory measures to tools involved in project initiatives.

Which models?

Although it is difficult to measure the efficacy of the various tools of land use management and improvement because they have been created only recently, their “capitalisation” -accumulated information, experience and lessons learnt from the experimental action- represents an important source of reflection resulting in the identification of levers that can change the situation. The analysis of operational tools thus opens the door to numerous solutions for reducing the future (over)consumption of land.

From a methodological perspective, whereas the indicators have focused on measuring the ever-widening fabric of urbanisation, the fact is that the operational tools for understanding the phenomenon suggest to planners that they “inverse their outlook”. Such tools start from the proposition that, before urbanising, a comprehensive audit is needed of the role of a given area, with the amenities in its landscape, agriculture, forest and natural heritage. More exactly, decisions should be taken on the basis of an assessment of which functions of the ecosystems involved can be ascribed to the land and soils. Then only can their real value to society be understood.

Such audits necessitate the mobilisation of interdisciplinary teams (technicians from local authorities, civil servants from decentralised levels of government, scientific and other consultancies from universities and research institutes). What is required is the point of view of agronomists, naturalists, landscape architects and, indeed, of the general public, in order to know what we possess and what we stand to lose.

Different though the tools be, what they all show when taken together is:

- having qualitative information to complement the quantitative indicators based on measurements of land use and consumption are indispensable for an understanding of why it is vital to preserve an area's agricultural potential and biodiversity;

- the constraint of normative regulations is indispensable. It can be seen that, though the impact of rules varies on account of the nature of their stipulations, the impact is clear;

- financial incentives enable action by public authorities to be concentrated on models for land use and development that take into account the consumption of land and which are indispensable for fostering new approaches within the framework of local development policies;

- concertation is a fundamental weapon in an effective fight against urban sprawl and the consumption of land because every solution can only be a shared effort and not the sole responsibility of elected representatives. Citizens at large, when involved in wide-

reaching action, can also be initiators of new, less land-hungry models of development.

An example: « Dwelling without spreading »

« Dwelling without spreading » is an alternative housing initiative by the Hérault Departmental Government Council (*Conseil Général*) and the CAUE (*Conseil d'Architecture, d'Urbanisme et d'Environnement de l'Hérault*.)

This action, aimed at raising awareness among elected local councillors, is designed to promote quality housing projects but with higher densities in a context that in France is dominated by detached houses on residential estates.

(See. Fig. 1, below).

The objective of this tool is to propose dense housing with individualised dwellings as an alternative to the estates of detached houses responsible for urban sprawl, thus reducing such spread (by an order of 1 to 3). The tool is seen as a response to the housing needs of a certain type of population (individ-

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CARNET 1

L'HABITAT INDIVIDUEL AUTREMENT

Pour une maîtrise du développement urbain dans l'Hérault

CONSEIL
urbanisme
environnement

Département
Hérault

ualized dwelling, security, privacy) using denser urban forms of good architectural quality.

It fits into a land use policy that is now comprehensive and encompasses farm hamlets, higher density commercial estates, quality social housing and higher density individualized housing.

This experimental project grew out of the necessity to find a response to a specific context and situation linked to the exceptional rise in population in the Hérault *département* and the ensuing pressure in the housing market and, also, the unremitting spread of urbanization. The *Direction des Etudes Territoriales* (land use study service) of the Hérault Departmental Government Council was asked by the councillors to present a new land use policy aimed at countering urban sprawl. In 2007, feasibility studies were carried out in six municipalities in the the Hérault *département*. This experience has resulted in:

- a change in the behaviour of decision-makers, sector professionals and the population in relation to the “bungalow dream”;
- the carrying out of five exemplary operations for which the studies and work were subsidised in part;
- the construction of around 100 houses;
- the organisation of four meetings for discussion attended by a total of some 1,000 people;
- the publication of three manuals for professional use in the production of quality higher-density housing with a very strong environmental commitment;
- the use of the Landsim3D software to provide modelling and visualisation of the area involved, based on geographical data, for use in developing and managing towns and cities and in protecting the landscape. The simulation presented to the municipal councillors facilitated their concertation with the local population in the presentation of the various housing alternatives;
- the creation of an itinerant exhibition to raise public awareness.

From the point of view of the various stakeholders, the experience has had significant interest beyond the limitation on the consumption of the land: the elected representatives could respond to the expressed needs of the population, the technicians were able to adopt an interdisciplinary approach

and those in search of accommodation had a wider choice in housing.

Who should use these new models -and why?

Over and above the example presented above, the operational tools that were analysed reflect the great diversity of the initiatives undertaken by local stakeholders, both public and private, against urban sprawl and the (over)consumption of land.

Such tools show that it is possible to take action at different levels in an area and that political will was behind many initiatives. However different the specific features of the areas concerned may be, with their various forms of governance and different human and financial resources due to their individual historical and cultural context linked to their politico-administrative system, it is possible to take action.

The exemplary nature of these experiences nevertheless provokes a question: though the tools for concertation are widespread, public concern is only slightly titillated by what is at stake worldwide in the preservation of agricultural food production and biodiversity. A major effort at raising public awareness and communication is necessary in addition to concerted action at a local level.

Hence, the inventoried operational tools must be used to incite decision-makers to become aware that it is possible to take action to help preserve land through their choices in land use and local development policies, by adopting less land-hungry measures which can be equally effective. Additionally, exploration should be made of other operational tools suited to preserving land, such as the instruments and measurements for financial incentives, which can encourage the renovation of abandoned city centres or the reconversion of disused industrial sites or, in contrast, penalise new construction on land with major heritage value.

Conclusion

It is possible to have reliable indicators for the measurement of (over)consumption of land available to the technical departments of local and regional government authorities throughout Europe, provided such indicators

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All contributions
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red on the website
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are associated to a Geographical Information System and have a stable and accurate nomenclature for information and data on the uses of land and resources. Satellite imagery, now increasingly abundant and precise, is a preferential resource when the images are of good quality.

Furthermore, the numerous local initiatives that have been recorded highlight the educational value of the new models along with their capacity to show how it is possible to adopt solutions that require less surface area and/or take profitable advantage of an area's natural resources. In fact, these pilot initiatives tend to take advantage of the land's role in ecosystems: green belts, landscape, ecological continuum, peri-urban agricultural soils. Financial incentives should be used to promote experimentation with ecosystemic functions in the agriculture (especially peri-urban), management of biodiversity and ecological corridors, and new forms of urban housing, thus fostering their shared or wider use.

Other operational tools helpful in preserving land and soils remain to be tried out: the instruments and measurement for financial incentives to favour, for example, the renovation of abandoned city centres or the reconversion of disused industrial sites or, in contrast, penalise new construction on land with major heritage value.

The objective is thus to promote, at every level of management of an area (municipality, *département*, region), the application of effective tools for planning which have as an integral perspective the frugal use of land and its preservation. However, at the present time there is one decisive lack: the absence of a European directive which effectively limits the (over)consumption of land and is based on an inter- or supra-municipal level for implementing efficient measures against the phenomenon.

S.A., I.A.D.

Summary

This article describes most of the results of the OSDDT Project « Land-use and sustainable development of localities and regions in the Mediterranean area » funded within the framework of the Med programme. The OSDDT project focused on the phenomena of land consumption and degradation that are compromising Europe competitiveness and long-term sustainability, as defined in the proposal by the European Parliament and Council for a Directive (2006) 232.

The OSDDT partnership worked to provide tools which can help to manage land sustainably and enabled the partners involved, who share a common approach, to build a set of indicators effective in evaluating land consumption and which can be used by any public institution around the Mediterranean Rim in land use planning. Furthermore, OSDDT identified and listed operational tools capable of helping decision-makers protect the environmental functions of land. Both tools (indicators and planning tools) should raise the capacity of public institutions to modify their planning models characterised over the last 20 years by over-consumption of land and to consider how to adopt planning tools in the light of sustainable development and the preservation of unaltered land.

Résumé

Cet article restitue une partie des résultats du projet OSDDT « Occupation des Sols et Développement Durable du Territoire » financé dans le cadre du programme MED. Le projet se place dans la droite ligne de la proposition de Directive du Parlement Européen et du Conseil de 2006, qui souligne que : « *le sol est une ressource d'intérêt général pour la communauté, bien qu'il relève pour l'essentiel de la propriété privée, et sa non protection nuit au développement durable et à long terme, à la compétitivité de l'Europe.* » Il a permis la mise au point d'un modèle de suivi et d'évaluation de l'utilisation des sols, construit sur des critères d'approches communs aux partenaires européens de l'arc méditerranéen. Ce modèle a l'ambition d'augmenter la capacité des acteurs publics qui gèrent les différents instruments de planification du territoire et ont contribué au cours des 20 dernières années à une consommation très dispendieuse, de repenser leurs modes de gestion dans une optique de développement durable et de sauvegarde des sols naturels.