Chapter 7
Land Use Indicators for Landscape Assessment

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Abstract The function of this type of indicators is to evaluate the "territorial conditions" of territorial use and processes, and the related landscape transformations. Territorial indicators are also used to provide guidelines for strategies and programmes for protection, management, and innovation, and their participation processes. They are useful for monitoring territorial and landscape conditions, estimating the impact of policies and territorial actions on the landscape, and guiding the actions of territorial and landscape planning. The following indicators are analysed: land use capacity, landscape capacity to support transformations, degraded landscapes and landscapes under pressure, protected natural areas, rural areas, protected landscape, ecological and landscape networks, actions of valorisation, effectiveness of the planning aims for the landscape, and sensibility of the planning aims for the landscape.

Keywords Territorial indicators • Territorial and landscape assessment • Territorial and landscape planning

7.1 Principles and Definitions

The function of territorial use indicators is to assess the "conditions" of use and territorial processes, and the relevant landscape transformations, but also provide guidelines for strategies and programmes aimed at the protection, management and innovation of landscape and interventions.

Vallega (2008) includes these indicators in the classification of "denotative" indicators, in other words indicators that "let you see and know" like a "process for deducing one thing from something else, to deduce the intended function of an object". These indicators let us interpret the forms, the tangible events of the

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C. Cassatella, A. Peano (eds.), *Landscape Indicators,*
DOI 10.1007/978-94-007-0366-7_7,

territorialization processes (Kušar and Černe 2006), in causal terms, on the basis of the relationships between the elements that characterise the "structure" of a given territory and its landscape; therefore they let us to:

- monitor territorial and landscape conditions, with reference to the natural and anthropic environment;
- assess territorial policies and actions with repercussions on landscape;
- provide guidelines for territorial planning and sectorial actions.

In fact, these indicators make it possible to simplify and, sometimes, quantify the information in a synthesis useful for interpreting the landscape through territorial use, comparing alternative scenarios and establishing monitoring activities, simplifying communication and decision-making.

The choice of the territorial use indicators in this study allows for some criteria: their application in international research, the capacity to represent and monitor the major characters of the relationship between use of the territory and landscape in time, easy interpretation and communication to people outside the sector, effective representation of results (in tables, alphanumeric data and/or geo-referenced or thematic maps, etc.), availability of data and reliable basic information (brought up-to-date and compared in time).

The brief notes below, with reference to the DPSIR model, show some samples of indicators of state, driving forces, impact and response with reference to land use and territorial policies, defined by territorial planning and sector and experimented in research and practices (CSD 2007). These indicators derive mainly from European experiences in the assessment of the sustainability of land use (Haines-Young and Potschin 2005), current policies or policies envisaged by planning instruments and/or in studies monitoring rural landscape conditions (diversity, naturalness, stability); in fact these are used to measure the sustainability and quality of the landscapes from an ecological, aesthetic and social-economic point of view (see Table 7.1), interpreting territorial use.

It is essential to say that the indicators proposed come mainly from countries where there is widespread use of sustainability strategies in policies and territorial and sector planning, such as in Germanic-British countries (The Netherlands, Germany, England, Austria; Voghera 2006; Brunetta and Voghera 2008). In these countries, sustainability has been interpreted in terms of protection, management and creation of landscapes, consolidating innovative methods of landscape interpretation and assessment. The function and goals of the indicators in the critical review are in line with the rural matrix of European and national landscape policies, where valorisation must—in accordance with the latest EEC documents for planning policies[1]—help promote the multifunctional and multisectorial management of agriculture, while also being aimed at the preservation of the environment and

[1] See: European Commission (1996) The Cork Declaration. The European Conference on rural development; European Agricultural Guidance and Guarantee Fund (CE Regulation n. 1257/1999); European Commission, Directorate-General for agriculture (2003) Reform of the common agricultural policy a long-term perspective for sustainable agriculture. Impact analysis; EC, DG VI (2000) State of application of regulation (EEC) No 2078/92: evaluation of agri-environment programmes. Working paper.

biodiversity, the recovery of historical-cultural heritage and the development of the system of touristic uses and accommodation (Voghera 2006). A good example is in United Kingdom and in The Netherlands—where the protection and use of rural landscape are subject to specific and consolidated political and cultural interventions—in accordance with the goal of promoting relations between the policies to support agricultural-productive activities and those for the valorisation of the visual, perceptive and recreational aspects.

7.2 Critical Review of Territorial Use Indicators

The critical analysis of territorial use indicators started with a study on the main national and international research methods for monitoring the sustainability of territory, environment and landscape. The following 11 indicators have been defined (see Tables 7.1 and 7.4):

- *land capability*, measures the extensification or intensification of agricultural production through the assessment of use and activities that put pressures on the landscape, with direct and indirect effects on the ecological and social-economic quality of the territory and environment;
- *capacity to support transformations*, establishes the capacity to support and respond to transformation processes on the long term for any kind of landscape, without significant effects or changes to the main characters and social-economic, cultural, ecological and perceptive values of the landscape;

Table 7.1 Indicators based on the DPSIR model in relation to various aspects of sustainability

Indicators		Sustainability	Ecological quality	Aesthetic quality	Social economic quality
Driving forces	Land capability	X	X		X
Pressure	Capacity to support transformations	X	X	X	X
	Land consumption	X	X	X	X
	Degraded landscapes—landscapes under pressure	X	X	X	
State	Protected natural areas	X	X	X	
	Rural area	X	X	X	X
	Landscape protection	X	X	X	X
	Ecological and landscape networks	X	X	X	X
Impact	Actions of valorisation	X	X	X	X
Response	Effectiveness of the planning aims for the landscape	X	X	X	X
	Sensibility of the planning aims for the landscape	X	X	X	X

- *land consumption*, assesses and monitors the relationship between the artificial surfaces for types of land consumption and the total surfaces of reference in time, assessing the sustainability of territorial policies;
- *degraded landscapes and/or landscapes under pressure*, interprets the negative values and the deficiencies in ecological and aesthetic quality, but also the pressures to which a certain territory is subject;
- *protected natural areas*, calculates the surfaces of the territory classified in different national and international categories for the protection of nature and landscape, in relation to the surfaces of the territory subject to research to assess the ecological and aesthetic sustainability of the same, and interpret the awareness of institutions on the themes of nature and landscape;
- *rural areas*, measures the number of rural areas in the territory, providing indications on sustainability, diversity and landscape attractiveness;
- *landscape protection*, measures the relationship between the territory and the landscape subject to restrictions for the preservation of social-cultural, ecological, aesthetic and landscape values and the total surface of the territorial entity of reference;
- *ecological and landscape networks*, assesses social and institutional awareness on sustainability, by measuring the amount of the territory used for interconnection between parks, Sites of Community Interest (SCI) and Special Protected Areas (SPA), and protected landscapes in relation to national/regional/provincial territory;
- *actions of valorisation*, measures the number of landscape valorisation actions envisaged in planning documents on various territorial scales and *implemented* at a local scale;
- *effectiveness of the planning aims for the landscape*, measures the operative effectiveness of the territorial planning and use policies with reference to landscape, assessing the number of specific actions envisaged and implemented by the plans on various scales;
- *sensibility of the planning aims for the landscape*, assesses the focus on landscape of territorial planning and use policies, on the basis of the number of landscape valorisation actions envisaged in the plans on various scales.

The methodology used for the above indicators refers to DPSIR categories, useful for interpreting the social-economic and territorial factors that put pressure on the landscape in terms of consumption of territorial and environmental resources, which—when exceeding the load capacity of the territory in question—cause inevitable direct effects, compromising the sustainability of the system and causing environmental and landscape degradation. The impacts, closely associated with the state of the territory and landscape are contrasted by the efforts of the social system to mitigate, compensate and/or overcome these problems, with the various responses from the institutional bodies governing the territory, landscape and environment.

As well as classifying the indicators—in relation to their role to highlight the basic factors that influence the territorial and landscape system, the direct cause of pressure, the current state, the effects of the impact, and the response of the social-institutional system (Wascher 2004, 2005)—the critical analysis method considers

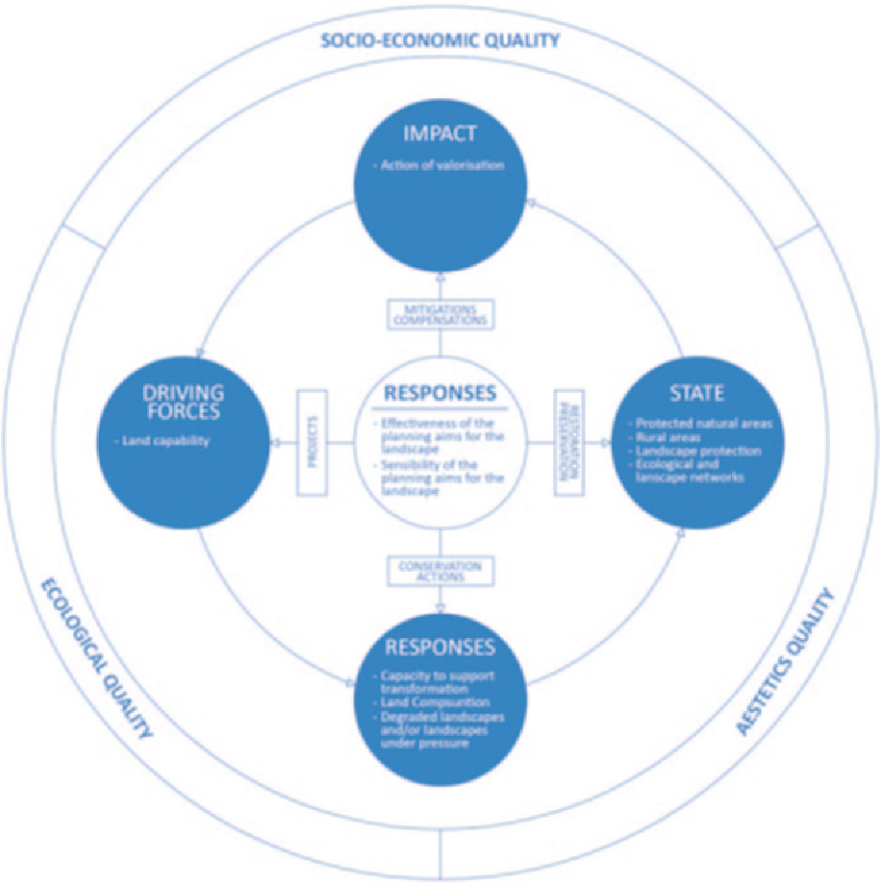

Fig. 7.1 Method used for indicator classification

the role of each indicator in the sustainability of territorial use and of the relevant transformations, expounding the ecological, aesthetic and social-economic components of the landscape quality it is related to (Fig. 7.1).

The critical review of the indicators is shown below, with reference to the categories of the DPSIR model, explaining the role of each in the assessment and monitoring of sustainability in the territorial and landscape system.

7.2.1 Driving Forces or "Determinant" Type Indicators

These indicators identify the use and activities that put pressure on the landscape, so we can describe and assess the changes underway in urbanization, mobility, agricultural practices, etc. Land Capability refers to this category of indicators (Weber and Hall 2001).

Land Capability (Table 7.5) is an indicator of the extensification or intensification of agricultural production on a regional and local scale (IRENA, Emilia Romagna Regional Authority, VALSAT).

Changes in agricultural practices and production methods influence the environmental and landscape conditions of the rural territory. In fact, changes in the rural use of land also indicate the intensification, extensification or marginalization of production (IRENA 2005). Land capability is a territorial classification based on characters of potential land use (8 categories and 5 sub-categories that indicate the type of limitation in the use of the particular land in question, if any). The indicator is expressed in mapped surfaces intended for a certain use. The loss of use indicates the transition from a higher category to a lower capacity of use; vice versa there will be an increment in use. This indicator is frequently used in national and international research, it is easy to interpret, and data is readily available as it is based on Corine Land Cover (European mapped database, available on line).

7.2.2 Pressure Indexes and Indicators

These indexes and indicators describe the cause of the modifications induced by land use and anthropical activities on environmental and landscape resources (EEA 1995). The meaning of the results provided by these indicators can vary notably as the territorial scale of reference for the analysis changes (EC 1999).

Note: the index *capacity to support transformations*, and the indicators *land consumption* and *degraded landscapes and/or landscapes under pressure*.

The *capacity to support transformations* is used in English Landscape Assessment to interpret the current state of the landscape (the conditions and integrity of the elements) and assess the processes, dynamics, trends and potential pressures caused by scenarios of development. For any landscape type it establishes the capacity to sustain and respond to transformation processes (landscape capacity) on the long term, without significant effects or changes to the main landscape characters and values. Landscape capacity assessment is used to establish criteria to identify the potential effects of landscape policies and strategies on some landscape elements, characters and values (Countryside Agency and Scottish Natural Heritage 2002).

The capacity depends on: the cultural, ecological and perceptive sensibility of the landscape, associated with changes induced by landscape policies, and the "measuring" of the overall perceptive, ecological, economic, etc. value of the landscape and its specific elements. Sensibility depends on: natural and cultural factors, the quality and condition of the landscape and its aesthetic-perceptive characters. The method used in the South Pennines Landscape Character Assessment (1999) is worthy of note, in which quality is assessed using the following indicators: importance, strengthness (in other words fragility) and condition. Condition in particular is a useful indicator, as it provides information on the state of preservation of a landscape value and/or character; it measures the level of integrity (intactness) and the quality of the territorial government. The quality of the territorial government can be measured through qualitative categories: ranging from degraded to excellent.

The capacity to support transformations index is used in Great Britain to assess landscape on various scales: national, regional and local, but some of the data must be obtained directly.

Land consumption (Table 7.8) is a widely used indicator at a national and international level. It is in fact defined in different ways on the basis of the aims of the research in which it is used, the territorial context of reference, how easy data is to obtain, etc. In some cases, "land consumption" is the quantity of new or envisaged settlements in an urban territory on rural territory (with reference to administrative boundaries) to measure the settlement pressures and the erosion of rural landscapes (used in reports on the state of the environment and town planning analysis, in the planning of extensive and local areas, in Dutch planning with reference to medium-sized cities and metropolitan areas); in this way we can monitor active processes and assess anthropical pressure on rural landscapes. In other cases, land consumption is the relationship between the artificial surfaces for various types of consumption and the total surfaces of reference. In both cases, this is a complex indicator, requiring high competence from the user, and it can be negatively affected by a lack of homogeneity and difficulty in obtaining data on the territory (different territorial units and data quality).

This indicator is used on a regional and local scale, based on the data in regional and/or municipal databases. In this sense the research is epitomized by the definition "relationship between artificial surfaces for various types of land consumption and total surfaces of reference", currently used in the Piemonte Regional Authority Table for monitoring land consumption, providing up-to-date data (Fig. 7.2).

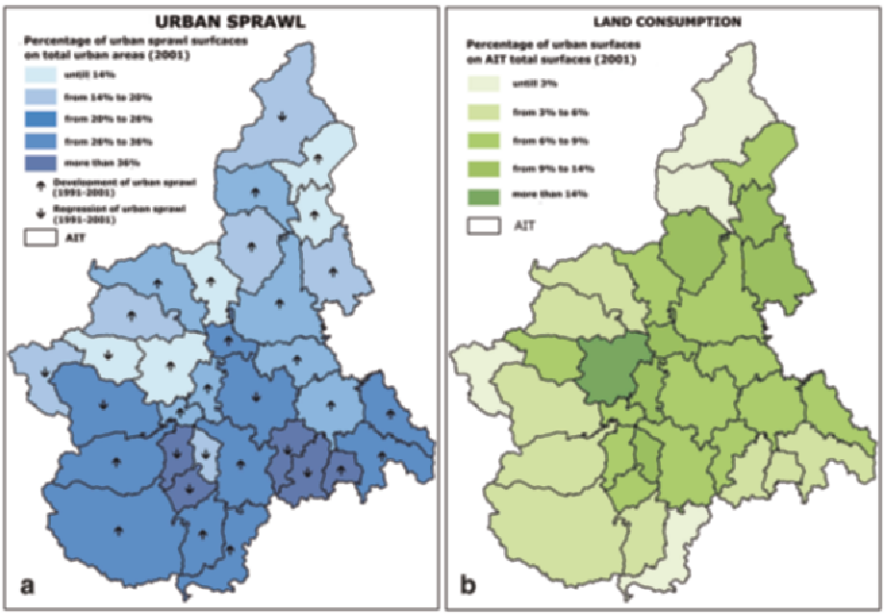

Fig. 7.2 Urban dispersion (**a**) and land consumption (**b**) in Piemonte. (Source: PTR 2009)

Box 7.1 Land Consumption At a European level, the evolution of land consumption and the relevant increase in impermeabilized areas has been studied in two major projects, Murbandy (http://murbandy.jrc.it/) and Moland (http://moland.jrc.it/). These projects are related, the first started in 1998 (under the name of MURBANDY Monitoring Urban Dynamics) with the aim of monitoring the development of urban areas and identifying trends on the European scale. The work includes the computation of indicators and the assessment of the impact caused by anthropogenic stress factors (with a focus on expanding settlements, transportation and tourism) in and around urban areas, and along development corridors.

The theme is subject to debate also in Italy, and the National Observatory of Land Consumption uses a national monitoring table which was drawn up by Milan Polytechnic with the National Town Planning Institute and Legambiente.

In Piemonte, a method for monitoring and propagating major territorial dynamics, through a common Geographical Information System, with the aim of assessing the urbanized surfaces was drawn up to implement the co-planning process by the Strategic Planning, Territorial and Building Policies Office—Territorial Information System Sector of the Piemonte Regional Authority and Territorial, Transportation, and Civil Defence Area of Turin Province—in collaboration with the CSI Piemonte (consortium of public bodies which promotes innovation in the Public Administration through ICT technologies).

To measure land consumption and environmental sustainability in various territorial interventions as an indication in territorial planning, the following actions were taken:

- a system was created for monitoring land consumption and a first balance on land transformation was drawn up;
- a new indicator was defined, to be applied on a different territorial government scale, to assess the eco-sustainability of territorial policies promoted by the various bodies governing the territory;
- the various systems developed for monitoring land consumption were integrated, and the information was shared by regional and provincial authorities, making it also available to the public.

This round table on land consumption studies the trend in time of the evolution of built-up surfaces by: monitoring the increase in new urbanized surfaces in a certain time interval and studying the trend of this phenomenon in terms of entity, its dispersion and impact on the territory.

For this purpose, the work used the following indicator types:

- the percentage of land consumption for new buildings, which defines the quantitative dimension of the phenomenon;
- an indicator of dispersion (percentage of the type of land bordering the new buildings) which makes it possible to interpret fragmentation and/or continuity in relation to the existing urban fabric;

- an indicator for the assessment of environmental fragility generated by anthropical pressure associated with land consumption, obtained by cross-referencing data on new buildings with some environmental data families.

These indicators are processed on the basis of data from the regional technical map, scale 1:10,000 (1991), brought up-to-date through the georeferencing of territorial data obtained from satellite images. At this point, the resulting data is processed and cross-referenced with other data families such as, current restrictions, and the physical characteristics and administrative aspects of the territory for example.

The processing refers to the first Report on the State of the Territory and Regional Territorial Information System[2], with its natural expression at a municipal level, also in the form of guidelines for general town planning schemes; reorganized data is also propagated on a supra-municipal scale, as a result of the greater effectiveness for some themes such as landscape, and the point of reference required for the Regional table to interpret the state of the territory. The indicator, on the basis of the satellite data processed at a municipal and supra-municipal level, provides a picture of the regional territory, identifying more or less dynamic areas in relation to the development of built-up areas in the period of time in question. The application of the quantitative indicator on land consumption is propaedeutic for investigating the nature of the land consumed, the causes of the same and the effects of the phenomenon, in order to attempt to elaborate the indicators of dispersion and qualification of environmental fragility in relation to anthropical pressure.

The *degraded landscapes and/or landscapes under pressure* (Table 7.9) indicator lets us interpret the negative values and deficiencies in aesthetic quality—by measuring the quantity of the areas used in the extractive (or mining) industry, dumps, quarries, unstable landscapes and landscapes subject to erosion in a given territory—and also the pressures to which a given territory is subject; it provides indications for defining ad hoc planning actions indirectly.

It is used to interpret (on a local or regional scale) the pressures to which a given territory is subject, but information must be obtained from local and/or regional databases.

In order to guarantee that the indicator considers current processes of degradation and/or landscapes threatened by anthropical pressures, which can generate irreversible disturbances in the quality and identity of the territory and landscape, a list of interventions and works has been drawn up which could put the "landscapes" under pressure; this list, created on the basis of indications in the regulations of reference for assessing the landscape compatibility of interventions (landscape and EIA report—enclosure A1), focuses on the following:

[2] http://www.regione.piemonte.it/sit/argomenti/pianifica/osservatorio/analisi.htm.

(a) area interventions: energy generation plants, waste burning plants, storage plants; dams, weirs and reservoirs[3]; goods depots or storage facilities for materials; port and airport infrastructures; dumps and waste disposal plants; mining and surveying; quarries and peat-bog utilization[4]; solid mineral extraction; utilization of hydrocarbons and geothermal resources on land; long-distance power lines with a nominal voltage of over 100 kV more than 10 km long; energy generation plants, waste burning plants, storage plants; production complexes; goods depots or storage facilities for materials.
(b) linear or network interventions and/or works: road and rail infrastructures/works; infrastructural networks; masts, pylons and telecommunications relay stations; cable cars, ski lifts and chair lifts; hydrogeological interventions; agricultural irrigation systems.

The list of works and interventions in letters a) and b) must be considered for the application of the degraded landscapes—under pressure landscapes indicator, as these can generate processes of degradation and/or anthropical pressure; furthermore, the specific updating of regional databases is required, which should assess also the types of interventions in letter a) on a per area basis, with the relevant territorial surfaces kept up-to-date.

7.2.3 Indicators Concerning the State of Territorial Use

These indicators describe the situation of the landscape, measuring the quality of the physical, ecological-natural, social-economic components of the various elements in the landscape system. These indicators, when correlated with pressure indicators, help provide a balance of "sustainability" for the landscape in relation to territorial use.

Corine Land Cover is a useful starting point for interpreting the state of use as it quantifies the intended use of the territory in terms of surfaces.

The following indicators are considered: *protected natural areas, rural areas, landscape protection, ecological* and *landscape networks*.

Protected natural areas is a useful indicator at various territorial scales to assess the sustainability of a certain territory and its naturalness, a quality which makes a landscape attractive (Table 7.10). In The Netherlands, the Ministry of

[3] Elements associated with the non-energetic use of surface waters in the cases in which the maximum outlet capacity exceeds 1,000 l/s, dams and other plants for containing, regulating or accumulating water on the long-term, for non-energetic purposes, with a height of over 10 m and/or a capacity of over 100,000 m³, water purification plants with a potential of over 100,000 equivalent inhabitants.

[4] In particular: activities connecting to the water table, tunnels for the exploration of underground quarries for the extraction of industrial materials, excavations used to obtain material for public works, quarries in fluvial zones A and B of Plans regulating the more urgent aspects of the Po Basin Project, quarries extracting over 500,000 m³/year of material or with an operating area of over 20 ha.

Housing, Physical Planning and Environment (VROM) and, also the National programme for monitoring the perception and appreciation of landscapes, use this indicator (Farjon 2007) to interpret the naturalness of the territory, one of the main aspects of landscape sustainability and quality.

By calculating the territorial surfaces subject to the various categories of national and international nature and landscape protection in relation to the surfaces of the territory in question, we can obtain indications on the ecology efficiency and attractiveness of a given landscape.

In order to apply this indicator, we must consider the territory in the various nature and landscape protection categories: categories of UNESCO World Heritage Sites and the Man And the Biosphere (MAB) programme; EEC categories such as for sites protected in accordance with Habitat and Wild Birds—Sites of Community Interest (SCI) and Special Protected Areas (SPA) Directives; national categories—with notable differences in European countries—such as natural parks, protected landscapes (category V of the IUCN), regional categories of protection of the territory and the landscape, etc.

In the urban context we refer to the calculation of green spaces. This is a consolidated indicator in international research, used to assess the sustainability of a territory on different scales (European/national/regional/local); furthermore, data is easy to obtain for the application of the indicator, from the databases of the IUCN, the European Environment Agency, ESPON and EUROSTAT, and/or research centres like the CED-PPN of the DITER—Polytechnic of Turin.

Box 7.2 Application of the Protected Natural Areas Indicator An interesting application of the Protected natural areas indicator has been implemented in the research "*Parks for Europe. Towards a European policy for protected areas*", developed by the CED PPN (European Documentation Centre on Natural Park Planning—Dipartimento Interateneo Territorio—Inter-University Department of Territorial Studies of Turin Polytechnic) in 2008, with the collaboration of FEDERPARCHI and AIDAP, and the contribution of the Piemonte regional Authority (Environment Councillor's Office).

With the aim of assessing the impact of protected natural areas on the European territory, the research has considered two sets of European Protected Areas:

- a general set (tPAs, "total" Protected Areas), containing 75,388 Protected Areas (for which alphanumeric data were available);
- a more reduced set (mPAs, "mapped" Protected Areas), containing 42,354 Protected Areas, for which, in addition to alphanumeric data, geometric and georeferenced data were also available.

Both the alphanumeric and georeferenced data have been obtained from the Common Database on Designated Areas (CDDA, European Environment

Agency—EEA[5]) (EEA 2005). Nevertheless, this database did not provide accessible and homogeneous alphanumeric and georeferenced data for all countries; therefore, in order to make up for the lack of data, the research has referred also to the IUCN World Database of Protected Areas (WDPA—IUCN[6]).

While on the first set of Protected Areas (tPAs) an analysis has been conducted for consistency, growth dynamics and diversification by categories, on the second set (mPAs), it has been possibile to conduct, trough the use of GIS tools, an analysis of the relationships existing between Protected Areas and the environmental and socioeconomic contexts (the principal sources for land use data has been Corine Land Cover 2000, while for socio-economic data, the ESPON Programme).

The research has higlighted that the European Protected Areas are a very wide set, spread out over the entire European territory: over 75,000 areas, covering roughly 90 million ha of surface, corresponding to almost the 18% of the sum of territories of 39 countries (see Tables 7.2 and 7.3 and Figs. 7.3 and 7.4).

Nevertheless, the territorial incidence varies notably from country to country:

- in Germany, the United Kingdom, Malta, Switzerland and Estonia, the incidence of the protected surface on the national territory is more than twice the European average;
- some other countries, on the contrary, still have not reached a figure of 10% protected surface, such as Albania, Belgium, Bulgaria, Bosnia, Cyprus, Denmark, Croatia, Ireland, Macedonia, Portugal, Romania and Serbia;

On the whole, there is a greater incidence of protected surface in Central Europe (29%), where anthropical interference is more marked; the incidence is slightly lower than average in Northern Europe (16%), where the territories have a lower population density and greater natural characters.

These elaborations let us assess the attention of the countries to the protection of nature and landscape, that seem to be more vital where the pressure from anthropical use of the territory is greater.

Table 7.2 Number, surface land incidence of total Protected Areas (Apt) by European countries groups. (Source: CDDA, EEA; elaboration by CED PPN)

	n.	%	Surface (ha)	%	Land incidence %
EU15	47,149	62.5	61,109,463	67.6	18.9
EU12	21,125	28.0	20,238,749	22.4	18.6
EU7	5,720	7.6	7,695,452	8.5	16.4
EU5	1,394	1.8	1,408,880	1.6	5.6
EU39	75,388	100	90,452,544	100	17.9

[5] http://dd.eionet.europa.eu/dataset.jsp?mode=view&ds_idf=CDDA, updated to 2007.
[6] http://www.WDPA.org, updated to 2007.

Table 7.3 Number, surface, territorial incidence of total Protected Areas (APt) by European countries. (Source: CDDA—EEA; elaboration by CED PPN)

Countries	n.	%	Surface (ha)	%	Land incidence %
Albania	802	1.1	240,075	0.3	8.4
Andorra	5	0.0	8,031	0.0	17.2
Austria[a]	1,090	1.4	2,347,879	2.6	28.0
Belgium	1,601	2.1	143,587	0.2	4.7
Bosnia and Herzegovina	155	0.2	38,528	0.0	0.8
Bulgaria	874	1.2	611,002	0.7	5.5
Ciprum	19	0.0	20,559	0.0	2.2
Croatia	195	0.3	421,096	0.5	7.4
Denmark	3,833	5.1	172,205	0.2	4.0
Estonia	12,041	16.0	1,640,431	1.8	36.3
Finland	5,979	7.9	3,234,701	3.6	9.6
France	1,543	2.0	8,625,049	9.5	15.9
Germany	14,791	19.6	21,202,618	23.4	59.4
Gibraltar	1	0.0	35	0.0	5.8
Greece	749	1.0	2,948,125	3.3	22.3
Ireland	208	0.3	304,485	0.3	4.3
Iceland	79	0.1	980,650	1.1	9.5
Italy[a]	771	1.0	3,175,304	3.5	10.5
Latvia	702	0.9	1,259,107	1.4	19.5
Liechtenstein	40	0.1	8,159	0.0	51.0
Lithuania	331	0.4	1,002,533	1.1	15.4
Luxembourg	36	0.0	54,599	0.1	21.1
Macedonia	77	0.1	188,774	0.2	7.3
Malta	150	0.2	12,044	0.0	38.1
Monaco	2	0.0	51	0.0	25.5
Norway	2,507	3.3	5,046,225	5.6	15.6
The Netherlands	2,006	2.7	1,006,073	1.1	24.2
Poland	2,058	2.7	9,126,648	10.1	29.2
Portugal	67	0.1	779,016	0.9	8.4
United Kingdom	8,842	11.7	9,063,952	10.0	37.4
Czech Republic	2,250	3.0	2,044,958	2.3	25.9
Romania	963	1.3	2,066,683	2.3	8.7
Serbia	165	0.2	520,407	0.6	5.9
Slovakia	1,145	1.5	1,322,043	1.5	27.0
Slovenia	350	0.5	253,397	0.3	12.5
Spain[a]	295	0.4	2,767,633	3.1	5.5
Switzerland	3,086	4.1	1,652,300	1.8	40.0
Sweden	5,338	7.1	5,284,239	5.8	11.7
Hungary	242	0.3	879,343	1.0	9.5
EU39	75,388	100.0	90,452,544	100.0	17.9

[a] Nonstandard datum to others official data sources

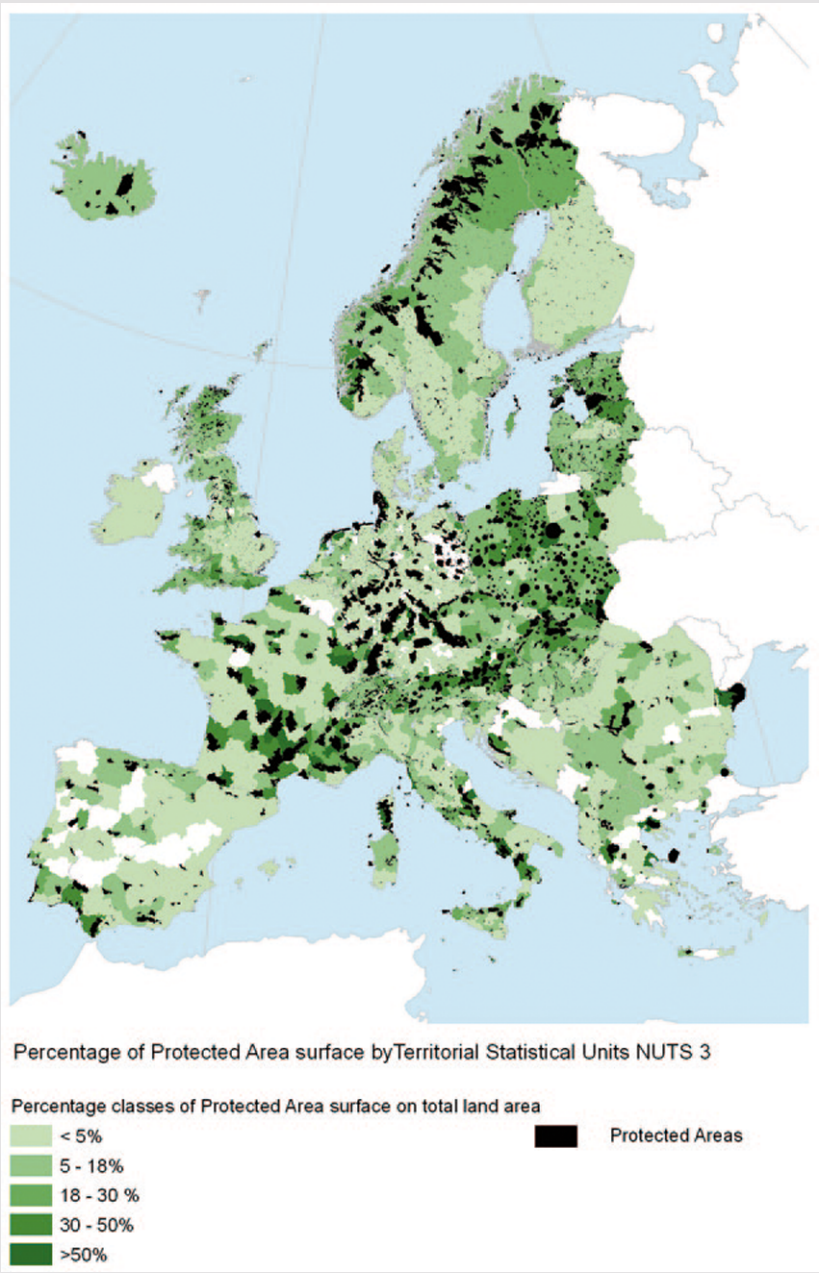

Fig. 7.3 Percentage of protected areas surfaces by NUTS 3. (Source: Gambino et al. 2008)

Fig. 7.4 Natural protected areas and urban territory. (Source: Gambino et al. 2008)

Table 7.4 List of indicators

No.	Origin	Indicator or Index	Source
1	Studies on rural landscape	Land capability	EEA, IRENA 2005; Emilia Romagna Regional Authority, VALSAT
2	Studies and programmes for the countryside valorisation	Capacity to support transformations	English Landscape Assessment; Countryside Agency 2005
3	Studies on rural landscape	Land consumption	Dutch local and provincial planning
4	Environmental reporting	Degraded landscapes	Vallega 2008
5	Environmental reporting	Protected natural areas	In The Netherlands' Ministry of Housing, Physical Planning and Environment (VROM) and the National programme for monitoring the perception and appreciation of landscapes; Vallega 2008
6	Rural landscape studies	Rural areas	Rural and landscape development plans; Vallega 2008
7	Environmental reporting/ Rural landscape studies	Landscape protection	National and provincial programmes in The Netherlands; Vallega 2008
8	Environmental reporting	Ecological and landscape networks	Plans in The Netherlands, Germany, Austria…
9	Environmental reporting	Actions of valorisation	Evaluation Effects of alternative plan in Trendscenario of Overijssel Province (The Netherlands)
10	Studies for the implementation of the ELC	Effectiveness of the planning aims for the landscape	Landscape Observatory of Cataluña
11	Studies for the implementation of the ELC	Sensibility of the planning aims for the landscape	Landscape Observatory of Cataluña

Rural areas (Table 7.11) measures the quantity of rural territory in relation to the total territory in question (Germany, Austria, England, The Netherlands), providing indications on sustainability, diversity and landscape attractiveness; this indicator is used at various territorial scales (European, national, regional and local) (Delbaere and Nieto Serradilla 2005)—with data obtained from EUROSTAT, ESPON, etc. databases—in international (EC 2006) research and rural development plans.

Landscape protection (Table 7.12) measures the relationship between the sum of the protected surfaces (landscape goods, areas protected by law, protected areas) and the total surfaces of the territorial entity of reference. This indicator is used in The Netherlands in national and provincial landscape programmes for example to assess the quality and value of the landscape in a given territory; furthermore the indicator is used at a national and/or regional scale, with data obtained from the

databases of the competent Ministries concerned with the protection of the landscape, or from the IUCN, EEA, EUROSTAT, and ESPON.

Ecological and landscape networks is an indicator used (in The Netherlands, Germany, Austria and other countries) to measure the quantity of territory used for the interconnection of parks, Sites of Community Interest (SCI), Special Protected Areas (SPA) and protected landscapes which constitute the core areas of the ecological network—in relation to the national/regional/provincial territory (number of existing and planned networks); the indicator is useful for assessing biodiversity at a national or regional scale, providing a comparison between natural spaces and cultural resources. The aim is to highlight the identity values of a landscape through the interrelation of natural and cultural factors.

7.2.4 Indicators of Impact

These types of indicators let us interpret the effects of changes in the state of the territory and landscape, by describing the cause/effect relations between pressures and state. The indicator *actions of valorisation* is particularly worthy of note.

Actions of valorisation (Table 7.13) measures the number of landscape valorisation actions envisaged in the planning documents on various territorial scales and *implemented* at a local scale; this indicator is often used to assess the effectiveness and effects on sustainability of plans and programmes (sometimes also to simulate the effects of transformation scenarios for the alternative territory); in the reports in which this indicator is used, the actions are assessed in relation to their effects on sustainability (and on ecological, aesthetic and social quality).

7.2.5 Territorial Use Response Indicators Envisaged by Planning at Various Scales of Territorial Governance

These indicators describe the various actions taken by society as a whole (institutions, planners, etc.) to solve major landscape-environmental problems and valorise the quality of the territory. The following indicators are presented: *Effectiveness of the planning aims for the landscape* and *Sensibility of the planning aims for the landscape.*

Effectiveness of the planning aims for the landscape is an indicator that measures the operative effectiveness of territorial planning and use policies with reference to landscape, assessing the number of landscape actions envisaged and implemented by the plans on various scales (Table 7.6). The assessment of the quality of instruments used in the planning of landscape is one of the European Convention's goals; the Landscape Observatory of Cataluña (Sala 2009) has already tested two such indicators: "application of the instruments required by law for landscape" and

Table 7.5 Land capability

Indicator	Land capability
Definition	Measures the extensification or intensification of agricultural production
Category	Territorial use
Aims pursuant to landscape	Individuation
Status/Process	State and process
DPSIR category	Driving forces
Typology	Simple
Component variables (if index)	–
Unit of measure	m^2
Territorial scale of reference	Regional/Local
Time scale of reference	Year
Characteristics of use	Technical-scientific analysis, monitoring, assessment of plans and programmes
Availability of data source	Corine land cover
Method of representation	Thematic maps
Other explanatory notes	–
Fields/work in which it was used	EEA, IRENA 2005; EMILIA-ROMAGNA Regional Authority, VALSAT; research done by the EU Directorate-General for agriculture and rural development

"public and private implementation of actions for the preservation, planning and management of landscape". The first measures the operative effectiveness of Act 8-2005 ("Ley de protecció, gestió i ordenació del paisatge") which established the Landscape Observatory of Cataluña as the instrument for introducing landscape goals in urban and territorial planning and sectorial policies, adopting the principles

Table 7.6 Effectiveness of the planning aims for the landscape

Indicator	Effectiveness of the planning aims for the landscape
Definition	Measures the operative effectiveness of territorial planning and use policies with reference to landscape, assessing the number of landscape actions envisaged and implemented by the plans on various scales
Category	Territorial use
Aims pursuant to landscape	Evaluation
Status/Process	State
DPSIR category	Response
Typology	Simple
Component variables (if index)	–
Unit of measure	n.
Territorial scale of reference	National/Regional/Provincial/Local
Time scale of reference	Year
Characteristics of use	Technical-scientific analysis, monitoring, plan assessment
Availability of data source	Territorial planning strategies and instruments
Method of representation	Thematic maps, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	Landscape Observatory of Cataluña

Table 7.7 Sensibility of the planning aims for the landscape

Indicator	Sensibility of the planning aims for the landscape
Definition	Measures the focus of territorial planning and use policies on landscape, assessing the number of landscape actions envisaged and implemented by the plans on various scales
Category	Territorial use
Aims pursuant to landscape	Evaluation
Status/Process	State
DPSIR category	Response
Typology	Simple
Component variables (if index)	–
Unit of measure	n.
Territorial scale of reference	National/regional/provincial/local
Time scale of reference	Year
Characteristics of use	Technical-scientific analysis, monitoring, plan assessment
Availability of data source	Territorial planning instruments, regional and/or municipal databases
Method of representation	Thematic maps, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	Landscape Observatory of Cataluña

Table 7.8 Land consumption

Indicator	Land consumption
Definition	Relationship between artificial surfaces for types of land consumption and the total surfaces of reference
Category	Territorial use
Aims pursuant to landscape	Evaluation
Status/Process	Process
DPSIR category	Pressures
Typology	Simple
Component variables (if index)	–
Unit of measure	ha, %
Territorial scale of reference	Regional/local
Time scale of reference	Year
Characteristics of use	Technical-scientific analysis, monitoring, plan assessment
Availability of data source	Territorial planning instruments, regional and/or municipal databases
Method of representation	Tables, thematic maps, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	In reports on the state of the environment and in the analysis of town planning such as planning on a local scale and for a vast area (used for medium-sized cities and metropolitan areas)

Table 7.9 Degraded landscapes and/or landscapes under pressure

Indicator	Degraded landscapes and/or landscapes under pressure
Definition	Relationship between the sum of surfaces used for extractive/mining activities, dumps, quarries, unstable landscapes and landscapes subject to erosion, and the total surfaces of the territorial entity of reference
Category	Territorial use
Aims pursuant to landscape	Identification
Status/Process	State and process
DPSIR category	Pressure
Typology	Simple
Component variables (if index)	–
Unit of measure	%
Territorial scale of reference	Regional/local
Time scale of reference	Year
Characteristics of use	Technical-scientific analysis, monitoring, plan assessment
Availability of data source	Territorial planning instruments, regional and/or municipal databases
Method of representation	Databases, thematic maps, GIS, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	Reworking from Vallega 2008

Table 7.10 Protected areas

Indicator	Protected areas
Definition	Indicator useful for assessing the sustainability of a given territory and its naturalness, the quality that makes a landscape attractive; by calculating the surfaces of the protected areas (territory in Sites of Community Interest (SCI)—Special Protected Areas (SPA), World Heritage Sites UNESCO, of the Man And the Biosphere (MAB) programme, national parks, regional and protected landscapes) in relation to the surfaces of the territory in question it is possible to interpret the ecology efficiency and attractiveness of a given landscape. In the urban context we refer to the calculation of green spaces
Category	Territorial use
Aims pursuant to landscape	Evaluation
Status/Process	State
DPSIR category	State
Typology	Simple
Component variables (if index)	–
Unit of measure	m^2/m^2
Territorial scale of reference	European/national/regional/local
Time scale of reference	Year

Table 7.10 (continued)

Indicator	Protected areas
Characteristics of use	Technical-scientific analysis, monitoring, plan assessment
Availability of data source	ESPON, EUROSTAT, ECNC or EDC-NPP databases
Method of representation	Databases, thematic maps, GIS, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	In The Netherlands' Ministry of Housing, Physical Planning and Environment (VROM) and, the National programme for monitoring the perception and appreciation of landscapes; Vallega 2008

of the European Landscape Convention. The indicator assesses the number and quality of: landscape catalogues, directives, landscape goals incorporated in territorial and sector strategies on various scales, to highlight also the effects of the Observatory's actions. The second "public and private implementation of the actions for landscape preservation, planning and management" assesses the number of actions envisaged in planning with financial instruments for implementation, which help valorise landscape. This indicator requires direct research.

Sensibility of the planning aims for the landscape measures the focus of policies for the planning and use of the territory on landscape, by assessing the number of landscape actions envisaged in plans at various scales (Table 7.7). This indicator is

Table 7.11 Rural areas

Indicator	Rural areas
Definition	The quantity of rural territory in relation to the total territory in question, useful for providing indications on sustainability, diversity and landscape attractiveness
Category	Territorial use
Aims pursuant to landscape	Identification
Status/Process	State
DPSIR category	State
Typology	Simple
Component variables (if index)	–
Unit of measure	m^2/m^2
Territorial scale of reference	European/national/regional/local
Time scale of reference	Year
Characteristics of use	SOE (State of the Environment reports) technical-scientific analysis, monitoring, assessment of rural development plans
Availability of data source	SOE, local planning instruments, Databases, ESPON, EUROSTAT
Method of representation	Databases, thematic maps, GIS, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	Rural development and landscape plans in Germany, Austria, England, The Netherlands; …; Vallega 2008; Landsis et al. 2002

Table 7.12 Landscape protection

Indicator	Landscape protection
Definition	Relationship between the sum of the protected surfaces (landscape goods, areas protected by law, protected areas) and the total surfaces of the territorial entity of reference
Category	Territorial use
Aims pursuant to landscape	Evaluation
Status/Process	State
DPSIR category	State
Typology	Simple
Categories variables (if index)	–
Unit of measure	m^2/m^2
Territorial scale of reference	National/regional
Time scale of reference	Year
Characteristics of use	Technical-scientific analysis, monitoring
Availability of data source	Databases, ESPON, EUROSTAT
Method of representation	Databases, thematic maps, GIS, temporal evolution
Other explanatory notes	–
Fields/work in which it was used	National and provincial programmes in The Netherlands; Vallega 2008

Table 7.13 Actions of valorisation

Indicator	Actions of valorisation
Definition	Number of landscape actions of valorisation envisaged in the planning and implemented
Category	Territorial use
Aims pursuant to landscape	Evaluation
Status/Process	State
DPSIR category	Impact
Typology	Simple
Component variables (if index)	–
Unit of measure	n.
Territorial scale of reference	Local
Time scale of reference	Year/period
Characteristics of use	Monitoring, SEA
Availability of data source	Data-base or direct research
Method of representation	Databases, thematic maps
Other explanatory notes	–
Fields/work in which it was used	Effects of alternative plan in Trendscenario of Overijssel in Overijssel Province (The Netherlands)

widely used, in various contexts, by landscape observatories, and also by the Landscape Observatory of Cataluña (2006).

7.3 Proposal for Territorial Use Indicators

Of the indicators discussed in the critical review, the following are proposed for applicative experimentation: land capability, the effectiveness of the planning aims for the landscape, the sensibility of the planning aims for the landscape, land consumption, degraded landscapes—under pressure landscapes, protected natural areas, rural areas, landscape protection and actions of valorisation.

This choice is based on the following factors:

- the suitability of the indicator for monitoring and expressing elements, processes and values of interest in relation to the use of the territory and the effects of said use on landscape;
- the effectiveness of the indicator in the assessment of landscape, from a point of view of territorial use, identifying the modification of said use in space and time as a result of policies, interventions and projects for landscape transformation (state and process);
- the versatility of the indicator, which can be used to monitor and assess territorial and landscape transformations and processes in the implementation of the European Landscape Convention (regional and local), as well as in other fields of application such as technical-scientific analysis, environmental reporting, monitoring, strategic environmental evaluations or environmental impact, in territorial and landscape planning;
- the applicability of the indicator, which depends on the basic availability of source data in existing international and regional databases, and the possibility of presenting the information in thematic maps, geo-referenced maps and temporal diagrams, also for the non-expert public.
- the results obtained with the indicator in other national and international research and experimentation contexts on the field.

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