The Development of the City Through the Green Strategy. The Use of Sustainability Indicators

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Abstract. This research concerns the complex analysis of ecosystem relations in territorial areas and has resulted in the identification and development of sustainability indicators with the attempt to promote actions aimed at the protection and valorisation of natural, cultural and identity heritage of the territory. The ultimate aim is to build scenarios and predictive models for monitoring the impact of transformations. The inspiring principle focuses on the growing awareness that natural ecosystems must be maintained in dynamic balances to ensure viable future growth through the provision of goods and services based on the logic of ecosystem services. The research work has as its objective the improvement of the quality of life and includes aspects relating to the environmental, social and cultural well-being of citizens linked to a better use of the categories of ecosystem services (life support, supply, regulation of cultural lore). In particular, from an infra- and intra-generational ecological perspective, a strengthening of identity values is expected, of the usability of the natural and cultural heritage of smaller urban centers and internal areas, of the quality of green and blue infrastructures aimed at sustainable use of territorial and environmental resources. The expected results are measured on the basis of the key indicators established by the European Commission to monitor the diffusion of innovation at a regional level.

Keywords: strategy · indicators · sustainability

1 Understanding the Phenomena at Play in Relation to the Objectives to Be Pursued

1.1 Knowing to Plan

Ecosystem services (goods, resources and services) are essential for survival.

Ecosystem services are the series of services that natural systems generate for the benefit of man: according to the definition proposed by the MEA - Millennium Ecosystem Assessment, ecosystem services are the "multiple benefits provided by ecosystems to mankind" (MIA, 2005). Ecosystem Services can be grouped into 3 main categories: such as: SE regulation of atmospheric gases, climate, water, erosion, prevention of hydrogeological instability, regulation of pollination, ha-bitat for biodiversity; SE of food supply, raw materials, fresh water, biological variability; cultural SEs, such as aesthetic, recreational, educational, spiritual, artistic and identity values. The importance

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of ecosystem services is therefore very high as they, directly or transmit, influence and support human life and well-being in terms of health, access to primary resources, sustenance…etc. Numerous studies confirm that our consumption and production systems are simply unsustainable. If current trends continue, regardless of country and income level, future generations will face a situation characterized by more extreme temperatures and weather events, reduced biodiversity, greater resource scarcity and higher levels of pollution. People cannot live well if the environment and the economy are in poor condition. Yet, despite the magnitude of the task ahead of us, it is still possible to build a sustainable future. The time has come to measure ourselves with new parameters aimed at the quality of the place, the well-being of the community, also through new governance. It is worth remembering that the impact of the research project on improving the quality of life includes aspects relating to the environmental, social and cultural well-being of citizens linked to a better use of the categories of ecosystem services (life support, supply, regulation of cultural values). In particular, from an infra- and intra-generational ecological perspective, a strengthening of identity values is expected, of the usability of the natural and cultural heritage of smaller urban centers and internal areas, of the quality of green and blue infrastructures aimed at sustainability of territorial and environmental resources.

1.2 Land Consumption and Ecosystem Services: An Indissoluble Relationship

Ecosystem services are considered one of the important issues for the sustainable development of the territory. Nonetheless, even today there is no full awareness of the need to save soil and even more so there is less conviction of the importance of ecosystem services in relation to their use in urban planning choices. A very interesting case study is that of the Municipality of Bruino (province of Turin), a pilot experience conducted as part of the drafting of the structural variant to the PRG [1]. Unfortunately, no value has been given to the soil and it is difficult to recognize it as a common good: it is a non-renewable resource and is threatened by growing both anthropic and natural pressures: contamination due to the gutting and burial of polluting substances harmful to health; desertification and hydrogeological instability and others which are irreversibly compromising the functionality of the soil resource. Appreciation must be given to the bill "containment of land consumption and reuse of built land n° 2383 which has set among its objectives that of valorising agricultural areas", promoting and protecting the agricultural activity of the landscape and the environment, in order to prevent the soil, as an essential resource for the balance of ecosystems, from being excessively eroded, waterproofed and consumed by urbanization with highly impactful and negative consequences in social, environmental and business terms. The increase in built land also reduces the ability of the environment to absorb CO2 and therefore to counteract the greenhouse effect and reduce global warming and its harmful consequences. Obviously, lower land consumption also has very significant economic and social consequences. A territory with settlements dispersed like a leopard is much more expensive and difficult to infrastructure and manage, while the right level of concentration allows for more economical management as well as the achievement of threshold levels not only for the cost-effectiveness of technological and transport networks but also for the creation of sustainable and identifiable social networks. The key principle is that the soil resource

is a vital, limited and non-renounceable resource and consequently a common commitment is needed to contain it, according to the general objectives set by the EU and in coherence with other national initiatives. It should be underlined that the practice of reusing already built land and urban regeneration represent the key tools for limiting land consumption and therefore the same cannot be framed in a sectoral perspective but must be addressed in a unitary vision of territorial policy and integrated ecology. The DDL on urban regeneration no. 1131 in art. Seems to be going in this direction. 2 paragraph 1, provides for an area identified by the municipalities called "green belt" with agricultural, ecological-environmental and recreational functions, consistent with the conservation of ecosystems pursuant to article 6 of law 14 January 2013, n. 10, aimed at preventing land consumption and encouraging the absorption of carbon dioxide emissions from the atmosphere through the increase and valorisation of the tree heritage, energy efficiency, the absorption of fine particles, as well as reducing the "heat island" effect, while promoting regular rainwater collection. But it's not enough. We need a law to limit land consumption. Although in recent years the extent of the processes of anthropisation and soil waterproofing has been reduced, compared to the quantities measured in the first decade of the 2000s when the average amount of land consumed exceeded 70 hectares per day (ISPRA, The consumption of soil in Italy, 2014; CRCS Land Consumption Research Center, National Report, 2010) land consumption continues today with an average rate of around 15 hectares per day. A law is necessary to reaffirm the non-conforming nature of territorial structural level plans and free planning choices from the "weight" of the "plan residue"; that is, the transformation and new urban development forecasts contained in the general regulatory plans in force, which are difficult to annul except with the risk of long and expensive appeals for the Administrations. A law that establishes a forfeiture of urban planning provisions if not implemented within a period of time, similarly to what happens for public constraints which cease to be valid after 5 years from their affixing without implementation.

1.3 The Urban Bioregion: A Possible Experimentation

This research operates in a new relational dimension, the urban bioregion: only sustainability-oriented planning and therefore a new form of plan will be able to generate a sustainable development process both from an environmental and socio-economic point of view and within the renewed urban planning instrument, ecosystem services find space in a new territorial dimension. Bioregionalism is an ethical, political, ideological approach, linked to the territory in which one lives, considered as a homogeneous whole from the morphological point of view and that of living beings. The term bioregion comes from the Greek word bios (life) and the Latin regere (to govern). It is therefore a question of considering a homogeneous geographical territory in which the rules dictated by nature should be predominant and not the laws that man would have defined. "The government of nature", this is how Kirkpatrick Sale defined the deepest meaning of bioregionalism. The bioregion is a territorial unit, with homogeneous physical and ecological characteristics. Since there is no standard size, we could consider it a synthesis between a biogeographical district and the territory of a province. Although bioregions are all interrelated, each person lives within a specific and determined bioregion. Peter Berg, one of the founding fathers of bioregionalism, defined the bioregion as "both the

geographical terrain and the terrain of consciousness", understood as the consciousness of places on the part of the inhabitants! Bioregionalism is therefore that "form of decentralized human organization which, aiming to maintain the integrity of biological processes, life formations and geographical formations specific to the bioregion, helps the material and spiritual development of human communities that inhabit it" (Thomas Rebb, 1998). In fact, once one has recognized one's own bioregion, one's own "place" be it urban, rural or wild, one must live there entirely, think in a bioregional way, which is not the adhesion to a new static ideology but the discovery, and daily practice, of a new personal and ecological way of living in harmony with nature (Gary Snyder's "real work", 1980) [2]. The elaboration of this concept is the responsibility of the Canadian intellectual Alan Van Newkirk who, studying human geography, came to the conclusion that communities of living beings interact with each other and with their physical environment, by organizing themselves into wholes that show continuity between physical and ecological characteristics. The determination of actions and projects aimed at redeveloping the settlement and naturalistic-environmental systems that compose them requires the identification of the main problems relating to these contexts and the possible directions of eco-sustainable development already undertaken or still to be undertaken. These themes are receiving growing attention and a different level of in-depth analysis. Current urbanization processes have a heavy impact on human settlement and the living environment in general. Social disintegration and economic fragmentation are accompanied by the compromise of ecosystems, the loss of fertile soil and worrying phenomena relating to climate change. Based on the bio-regionalist approach, this contribution exposes the main references for the definition of a new territorial dimension to methodologically address (and with a utopistically concrete vision) the indicated problems. In this framework, the main point of reference is the idea of the territory conceived as a "common good" and the recovery of the co-evolutionary relationship between human settlement and ecosystem resources. In particular, the need to support a process of construction and recovery from the bottom of "place awareness" on the part of the inhabitants is indicated, as a key element for fueling conviviality of life and sustainable use of the territorial heritage, also suitable for generating self-sustaining local and regional economies. -sustainable. The following considerations are based in particular on the figure of the urban bioregion and its constituent materials: contextual knowledge and skills, ecosystem quality and hydro-geomorphological stability, polycentric settlement systems and regeneration/centrality of public space, self-sustainable local economies, mixed local energy systems, multifunctionality of agro-forestry areas and, last but not least, the redefinition in participatory terms of local bodies of political/administrative life.

2 Innovate the Rules. From the Traditional System to the Performance One

A renewed approach to territorial planning that includes energy efficiency and renewable sources, sustainable agriculture, soft mobility and accessibility, maintenance and safety of buildings, social regeneration of abandoned and degraded areas offers prospects for qualitative development of the territory. To translate it into concrete proposals it is necessary to measure ourselves with the specific characteristics of each territory, both in

terms of the available resources, and in terms of the needs to be filled, and in terms of the social composition, i.e. the actors of the communities who live there but also and above all to interpret current needs. Each territory has different resources and potential and therefore a single project cannot be proposed and cannot be replicated everywhere. The main objective remains to propose coherent and compatible scenarios with respect to the endogenous resources present and the activation of self-propelled development mechanisms and the correct application of ecosystem services through nature-based solutions, recognizing those limiting factors that create difficulties of implementation in current practices. It is a challenge that requires responsibility and planning. The tools chosen are those useful for founding a widespread culture of an ecological and supportive nature: research and development, training and information. The European experience that best suits our level of study is the French one centered on the "schéma diréctéur", a term that designates, with general value, the project management tool also in fields other than urban and territorial planning. The direct scheme combines several municipalities and can be assimilated to a strategic plan at an inter-municipal level. In this context, the performance criteria of the settled communities must be fully accommodated. The performance interpretation recalls the idea of Kevin Lynch [3] who delves into the theme of the shape of the city according to a perceptive reading modality, as already addressed by the author twenty years earlier in the text The image of the city in which he places particular attention to the human scale by investigating the perception of spaces by the people who use them. Lynch, convinced that the planner's main concern should be to understand the physical environment and help shape it to meet the needs of citizens, starting from the analysis of existing forms to determine their effectiveness with respect to the initial objectives, formulated together with Lloyd Rodwin an innovative investigation system, useful for strengthening even the most consolidated planning methodologies. This system attributed particular importance to physical space, to the complex and dense relationships that flows establish with it and to the spatial structure of urban functions according to the concept defined as grain, or "the grain, i.e. the internal structure of a settlement, a fundamental aspect of its fabric, an aspect that is often confused with density. This term refers to the way in which the different elements that make up a settlement are mixed together in space. These elements can be: activities, building types, people or other aspects" [3]. The methodological path just outlined implies a "normative theory" based on the clarification of performance rules with an open method "whose physical forms must correspond to specific requirements, relating primarily to the biological characteristics of man and the morphological characteristics of the site" [4]. This interpretation is characterized by the construction of the city "providing a corpus of rules that not only constitute a criterion of analysis and measurability of the compatibility of the intervention on the new, but also a method of evaluation for the existing city" [5]. In conclusion, it is important to pursue the transition from traditional zoning rules (the so-called exigent rules) to performance rules, according to which public objectives and an updated regulatory framework are defined which allows the subjects interested in planning, and last but not least the citizens and cultural associations, to find an operational agreement capable of synthesising the different interests and needs such as to promote a correct approach to ecosystem services and more effective planning solutions to face the emerging challenges of the contemporary city.

2.1 The Development of the City Through the Green Strategy

A green strategy for the territory involved in the Tech 4 For You research project can only start from the recognition of the important role played by greenery in urban settlements and other sectors of the economy and society. The green deal for the south is the opportunity for a major green restructuring work for the territory, favoring the mitigation of seismic, hydrogeological and other environmental risks that limit and very often strongly inhibit the development of good planning practices. In light of this, quality job opportunities are needed, generated by companies capable of competing, growing and innovating. All this is possible if virtuous processes of promotion and strengthening of networks between business and research are triggered, through the construction of a modern and competitive technology transfer fabric in compliance with sustainability. The following considerations refer to a principle according to which the city is first and foremost a complex of networks: "cities are, by definition, plural, public and productive, they are the Petri dishes of experimentation and are guided in their evolution by society itself, except in exceptional cases such as Brasilia, created on the basis of a vision imposed from above [6]. In this context, green infrastructures will have to take on a multi-functional character, reconnecting the concept of greenways with that of ecological networks with the aim of bringing advantages to the settled communities but at the same time enhancing the ecological aspects present in a sustainable development perspective. In this sense, green networks take on a different role than in the past in order to increase the degree of biological diversity and self-propelled and regenerative capabilities. In the context of an emerging consciousness and in the face of the current environmental imbalances of the contemporary city, the idea of a green city is taking shape, that is, a renaturalization of the city through real initiatives of structural integration of greenery with the built environment (creation of urban gardens and wooded areas, habitats for wildlife, ponds and wetlands and natural and artificial plant corridors, where the horizontal space does not allow the insertion of further and appropriate spaces greens). We are now far from considering greenery as a simple merely decorative fact, especially since it can significantly contribute to guaranteeing a high quality of living within an ecological vision of the city. The quality of the territory necessarily also passes through both public and private urban greenery. Greenery, as one of the most important elements of attraction, also becomes a factor of competitiveness for the city's economy, of quality for the life of its citizens, of the city's landscape identity, it becomes a "future common good" [7]. Urban spaces are made up of public and private greenery, in their various typologies, from the small garden to the large park. To these spaces must be added the tree-lined avenues which give the whole the shape of a system. Some thematic indications on renaturalization offered by the Urban Agenda (goals 6–11-13–15) invite us to plant evergreen trees resistant to climatic stress, to the use of filter-plants as a bioremediation strategy, to the of urban gardens and hedges capable of hosting animal species useful for the economy of ecosystems and of absorbing fine dust (5–10 ppm) harmful to health, to the redevelopment of sheds and terraces with hanging garden systems to contain heat losses. This network can also be connected by green, pedestrian and cycle paths, continuous and protected from vehicular traffic. The network idea also constitutes the reference model for local urban green policies. By virtue of what has been said, the need to abandon the sectoral approach that characterized rationalist urban planning to

converge with conviction towards integrated and sustainable urban planning of networks is increasingly emerging.

2.2 Th Function of Greenery in the City

Increasing greenery by redesigning our cities allows us to have effective tools against the worrying climate change of recent years. Some measures, such as Agenda 21 and the Aalborg Charter, highlight its importance for improving the quality of the environment and life in cities. But what are the advantages of green? First of all it has a decorative function, useful for making cities beautiful, welcoming, livable, then ecological as it is decisive for improving the microclimate, for energy saving and for the sustainability of cities, and more. Over the years it has increasingly taken on a social function without underestimating the fact that it also increases citizens' safety and improves their mood, to the point of combating depression and loneliness. The time has come to measure ourselves with new parameters aimed at the quality of the place, the well-being of the community, a new governance. In Italian urban planning, the functions assigned to greenery have remained those prescribed by the urban planning standards referred to in Ministerial Decree 1444/1968 with the obligation of an abstract relationship between the quantity of areas to be allocated to services and those to be allocated to buildings for settlements, within the functional areas of the plan.. Law no. 10/2013 "Regulations for the development of urban spaces" did not produce obvious results. It is desirable to have a different urban planning culture that takes these spaces into account, with the extension of green roofs, right from the design phase, so as to contribute to improving both green and energy saving policies. We can and must underline the role of greenery from a bioclimatic point of view: the evapotranspiration produced by plants can contribute to a significant mitigation of summer temperatures in urban areas, without also neglecting the role of rivers. In line with the indications deriving from the planning, the objective of these reflections is to ensure the protection, safeguard and conservation of the river habitats and of the plant and animal species present and to guarantee - therefore - along the course of the rivers, the maintenance and /o the restoration of the ecological balances that characterize the habitats and which underlie their conservation. Achieving this conservation objective makes it necessary in particular to reconcile human activities that influence the status of species and habitats present in the river territory with their conservation. Precisely with a view to reorganizing the human activities present in the river territory to guarantee the protection of biodiversity, interventions are proposed aimed at promoting eco-compatible economic activities, correlated with the sustainable management of the natural environment and its resources, for the benefit of the economic development of the river territory. One of the main objectives is to support a use of the river territories modeled on the conservation needs of the territory itself to be considered as a priority. In the context of the European indications, in particular of Directive 2000/60, of the Birds and Habitats directives, in relation to the regulations in force regarding protection from and against waters, in the light of experiences gained in projects that provide for the protection and negotiated management of the landscape and the river environment, the proposal identifies the river system as the most suitable component for defining and developing the knowledge and dynamics of the "river world" in its territory, not only from an environmental point of view but also from a socio-economic point of view. co,

promoting the governance of local development processes, involving the bodies responsible for this river redevelopment activity but above all the actors and subjects who are directly involved in this process starting from the municipalities involved and ending with private subjects. In particular, it is necessary to recognize rivers as entities with which we must coexist and perceive them as territorial, environmental, landscape and cultural references unifying the urban communities that find hospitality in its basin.

2.3 An Innovative Approach to Measure the Efficiency of Greenery. The Usefulness of Urban and Environmental Sustainability Indicators

It is not infrequently noted that some land use destinations contrast with the natural areas of the river course which favor different destinations that are more in keeping with the surrounding environment such as: areas of public interest, parks, leisure areas. ro and sports. The latter would allow us to obtain not only a status of environmental harmony, but also a better quality of life in the areas of the entire city. The objective of the proposed experimental model is to measure, through physical indicators (Fig. 1).

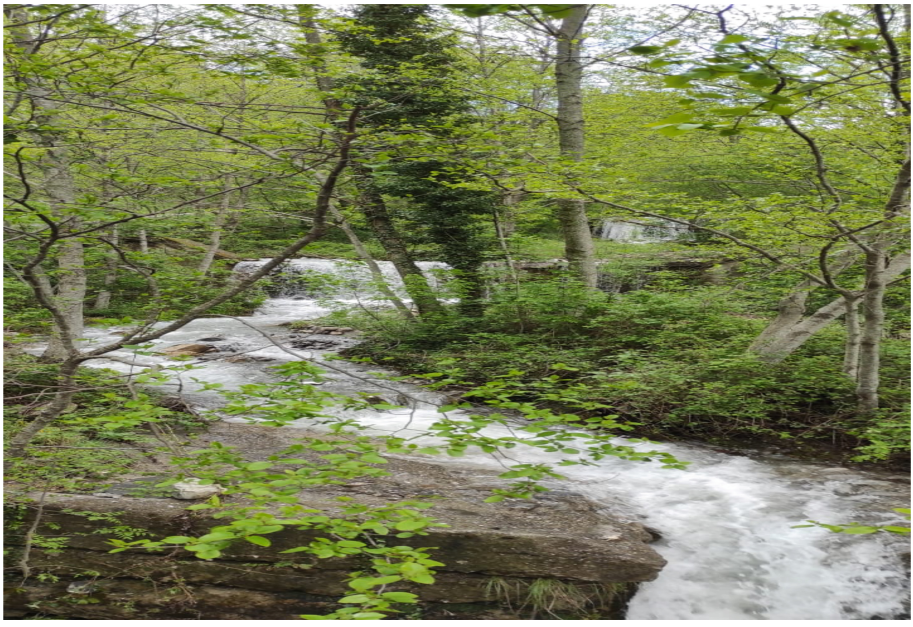

Fig. 1. Ruscello San Pietro a San Lorenzo Bellizzi (Calabria). Source: photograph taken by the author

geometric and vegetational, the performance of urban greenery (permeability, hedge lawns, shrubs, low - medium - tall trees) with respect to a series of functions (shading, permeability, production of oxygen O2, absorption of anhydride carbon CO2 and pollutants, acoustic insulation, creation of urban habitats and urban ecological microcorridors to promote biodiversity, windbreak effect, division of spaces, visual isolation,

etc. In addition to the well-known aesthetic and recreational functions, green areas contribute to mitigate pollution of the various environmental matrices (air, water, soil), improve the microclimate of cities and maintain biodiversity. However, these functions and benefits are poorly integrated into open space management policies. To make the urban sustainability and integrating it into territorial policies, it is useful to define a system of indicators that allows the level of sustainability of a city or metropolitan area to be assessed. The identification and use of sustainability indicators to support sustainable development policies are objectives widely recognized by the main international and European bodies. These indicators allow not only to draw up a diagnostic framework of the conditions present in a given context under examination, but also to monitor and verify the possible achievement of the pre-established objectives, thus constituting a valid cognitive and strategic tool for administrators, planners and citizens. Generally. Among the indicators developed at various levels by national and international bodies to pursue the objectives of urban sustainability, we recall urban green spaces, as well as that which refers to the accessibility of public green areas and local services, measured by the percentage of population living within 300 m of green areas of a size of at least 5000 m2 (parks, gardens, open spaces, equipment, usable private greenery…) and some basic services (healthcare, transport, education, food, greengrocers, etc.). Green areas are defined as: public parks, gardens or open spaces for the exclusive use of pedestrians and cyclists except green islands or traffic islands; equipment for outdoor sports, accessible free of charge to the public; private areas (agricultural areas, private parks) accessible to the public free of charge. The indicators that refer to urban greenery are: usable urban greenery, m2/inhabitant of usable greenery, excluding parks and protected areas and green areas, surface area of the various green areas on the total municipal surface area (m2/ha). Each requirement depends on a set of basic indicators; the requirements are measured using an index calculated as a weighted function of the basic indicators with respect to functionality (rare functions; children's and teenagers' play area; elderly space; dog enclosure; barrier-free paths), aesthetic quality (historical and artistic value, floristic variety; presence of water; context and background), safety (safe pedestrian and cycle access; fence), services and furnishings (toilets; drinking water; bicycle parking; benches and bins), pressure factors (traffic roads; railways; power lines; industries and warehouses) and maintenance (turf; paths; cleaning). Furthermore, the quality of these areas is essentially measured according to their usability. However, it is believed that the quality of green areas also strongly depends on the ecological and environmental dimension: phytosanitary state of plants, biodiversity, care and forestry interventions could be some of the basic indicators for measuring and evaluating the environmental quality of greenery, to be on which the social one depends. It is appropriate to remember that the importance of ecosystem services is very high as they influence and support human life and well-being with reference to the basic ones: breathing, drinking and eating, but also those, equally vital for quality of life, such as leisure, physical movement in the open air, psycho-physical balance. The theoretical model of "environmental services" is a very useful analysis tool because - by identifying in detail the various functions of nature and the multiple services it provides - it helps us to "translate" the benefits for society into concrete terms. The indicators mentioned above will be useful for evaluating sustainability and urban quality in order to improve the local context and environmental impact

which is fundamental for supporting the well-being of the community. Natural based solutions can bring benefits in relation to the protection of species and habitats, as well as adaptation to climate change and disaster risk reduction through the implementation of urban gardens and allotments, green parks, pollinator sites, green corridors, wetland restoration, sustainable urban drainage systems or green walls and roofs. At the conclusion of this writing, it is appropriate to remember that on 21 December 2023, with decree 434, the national climate adaptation plan was approved, the main objective of which is to provide a national framework for the implementation of actions aimed at minimizing the risks deriving from climate change as possible, to improve the adaptive capacity of socio-economic and natural systems, as well as to take advantage of any opportunities that may arise with new climatic conditions.

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