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ECOLOGICAL AND SELF-SUSTAINING CITIES - A SYSTEMIC APPROACH FROM THE POINT OF VIEW OF LANDSCAPE PLANNING DISCIPLINES

ORAŞE ECOLOGICE ŞI AUTOSUSTENABILE – O ABORDARE SISTEMICĂ DIN PUNCT DE VEDERE AL DISCIPLINELOR PEISAGISTICE

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Abstract. *Eco-urbanism involves a series of concepts and principles of planning, implementation and use of the elements of the system called City, generically called green technologies. These include: intelligent management of all urban utilities networks, wasted water management and solid waste recycling systems and management, passive energy building technology, clean energy technologies (solar, wind, hydropower or biogas technologies, etc.), rehabilitation and revitalization of depreciated or abandoned urban spaces, food and consumable objects production in a sustainable way. The present paper illustrates the importance of the fact that the city planning and the landscape planning involves knowledge applied from several areas listed above or not mentioned yet, which implies an overview of landscape architects on all these areas and the connections between them, both in territorial and urban planning, as well at the scale of the detailed landscape design.*
Key words: green urbanism, green cities, green technologies, urban infrastructure, the principle of eco-urbanism

Rezumat. *Eco-urbanismul presupune o serie de concepte şi principii de planificare, implementare şi utilizare a elementelor sistemului numit Oraş, numite generic tehnologii verzi. Între acestea se disting următoarele: managementul inteligent al tuturor reţelelor utilitare urbane, sistemele de management şi reciclare al apelor uzate şi al deşeurilor solide, tehnologia clădirilor pasive energetic, tehnologiile energiei electrice nepoluante (solare, eoliene, hidroenergetice sau tehnologiile biogazului, etc.), reabilitarea şi revitalizarea spaţiilor urbane depreciate sau abandonate, producerea alimentelor şi bunurilor în mod sustenabil, etc. Lucrarea de faţă ilustrează importanţa faptului că planificarea şi amenajarea peisagistică a oraşelor presupune cunoştinţe aplicate din mai multe domenii enumerate anterior sau nemenţionate încă, ceea ce presupune o viziune de ansamblu a specialiştilor arhitecţi peisagişti asupra tuturor acestor domenii şi a conexiunilor dintre ele, atât în planificarea urbană şi teritorială, cât şi la scara amenajărilor peisagere de detaliu.*
Cuvinte cheie: urbanism ecologic, oraşe verzi, tehnologii verzi, infrastructura urbană, principiile eco-urbanismului

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INTRODUCTION

Over the time, the development of human settlements has gone through several stages of evolution: from the ancient cities of Egypt or Babylon, up to the latest urban design concepts brought by Eco-Urbanism (Sharifi, 2015). All these ways of planning the cities have always considered the ways to create communities of people who can live, work, be able to have cultural, social, educational or relaxation activities, with facilities of hygiene and comfort specific to each epoch in part.

Nowadays, these facilities of hygiene and comfort of the cities, together with the principles of sustainable development (according to The New Charter of Athens, 2003 and Brundtland Report, 1987) are the basis of the design of any new locality and implicitly of any new building, being generically called urban services infrastructure. The science of designing and implementing ecological cities requires innovative ideas and the concerted effort of specialists in the fields of: urbanism, architecture, constructions, installations, landscapes; but also from other fields such as: medicine, socio-human sciences, economic sciences, nature sciences, agronomic sciences, exact sciences, management and production of goods, art or politics, etc.).

MATERIAL AND METHOD

The ecological urbanism is by definition interdisciplinary, generally aiming to minimize the consumption of energy, water and materials in each of the stages of existence of the city, from the extraction and transport of raw materials, to the manufacture of different materials and construction elements, as well as the placing them in work, the exploitation of buildings and all systems of the city, until the end of their use, dismantling and recycling their components.

Table 1

The three pillars of Green Urbanism

GREEN URBANISM		
ENERGY AND MATERIALS	**WATER AND BIODIVERSITY**	**URBAN PLANNING AND TRANSPORTATION**
Embedded energy Material types The way of provisions Green energy consumption Ecological building systems Prefabrication and recycling Energetic efficiency Resources management	Urban management of water Water recycling and irrigation Urban farms Typologies of urban landscapes Maximizing ecosystem biodiversity Waste water recycling Storm water storage Climate change impact management Waste management	Urban design Social sustainability The theory of ecological cities Health and Movement Mobility and Public transport Infrastructure Energy efficient buildings Mixed use of land Convenient houses Reducing car dependency Urban sectorization
THE INTERACTION BETWEEN THE THREE PILLARS OF ECO-URBANISM		

The development of cities must take into account the climatic changes arising from the non-rational exploitation of natural resources and the development of industries and transport based on fossil fuels, so that, by rethinking all the concepts of building cities, they become ecological living and working environments for their inhabitants, adapted to their geographical location and climatic region, to become compact again, with mixed use and multiple centers of interest (Keeler and Burke, 2009). Thus, in the thinking of the specialist designers of today, a series of principles of ecological urbanism have been outlined, ilustrated in table 1 and briefly presented in the following section of paper (Lehmann, 2011).

RESULTS AND DISCUSSIONS

The future of human society depends not only on the application of green technologies but on a holistic vision on the sustainable development of urban and rural communities, in harmony with the nature and ideals of next generations.

The principles of ecological urbanism are based on the three-zero scheme: Zero fossil fuels - Zero waste - Zero carbon emissions (Lehmann, 2010).

The sustainability matrix of cities consists of the 15 principles of ecological urbanism described by Steffen Lehman in the chapter: "What is Green Urbanism? Holistic Principles to Transform Cities for Sustainability "(Lehmann, 2011).

The first principle refers to *the adaptation of the city to the unique conditions of geographical location and climate*, to the opportunities and constraints given by orientation, solar radiation, rain, humidity, the direction of the prevailing wind, the topography of the site, the lighting and shading, the conditions of noise pollution, olfactory, visual, pollution of water or soil, but also of the social, cultural, political context specific to the given site, etc. All these conditions determine the choice of the types of green technologies used in energy production, construction, avoiding heat loss or overheating of densely built urban areas, helping to minimize the impact of expanding cities on the natural environment.

The second principle is given by the *Zero CO_2 Emissions Directive*, by using clean energy, from renewable sources, possibly using natural gas, as a transition from the energy resulting from the burning of coal or oil to that of renewable sources. The criterion for choosing the types of technologies that generate renewable energy is that of the availability of conditions and specific resources in the urban or rural area where their implementation is intended. The purpose of this principle is to transform cities from energy-consuming areas into local stations for producing the necessary energy, from the renewable resources available in those areas. Among the types of green energy technologies can be listed: photovoltaic panels, solar thermal panels, wind power plants, heat pumps, ventilation with preheating/ cooling of the air through underground channels (Canadian/ Provenal well), cogeneration plants for electric and thermal energy, hydroelectric plants, biogas plants and so on. To support the process of energy efficiency, new buildings are constructed of materials with a high coefficient of thermal insulation, and the old ones are introduced in thermal rehabilitation

programs, the electricity or thermal energy produced by the various green technologies will be stored or redistributed in other areas, through national energy distribution systems. Consumption will also be streamlined through intelligent systems for automated and sectorized monitoring and exploitation of energy, both in the residential, services and also industrial sectors.

The third principle - *the city without waste* - aims to change the mindset of a consumer society - a large waste producer that ends up being dumped in huge dumps of polluting waste - in a society that produces green goods, which at the end of the life cycle can be fully recycled and re-introduced in another production circuit or in nature. This concept of urban planning - "The City with Zero Waste" is based on a circuit of goods, from production, reduction of consumption, to the complete recycling and reuse of the materials resulted at the end of the exploitation of the goods and finally, to the production of energy (biogas), from composting organic waste. Particular attention is paid to the recycling centers for materials that will selectively collect from both domestic and industrial users (PET, Plastic, paper, cardboard, glass, metal, aluminum, heavy metals or precious metals from the electronic components of the electronic appliances or household appliances, wood, textiles, ceramic materials or construction waste and so on). The next very important step is the processing of these recycled materials so that the new products obtained do not suffer a decrease in quality. Another problem pursued at global level is controlling and diminishing the impact of agriculture and implicitly controlling the nitrogen cycle, by improving fertilization technologies, but also by capturing the biogas resulting from the decomposition of waste.

The fourth principle concerns the *management and maintenance of water quality in the urban environment*, so that the drinking water resources are maintained in terms of sustainability. Within this principle, the following main aspects are pursued: reducing water consumption, streamlining the use of water resources by desalinating seawater, collecting, filtering and using rainwater or flooding, for hygiene in households or toilets, ensuring a good quality of drinking water and also the protection of aquatic habitats by recycling and biofiltration treatment (with the help of algae or specific microorganisms), of the water used and discharged into natural streams. Particular attention will be paid to water management in agriculture and animal husbandry, both by choosing efficient irrigation systems and drought-resistant types of plants, and by treating and recycling the water used in livestock farms.

The fifth principle - *landscaping, gardens and biodiversity* - refers to the main objective of landscape as a discipline, namely the conservation and harmonious integration of landscape and gardens on the roofs of buildings or on the ground, in the urban built environment, so that obtain rest and recreation areas in parks, new local food resources, but also the effect of cooling and purifying the air in the area, maximizing biodiversity and not least protecting natural habitats, through infrastructure projects that ensure freedom of movement of wild animals

and at the same time their protection against heavy traffic or interference with urban areas.

The sixth principle envisages *the design and development of compact and polycentric cities, with well-organized and environmentally friendly transport* and public spaces - so-called urban eco-mobility that encourages walking or cycling, but also the use of public transport instead of personal cars and also the "car-shering" system, the use of electric or hybrid cars. All these transport options, besides reducing CO_2 emissions, lead to an average density of buildings and a balance between residential areas and those for offices, services or production, ie the compact and polycentric cities mentioned above.

The seventh principle calls for the use of *local sustainable materials*, the incorporation of a *minimum amount of energy in the construction sector*, but also the application of modular prefabricated systems, focusing on the use of new design innovations and sustainable technologies in the field of construction (described in detail in the principle of 9th), which will improve the specifications of materials and components, shortening the product chain to reduce transport, obtaining convenient eco-passive buildings, which at the end of their life cycle can be completely disassembled and recycled, thus greatly reducing the construction waste.

The eighth principle refers to increasing sustainability by *redesigning and compacting cities* - vertical housing construction in city sights - for better use of land for local agriculture (mentioned by the 11th principle), but also landscaping dedicated to relaxation and leisure, by creating efficient road and public transport systems within cities, by reducing the distances between housing and work places, schools, kindergartens or other cultural centers, services or recreation, thus minimizing CO_2 emissions. Also, thease strategies are being adapted to each type of city (metropolis, small or medium-sized cities, rural or island, etc.), which will lead to the re-energization and remodeling of their centers, in order to determine the population to return from the peri-urban areas to these revitalized central areas, through reconstruction and refunctionalization with different facilities. Compact cities can thus become sustainable and self-sufficient, from energy and financial point of view, but also from the point of view of population coexistence programs within these multifunctional urban centers, in a healthy and sustainable lifestyle (presented by principle no. 10).

The ninth principle lists the principles of *design and construction of green buildings and neighborhoods* (eco-passive), described also within the principles of the first, the second ("Zero CO_2 emissions"), the third and the seventh, referring mainly to the modalities of minimizing the energy consumption in constructions, both through the design of the bio-climatic architecture. Buildings with ventilated façades adaptable to the environmental conditions (Grecu, 2012) will be able to benefit from the night breeze, the natural ventilation intersected but also the one based on the thermal circulation, the possibilities of natural lighting (courtyards of light or illuminators) or shading of the building, by air conditioning

through underground channels (Canadian or Provençal wells) or by storing heat in summer and releasing it in winter as needed (Tromb wall), all with minimal energy and materials consumption, local sources, recycling and reusing all these materials without diminishing the quality of new products. When these buildings are equipped with technologies for the production of green energy, or for collection and recycling and reuse of rainwater but also the waters already used within them, and the neighborhoods contain all the necessary functions including small gardens (on the ground) for recreation, but also for practicing local agriculture (vertically or on the roofs) cities can boast of self-sustaining communities.

The tenth principle indicates the constant concern for *cities with mixed programs* - from housing, to services, offices, non-polluting production, to affordable homes, to communities with a vibrant and healthy lifestyle. Typologies for the development of cities with mixed programs in central areas and on land with mixed uses, both as a function, within the circadian cycle (day-night), as well as as a variety of population segments (young - old, workers - intellectuals, rich - poor, owners – tenants and so on) who use these areas, thus providing greater inclusion and social sustainability, helping to repopulate the centers and avoiding gentrification of the population and the transport between remote monofunctional areas.

The eleventh principle militates for *cities that ensure food safety and freshness, through food resources obtained locally, in "urban agriculture"*. Sustainable cities support this principle by allocating land on the ground or spaces on the roofs of buildings, suitable for gardening, as well as producing and distributing food locally, to minimize the need for fuel consumption for its transportation. Vegetable and organic waste will be used to produce compost, much needed in organic farming, and recycling and reusing plastic or cardboard packaging as well as shortening the transport chain could lead to a decrease in product prices, but especially to a reduction in pollution.

The twelfth principle concerns the *cultural identity of the communities*, *the health, safety and the feeling of the locals belonging to an urban space*. The design of cities should take into account their specific environmental conditions (climatic and geographical), the local materials available, the history of the place but also the wishes of the population. The main purpose of the ecological cities is to improve the basic strategies by which the health, the activities and the safety of the inhabitants are maintained. It is also aimed at protecting the built heritage and preserving a distinct cultural identity, by promoting small local businesses or creative crafts, inserted in spaces arranged within the rehabilitated historical buildings.

The thirteenth principle provides for the *improvement of city governance in the sense of implementing the best practices and strategies necessary for their transformation into sustainable communities*. A sustainable city from the point of view of its government has a high degree of awareness and participation through

public consultations of citizens in the administrative decision-making process, legislates the regime of land occupation and city extension within certain limits, implements a situation management system. urgently, it encourages through subsidies and tax exemptions the sustainable projects that create ecological jobs, but also the projects of production and use of renewable energy, thus diminishing to the maximum the CO_2 footprint at the level of all the activities of the city, has an integrated plan of action and a database of good practices to support sustainability.

The fourteenth principle *refers to educating citizens to adopt a new lifestyle in the spirit of sustainability, but above all it is necessary to redefine the training of designers, urban planners, landscape designers and architects involved in the design of green cities.* The scientific research in the fields related to constructions and urbanism will be oriented towards achieving a sustainable development of the city in all its aspects.

The fifteenth principle draws attention to particular strategies for building sustainable cities in developing or underdeveloped countries, which initially require the development and diversification of the area of economic activities and infrastructures on an ecological basis, all other principles being pursued concurrently.

CONCLUSIONS

Urban design is an increasingly complex process in recent years, following a holistic conception, bringing together all the multidimensional approaches of the system called City. Moreover, the ecological city will follow the adaptation to the unique context of the geographical and climatic zone, through a qualitative and quantitative combination of theoretical knowledge and technologies, to which is added the increased delay for understanding the connections and interactions between the forms of urbanization, the population density, the consumption of raw materials, the efficient use of water and energy, but also the gradual depletion of resources.

The principles of ecological urbanism previously presented are meant to form an integrated matrix at a holistic and practical level, which, enriched permanently with the new discoveries in the field, can be a guide of good practices for both designers in urbanism and related fields, as well as for political or administrative decision-makers.

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