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New paradigms and concepts for urban nature: an integrative model practical applications in landscape planning education at Aalto university

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Introduction and research questions

Despite the numerous definitions of some of the new basic concepts supporting the use of urban nature in the landscape and urban planning (e.g. urban green infrastructures (UGI), ecosystem services (ESS), nature-based solutions (NBS), Urban Sustainability and Resilience), the concept is implemented through a comprehensive literature review and thorough analysis of the above-mentioned concepts. Secondly, the model was applied to redefine the contents, structure and objectives of one of the two compulsory courses (MAR-E1025 Green Area Planning) of the Aalto University master programme in Landscape Architecture. The implementation of the course during the last three years produced some tangible results that were systematically analysed to assess the level of understanding and use of the new-urban nature concepts by the students, both during the Green Area Planning course and in their future studios or master thesis.

Finally, the potential of the synthetic model and its application in landscape architecture education was discussed with a wide range of stakeholders including decision-makers from the Baltic and Finnish Cities where the students developed their works and with experts from other disciplines using actively the selected urban nature concepts for analytical or planning/design purposes.

Results

A review of the novel concepts used in Urban Nature Planning shows that they often operate at different semantic levels. These levels are not complementary or hierarchical (Table 1). As displayed in Figure 1, Urban Sustainability and Resilience can be perceived as moving processes driving towards the positive evolution of urban socio-ecological systems and promoting transversal and systematic ways of thinking. In the proposed model, Urban Green-blue Infrastructures are mainly understood as physical and spatial networks where nature and natural processes occur in cities. From a human-centred perspective, these infrastructures have the capacity to deliver a wide range of benefits or Ecosystem Services that, if properly considered, can facilitate the assessment of Green-blue infrastructures’ performance and inform their planning/design (e.g. networking and development (especially regarding point or site related properties)). On the other hand, the emergence of Ecosystem Services greatly depends on the functioning, characteristics and composition of each Green-blue Infrastructure, whose performance can be managed or modified by using tools, features or elements assisted by nature and natural processes (e.g. Nature-Based Solutions). According to the proposed model, the aggregation of the physical, functional and benefits delivered by urban nature,

<table>
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<tr>
<th>CONCEPT</th>
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<th>MAIN AIM</th>
<th>POTENTIAL USE IN CITIES FOR URBAN NATURE PLANNING</th>
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<tr>
<td>GREEN-BLUE INFRASTRUCTURE (GSI)</td>
<td>Green infrastructure is a strategically planned network of green-blue infrastructure in natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, habitat, space for recreation and climate mitigation and adaptation. This network of green (land) and blue (water) spaces can improve environmental conditions and therefore citizens’ health and quality of life. It also supports a green economy, creates job opportunities and enhances biodiversity. (European Commission, 2016).</td>
<td>The use of GIs as a spatial network affecting urban nature in planning and decision-making. (Pauleit et al., 2017). GI can provide a spatial network of infrastructures that can support a green economy. It is an implementation approach needed for the production of ESS and the application of NBS.</td>
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<td>ECOSYSTEM SERVICES (ESS)</td>
<td>Benefits people obtain from ecosystems. They include provisioning, cultural, supporting and regulating services (Millennium Ecosystem Assessment, 2005). If natural capital is the stock of assets, ecosystem services are the flow of benefits derived from those assets (Daily et al., 2011).</td>
<td>Assessing different types of benefits and functions in order to inform other concepts. (PAULEIT et al., 2005) and (DAILY et al., 2011).</td>
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<td>NATURE BASED SOLUTIONS (NBS)</td>
<td>Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions (European Commission, 2015).</td>
<td>Tools and Solutions for a wide range of problems. (PAULEIT et al., 2005) and (DAILY et al., 2011).</td>
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<td>SUSTAINABLE DRAINAGE SYSTEMS (SUDS)</td>
<td>Approaches to manage surface water that take account of runoff characteristics (quantity, quality and timing), water usability (hardscape and softscape), biodiversity (wildlife and plants) and amenity (SURAIN, 2012). SUDs can be integrated inside Sustainable Storm Water Management and can be connected to other systems in such a way to increase the performative character of the overall system (Kennedy et al., 2007, p.44). UM can be understood as the way of thinking based on the interaction between biogeo physical systems and socio-ecological systems, with the philosophy of urban green-blue infrastructure planning. (Nesshöver et al, 2017). NBS or other instruments.</td>
<td>Tools and Solutions for Storm Water Management and for the production of other ESS. (SURAIN, 2012)</td>
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<td>SOCIO-ECOLOGICAL SYSTEMS (SES)</td>
<td>A socio-ecological system (SES) consists of a biogeo physical system and its social and economic context (Nesshöver et al, 2017). SESES and NBS can be used as tools to combine urban design (USD) with integrated urban water management (IWM).</td>
<td>Systems framework - SES can be used as a new lens to work with nature in urban or non-urban environments. SESES and NBS can promote the generation of multiple ESS and the connectivity of GI.</td>
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<td>URBAN METABOLISM (UM)</td>
<td>In the field of industrial ecology, UM is defined as the sum of the material and socio-economic processes that influence the composition of cities, resulting in growth, production of energy, and elimination of waste (Kennedy et al., 2007, p.44). UM can be understood as a framework for analyzing, modeling and planning material and energy flows in complex urban systems.</td>
<td>The UM concept can support the analysis and planning of GI, ESS and NBS in order to increase the performative character of nature in sustainable urban development.</td>
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<td>NATURAL CAPITAL (NC)</td>
<td>“Stock of living and non-living parts of the natural system that directly and indirectly yield benefits to humans...Natural capital usually include both renewable and non-renewable resources (Daily and Farley, 2011). Costanza et al. (1998) and include the information stored in natural resources (e.g. fisheries and forests), the services that nature provides and the substance of the stock as well, but this is normally separated” (Nesshöver et al., 2017, pp. 1238).</td>
<td>The NC concept can help demonstrate the value of nature in meeting human needs and hence the value of considering NC in various other types of interventions. (Nesshöver et al., 2017). In an integrative framework, the NC can be defined as a function of the combination of GI and ESS and enhanced by NBS or other instruments.</td>
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together with the nature-based tools supporting its amplified performance, could be described as the overall urban nature capital.

The overall model provided the methodological and conceptual framework to work with urban nature in the course Green Area Planning (7 credits) and to support sustainable transitions in different Finnish and Baltic Cities on the base of the performance of nature and its capacity to influence on urban metabolisms, urban morphology and urban ways of living.

The development of the course included the progressive introduction of key concepts, the identification by the students of their mutual interactions, and the combination of different qualitative and quantitative methods to produce new green strategies for the studied cities and for its different functional areas, urban landscape types or typological urban fabrics. In general, the results of the course displayed a deep articulation and interconnection between all the studied concepts, a remarkable level of scalability and a high potential to facilitate the engagement of the students in wider urban discussions and urban planning challenges, both in future studies and in professional practice (Figures 2 and 3).

In particular, Figure 2 includes in its upper part a matrix with different urban green types (columns) and the ecosystem services (provisioning, regulating, cultural and overall) provided by each green type (rows), and the map at the bottom of the figure shows the location of each green type in the city of Oulu (Finland).

The upper part of Figure 3 includes two sections in two districts of the city of Espoo (Finland). The pie-charts on the left illustrate the contribution of each green type to the overall green infrastructure of each district and the type of ownership. The improvements displayed in the sections produced a significant increase in the quality of the green types and of the overall green infrastructure without an increase in their respective areas. For the purpose of this exercise, it was assumed that the quality of a green area could be associated with the diversity and intensity of the ecosystem services provided by it. The same sort of approach was used in different neighborhoods of the city of Turku in Finland (see lower part of Figure 3).

Finally, the synthetic model for the integration of new Urban-Nature concepts and the proposals generated in the successive editions of the Green Area Planning course were discussed with different urban stakeholders and experts.

**Discussion and conclusions**

The proposed model integrates different urban-nature and sustainable-planning concepts (e.g. green-blue infrastructure, ecosystem services, nature based solutions, natural capital, socio-ecological systems, etc.) and offers a potential path to facilitate the definition of smarter and more performative natures in more sustainable cities. In addition, the developed research suggests potential improvements in the proposed model and in the applied teaching methods as well as future lines for further research.

**References**


Millennium Ecosystems Assessment (2005), Ecosystems and Human Well-being: Ecosystems and Their Services, Millennium Ecosystems Assessment.


SUSDRAIN (2019). Sustainable drainage, CIRIA.
Figure 3. Expanding the performance of nature by improving the quality of the Green Infrastructure through the generation of Ecosystem Services (Espoo, Finland). Improving Green Infrastructures, Urban Metabolisms and Ecosystem Services in different urban fabrics (Turku, Finland). Students: S. Aalto, J. Jaaskelainen, D. Mavliutova and S. Palmu, Teacher: J. Galan (2017); Students: M. Paija, E. Renkoven, S. Sawada and A. Puska; Teacher: J. Galan (2016)