

THE IMPACT OF CLIMATE CHANGE ON URBAN PLANNING AND ARCHITECTURAL DESIGN IN SERBIA: SEARCHING FOR OPTIMAL MODELS OF ACTION

Introduction

Climate change and their effects present rather complex and acute problems that we face nowadays. The entire humanity and particularly those persons passing strategic resolutions require a reliable source of information on the causes of climate changes and their potential impact on the environment, as well as possible measure for their mitigation and adaptation. Planning of urban and rural development makes one of the strategic priorities of each country having in view that by planning the arrangement, organization and use of the natural and built resources is established. The subject of research of this sub-project is the multidisciplinary overview of the impact of climate changes on planning the urban and rural development with an aim of environment preservation, which is manifested on dwelling, agricultural production, availability of water resources, forestry, biodiversity, energetics, infrastructural systems, but also on social needs and cultural patterns.

Numerous problems conditioned by global climate changes are quite clearly reflected in the contemporary urban and rural environment. A series of extreme weather conditions in the European cities and worldwide has shed the light on the vulnerability of the cities to the impact of climate changes. On the other part, the cities represent the major originators of the same, however, also the main field of action to minimize their impacts. In light of that, the growing cities, particularly in respect to the growth of the density of dwelling, industry and traffic, represent the strategic place for mitigation of the harmful impacts of climate changes on the environment. Climate changes, to a great extent, affect the change of behavior of the stakeholders in the city. These changes are reflected also through diverse changes in the urban structure: morphological, organizational – functional, economic, social and the changes in the quality of the environment. The phenomenon of global climate changes has also the unavoidable impact on the structure and functioning of the region, changing thus the region topography and relationships among its basic building elements, which is especially manifested in rural regions.

Serbia is ranked among the most endangered regions in Europe to be affected by climate changes. During the past decade that could be seen in the form of: increased monthly and seasonal variability of precipitations, increased frequency and duration of heat waves, as well as more frequent phenomena and greater intensity of drought. This has brought about many changes, both in the urban environments and also in the rural regions. The urban and spatial policies in Serbia up to date have not in a corresponding measure taken into account the effects of urbanization on climate changes. The consequences are uncontrolled spreading of cities and settlements, pollution of the environment, unsustainable use of natural resources and negative impacts on climate changes. Confronting the challenges and requirements of the sustainable development comprises adaptation to the system of planning and elaboration of the adequate planning instruments at diverse decision-making levels.

The criteria of the successfulness of the undertaking/project within architecture and urbanism and the standpoints on the desirable direction and characteristics of the urban environment development have been changing. The search for the new solutions which should “save us” from the uncertainty of the future climate changes have produced a new hierarchy of values, the new ethics and aesthetics, new culture patterns, which transform the paradigms of architecture and urbanism, changing our positions on the good, beautiful, humane, comprehensively desirable village or the city. The approaches applied in their solving vary depending on the natural conditions, level of the economic and technological development, but also on the increase in the number of the affected groups of inhabitants.

The complexity of the time we live in requires, first of all, the understanding of the reality through numerous interactive interdependences which can only intensify the unfavorable effects of the individual issues of several diverse phenomena. For that reason the context of action in light of climate changes in Serbia will be presented in three aspects, through the following:

- Strategies and policies / context: Serbia,
- Case studies / context : Serbia,
- Education/ the curriculum at the studies at the University of Belgrade – Faculty of Architecture.

STRATEGIES AND POLICIES / CONTEXT SERBIA

(Lazarević-Bejec, N. (2012). "Integration of the policies of adaptation to climate changes". Intr: V. Djokić and Z. Lazović (ed.) *The impact of climate changes upon planning and architectural design: development of optimal models*. Faculty of Architecture, Belgrade, 58–82.)

The Republic of Serbia has no strategy within the field of climate changes. *The Initial National Communication of the Republic of Serbia* is the first official document dealing with climate changes and includes the problem of adaptation to them. This document confirms the obligations ensuing from signing the Kyoto Protocol. While this document is declared as strategic, it does not present clear objectives, priorities, responsibilities, necessary policies and measures, or refers to the responsible stakeholders, institutions. The document provides an overview of the conditions and is a framework for future activities of the Ministry of Spatial Planning and Environment as the primary coordinator of all obligations for the period up to 2015.

In the *National Program for Environment Protection* it has been emphasized that for Serbia, alongside the CC (climate Changes) mitigation activities, also important are the activities on identifying the impacts and establishing the adaptation to changed climate conditions. A significant document, in terms of directing the CC policy towards adaptation could be a *The Framework Regional Plan for Adaptation to Changed Climate Conditions for the Region of Southeast Europe* (2008), drafted by the representatives of Albania, Bosnia and Herzegovina, Macedonia, Montenegro and Serbia. The aim of this initiative is the understanding of climate vulnerability and hazards in the region, an overview of existing institutional arrangements and identifying the opportunities of adaptation to climate changes, both in the region and at the level of individual states. The action plan anticipates the verification of the activities performed in 2012 in order to determine the progress toward the goals set and determination of further priorities.

In Serbia, in the period from 2003 to 2012 sectorial and inter-sectorial adopted strategies were passed as well as the plans and programs at the national level that might provide more detailed guidelines in building the frameworks for ACC policies. This primarily applies to *The National Strategy of Sustainable Development for the Period 2009/2017*, *National Program for Environment Protection*, *Strategies of the Regional Development of Serbia for the Period from 2007 to 2012*, *National Strategy for Inclusion of the Republic of Serbia into the Clean Development Mechanism under the Kyoto Protocol*, *National Strategy of Sustainable Development of Natural Resource and Goods Use*, *Development Strategy of Serbia*, *National Strategy of Protection and Rescue in Emergency Situations*, which is interesting for the ACC policies because of emphasizing the need for risk evaluation at the national and local levels, as well as their integration into urban and spatial plans. However, *The Biodiversity Strategy of the Republic of Serbia for the period from 2011 to 2018* at several places deals with the impact of climate changes and adaptation measures defining. It has been stated in the *Strategy* that "there is no systematic monitoring of climate changes impacts on biodiversity in the Republic of Serbia. Current research and planning is based primarily on global research, experiences and recommendations of other countries." This statement could be extended to other relevant fields and documents. In the part dealing with the strategic objectives it is emphasized the importance of linking the activities related to biodiversity strategy to adaptation to climate changes strategy. It should, however, be noted that the recommended activities, which are delegated to the institutions at the state level – the assessment of vulnerability to climate changes for protected regions, as well as evaluation of the effectiveness of strategies and adaptation measures, are also contained in other

mentioned documents adopted prior to this strategy, and that some significant progress in these activities has not taken place.

Spatial Plan of the Republic of Serbia ("PPRS"- SPRS) is the first formal comprehensive document, the strategic spatial plan in which the climate changes, mitigation and adaptation have been given a significant place. This document formulates great number of operational objectives and includes various aspects of activities related to climate changes. The document itself does not indicate the manner in which they will be implemented at different levels, and especially at the local level, which is expected significant results from. In *The Program of SPRS Implementation from 2012 to 2002 for the Period from 2011 to 2015*, a number of objectives have significantly been reduced. They are limited primarily to CC mitigation. Little attention has been paid to elaboration of the instruments of implementation, setting responsibilities at different administrative levels (beyond the obvious competences of government institutions), as well as to precise determination of the actions / measures and costs. In implementation the emphasis is on creating an information database, as well as conducting the research within the area of vulnerability and risk, which certainly is an important activity at the state level. However, the guidelines are absent for policy-making activities at various levels, sectorial and intersectoral, regarding the development of plans, programs and measures, as well as methods for their monitoring and auditing. This is particularly important for Serbia as developing country, where the CC challenges are great, the actions are urgently needed, the resources are limited, time is short, institutional capacities are small. Although in the SPRS and other strategic documents the sustainability issues, as well as a broader framework of CC policy, have acquired a significant place, there are no clear criteria, measures, regulations that would facilitate the work for the local stakeholders. Local planning, which in Serbia is traditionally formulated as a highly complex activity, is not getting from the SPRS enough directions, guidelines for reducing vulnerability or increase in resistance at the local level, as expected. The fact is that neither *The Program of Implementation* has provided the answers to the open questions.

It can be concluded that at the national level in Serbia there is a certain number of CCA potentially relevant strategic documents. In the absence of systematic critical analysis of the strategy quality from the aspect of the possibilities of operationalization and implementation, only general observations can be presented here. The adopted strategies are mostly declarative; it concerns the general standpoints with a vague connection with the real social, economic, institutional and cultural frameworks. The focus is mainly on the objectives, while the absence of more precise implementation is felt, namely, the manner of realization of the goals defined. The degree of operationalization of certain strategies differs a lot. While for some it can be stated that they have been developed to the level of action plans (for which it cannot be determined whether they are indeed real), others are more general and dwell on the objectives yet to be translated into appropriate actions and activities. Most often there is a lack of more detailed quantification when it comes to scenarios of future development, funding and implementation schedule of the individual tasks. Some strategies include action plans and activities matrices, although the extent of their usefulness is very different. The subject of participation ranks high in the number of strategies, it is emphasized and supported, but it is usually reduced only to formal public participation in debates, and not to the de facto division of responsibilities in strategies implementation.

By reviewing the up to date action in direction of the CCA from the national level two conclusions can be drawn. On the one hand, the state of policies at the national level is unsatisfactory. The reasons are first of all political and institutional.

It may be stated that poor integration of various policies (and even the existing ones) which could be relevant to the CCA, especially with the development and other sectorial policies. Also, the insufficient awareness of the urgency of problems and the requirement of proactive action has been stated, for which there are no institutional capacities, resources, knowledge, or clear systems for monitoring and reporting. Consideration of the possibilities of action, creation of integral policies at the national level, have particularly been made difficult by poorly developed cooperation between sectors, underdeveloped horizontal and vertical collaboration, which is essential for the success of

climate policy measures beyond the local level. To add also to this the inadequate participation of relevant stakeholders in decision-making and policies implementation, as well as insufficient and ineffective funding. However, on the other hand, it has also been determined that the relevant national strategic documents and legislation passed in the recent years have opened up significant opportunities for integration of CCA policies at the local level. It can be expected that in the following period the arena of dynamic activities will be at the local level, since that is where the interests lay, the consequences are directly suffered there, but there is also experience in informal strategic planning, as well as local spatial plan as an instrument that can play an integrative role.

CASE STUDY / CONTEXT BELGRADE

(Bazik, D., J. Milošević, N. Galečić (2012). "Innovation of the Process of Residential Settlements Space Forming by the techniques of Water Sensitive Urban Design". Int: V. Djokić and Z. Lazović (ed.) *the impact of climate changes upon planning and architectural design: development of optimal models*. Faculty of Architecture, Belgrade, 128–151.)

Water Sensitive Urban Design concept – WSUD – originated on the grounds of Australia in 2006, through merging of the urban design process and the integrated urban water management process. WSUD is a modern concept of the developed environments in the integral improvement of the urban environment and quality of life in the city, appropriate to global climate changes, in the procedure of innovation of residential settlements, by the elements of which the formal and usable potential of the public, namely common spaces could be enriched and enhanced - residential streets, yards and parks, to become comfortable, pleasant spaces.

Forming the urban space according to the principles of water sensitive urban design in the context of climate changes contributes to: (a) the protection against urban rivers, river basins and bays pollution; (b) defense against floods; (c) improvement of microclimatic conditions; (d) forming of natural environments; and (e) creation of urban farms.

The actual verification of the possibility of implementation of the postulates of the water sensitive urban design was made on the example of preparation of the design documentation for the new residential-business complex *Stepa Stepanovic* in Vozdovac in Belgrade, which originated by transformation of *Stepa Stepanovic* army barracks into the residential settlement with pertaining functions. The urban solution was prepared by the Urban plan (design) without previous announcement of the public and anonymous urban-architectural competition. The territorial coverage is 42 ha of the running slope with 30 m de-leveling 5 and orientation towards north-northeast and northeast (Enclosure 2).

Enclosure 2: Aerial photograph on Google Earth in 2002 and in 2011.

The urban design of the settlement defines the location *communication function*, by making use of its morphological potentials and the routes of the existing traffic routes. Also the *information function* of the entire settlement space has been completely defined through anticipation and positioning the non-residential functions, as well as defining the settlement physical structure. Dominating is the concept of construction of the rational and large-capacity settlement as per *quantitative characteristics* of the number of flats and residents, as well as residential and non-residential square meters. This way, some *quantitative themes* and indicators within the domain of contemporary approach to forming environmentally healthy cities have partially or completely been superseded. An opportunity was missed that with the urban design, as a planning document, the following topics, for decades represented in the global building experience within the concept of sustainable development be prescribed or at least suggested: (a) forming of internal block access to parking spaces as per the concept of traffic calming through *integrated streets*, namely, the common space of equal use both for drivers and pedestrians, appropriate to the theme of newly constructed residential settlement courtyard, (b) alternative forms of urban water management (c) *green roofs* to reduce roof surfaces heat emissions, as well as storm water discharge regulation, (d) *green walls*, as the theme of obliging

vertical gable greening for the same reasons, and the like. It was necessary at the level of the whole residential settlement to set the criteria appropriate to the climate changes that cannot be subsequently regulated by partial action at the level of details. Thus a failure has been made to adapt a new settlement to the climate changes that had already occurred, and simultaneously to contribute to the reduction of future changes. At the same time it would be a way to change the environmental awareness of all participants in realization of the project with long-term and uncertain effects.

The basis of the concept of free spaces arrangement is made of formation of *relational space* in which the residents will find polygons to achieve their personal preferences and thereby contribute to humane and environmentally healthy environments for living in the settlement to become a reality. Multi-family dwelling in the open blocks requires further elaboration of the free spaces to form an identity, both of the entire residential complex and also of individual blocks. It does not comprise just the realization of the functional pedestrian and vehicular access to property, parking spaces and infrastructural equipment, but also the organization and forming of *relational space* in terms of achieving environmental comfort and recognisability which will inspire in people the sense of belonging and a specific experience of space with the ability to personalize it.

With the Conceptual and Master plans of the arrangement of the free spaces of *Stepa Stepanović* complex the following *relational spaces* within the free area on the entire location have been defined: (a) *my yard* – zones of access to the facilities (squares, plateaus, sidewalks), as well as accesses to the garages and parking areas within the residential blocks are enriched with appropriate architectural-building elements, urban furniture and greenery, so that they become a *social collector* and the meeting place and place for socializing, especially in the entrance zone of multi-family residential buildings, (b) *children's playground* - the play of the youngest at the appropriate audio and visual distance from the residential building for safety and security of children, (c) *my nook* - a space for sports activities and gathering of the youth while utilizing the potential of the de-leveled field, as well as being at a respectful distance - insulation from the residential buildings as prevention and protection against noise, and (d) gathering point for the elderly – *the pensioners' point* - board games for all ages, especially for the eldest, (e) settlement park - *a green carpet* formed from variously leveled, interconnected and park-like landscaped spaces with greenery, flowers and carpets with appropriate urban equipment and furniture for relaxation, socialization, play or formation of *the urban farms*, and (f) the network of pedestrian walking paths of various degrees of communicativeness and finish – against the principle of paths routing which supports the rapid targeted movement of the residents and prevents the formation of beaten ground shortcuts. By avoiding the parallel path edge lines the visual dynamic space is achieved, as well as directing the movement of pedestrians through the associations of pedestrian streams flowing in and out. At the same time widening is created for meeting and stay without disturbing the pedestrian transit movement. Diagonal routing of paths contributes to reducing the paths gradients. The combination of stairs and ramps in the form of hairpin-bends has been provided, in harmony with the terrain morphology, the choice of the lines of movement for various age groups and mobility requirements of the citizens and residents (mothers with babies in prams, persons with disabilities, roller-masters and the like).

Directing precipitations is achieved by corresponding gradients of the paved surfaces, drain channels as far as the drains or grass covered areas and gully gratins. The paths-hairpin-bends in free spaces and cascade worked flower pots at the pronounced de-leveling next to the buildings, besides communication and aesthetic properties, also have the function of directing and retaining precipitations at the extremely running terrain, and for the purpose of regulating torrents and draining of storm waters.

It has been noticed that the adopted principles of water sensitive urban design contribute to the innovation of the approach to forming the settlement space, opening up numerous options of trans-disciplinary consideration and integration with an aim of forming the residential settlement as a climate resistant ecosystem. The design documentation for the construction of *Stepa Stepanovića* settlement has covered an exceptionally small number of elements of contemporary waters sensitive urban design concept, both within domain of perceiving the settlement as a comprehensive section

from the urban tissue at the level of plan documentation and Urban plan (Enclosure 3), and also by forming the urban environments in the settlement through elaboration and detail at the level of technical documentation. One favorable circumstance is presented by the fact that the adopted concept of arrangement of free spaces has anticipated the possibility of *personalization of the settlement* space through personal action of the residents and thus enabled future activities within domain of utilization, maintenance and equipping the settlement.

Enclosure 3: Relation of water sensitive urban design and settlement urban tissue.

Enclosure 4: Relation of water sensitive urban design and urban environments in the settlement.

The open concept of forming the free spaces of *Stepa Stepanović* settlement leaves space for transformation of the approach from technological towards biological equipping, from traditional *hard* to environmentally aware *soft* engineering, as well as from professional to user action (Enclosure 5).

Enclosure 5: Transitional options towards water sensitive residential settlement.

EDUCATION AND CLIMATE CHANGES

Architectural curriculum and sustainable development

(Implementation of curriculum within the field of history and theory of architecture)

(Ćorović, D., Lj. Blagojević (2012). "Education of the architects as a response to climate changes: development of the model of the curriculum of the history and theory of modern architecture", Int: V. Djokić and Z. Lazović (ed.) *the impact of climate changes upon planning and architectural design: development of optimal models*. Faculty of Architecture, Belgrade, 15-35).

It is well known that each problem requires particular methodology of solving; meaning that in the implementation of the model the educational process is of utmost importance, so that all participants in the process would be at approximately same level and that model optimization should also possess as a priority characteristics in its proposal. The curriculum of the schools of architecture should develop and promote the specific features of the profession which relate to the necessity of forming the crystallized awareness of the architects, urbanists and planners on the impact of, both their own activities, and also the activities of the others on the environment. It is necessary also the critical understanding of the processes such as *global warming, energetic crisis, living environment, environmental sustainability, environmentally sustainable development, environmental history, sustainable future*.

The latest approaches to the architectural education, promoted and implemented under the sponsorship of the organizations within the European Union (for example, *Educate: Framework for Curriculum Development*, 2011) give directions towards the full integration of the sustainable development principle in all fields of instruction and at all levels of architects education. The United Nations Charter for Architectural Education (*UNESCO/UIA Charter For Architectural Education*, 1996, 2005) advocates also for inclusion of the environmental studies in the curricula of the Schools of Architecture with an aim of forming and developing the awareness of the responsibility towards the environmental values.

The process of introducing sustainable development into university curricula in the current reform of the university education in Serbia in principle represents the consent to the acts of the United Nations and the European Union. In the Republic of Serbia in 2003 the concept of sustainable development was accepted and since then its implementation has been elaborated through several government

planning and strategic documents, Thus the First action plan for environmental education for sustainable development (*First Framework Action Plan for Environmental Education for Sustainable Development, FFAP EESD, 2008*) perceives the environmental education as crucial in the general education for sustainable development and the very process of education implementation within this field places in the first phase of implementation of the principle of sustainable development in Serbia (*FFAP EESD, 2008: 4*). Within that context we find the necessity and value of amendment of the curriculum within the frame of the university education of architects, the profession the essence of which is just that attitude towards (and instruction on) living environment.

Here, as being rather important for the process, we would like to emphasize two prerequisites of actions: a) inclusion of the principle of sustainable development in the curricula from the very beginning of the studies, and b) understanding the specific properties of the architectural profession in the context of sustainable development. The second insight, on specificity of the profession, relates to the necessity of existence of the clear awareness of architects of the impact of their own activities on the living environment. Also, it is very important to highlight the undeniable relationship of architecture with ecology. This relationship is not only manifested through etymological origin of the word ecology (*οἶκος*, in old Greek *house*), but also through the definition that ecology *studies* the relationship of the organism and the environment, whereas architecture and urbanism *produce* the environment for the human organism, but through this they also deal with the study of relationship between men and their environment.

The Aesthetics of Contemporary Environmental Architecture (headed by Prof. dr Ljiljana Blagojević and the associate assistant mr Dragana Ćorović) is the course developed and incorporated in the new study program at the Faculty of Architecture of the University in Belgrade, inspired by the phenomenon of global warming and energetic crisis, so that the instruction has been made possible in the courses which include the thematic fields of sustainable development and develop the awareness of climate changes, together with its already existing, fundamental contents of history and theory of contemporary architecture, however, without *technocratic disregard of the wisdom versus skill*, considering the notions of the *rapid and slow knowledge*, but also *profound learning* in the sense of enlightenment through education.

For the purpose of consideration of the problematics of the actual development of the model of promoting the curricula, hereinafter are presented the implemented curricula of the course *Aesthetics of contemporary environmental architecture*, which is organized within three whole units:

1. *Ex-cathedra* lectures of the course teacher, with the presented thematic fields:

a. *theoretical and historical precedents within the context of environmental aesthetics anticipation*

Lecture: Theoretical concept of the „Garden City „ of Ebenezer Howard.

b. *key historical precedents of the environmental aesthetics within the field of landscape architecture*

Lecture: Urbanism and landscape architecture: The French regular shaped gardens.

c. *environmental theories of modern architecture*

Lecture: Theory of Richard Buckminster Fuller.

2. Lectures of visiting experts with transdisciplinary and combined practical character:

a. *environmental characteristics of the region of Belgrade* dr Jasminka Cvejić, Professor of the Faculty of Forestry in Belgrade

Lecture: Belgrade biotypes mapping and evaluation

b. *principles of bio climate architecture*

mr Vladimir Lovrić, architect

Lecture: Environmental energy efficient sustainable architecture

3. Interactive classes of students' presentations and discussions

a. *urban ideas and concepts of sustainable development, in theory and practice:*

b. *realized buildings of environmental architecture:*

c. *examples of creation within the field of sustainable building in compliance with the Fuller's principle „more for less“.*

Through the presented approach to instruction and through the activities presented the authoress' aim is:

- to raise the awareness on the necessity of environmental sustainable development,
- to create the environmental literacy in students from the very beginning of the studies,
- collaboration in order of inclusion of all interested parties in acquiring environmental literacy within the university education,
- communication and collaboration which encourage creation of interdisciplinary approach to changing the university education curriculum.
- collaboration within the frame of the national and international organizations promoting university activity towards sustainable future.

IN PLACE OF CONCLUSION: THE PHASES OF THE EFFECT OF THE RESEARCH OF PLANNING AND ARCHITECTURAL DESIGN UNDER THE IMPACT OF CLIMATE CHANGES

The studies presented are parts of the researches performed within the first phase of the Project *The impact of climate change on urban planning and rural development in order to preserve the environment*. The Project is coordinated by Vladan Djokic, Dean, Faculty of Architecture, University in Belgrade, and it is part of the research project *Studying climate change and its influence on environment: impacts, adaptation and mitigation*, funded by the Ministry of Education, Science and Technological Development in the framework of the integrated and interdisciplinary research for the period 2011-2014., which originates from commitments made in the Strategy of Scientific and Technological Development of Serbia by 2015, with the 330 researchers on the project within 17 institutions. The Scientific and Technological Development Strategy of the Republic Serbia by 2015 highlights that Serbia faces great environmental challenges, and that climate change will have an important influence on the changes in ecosystems and key environmental resources and thus on the sector of economics.

On this occasion a brief overview has been presented, namely the parts of some of the researches originating within the first two, out of Project's four annual phases. The activities within the first two phases were directed towards assessment of the existing systems and spatial patterns, and with the aim of development of the optimal patterns which was the focus of the second phase. The next two phases of the Project are: creation of strategies and patterns and providing the guidelines and recommendations for the action within urban and rural development under the impact of climate changes, and with an aim of environment preservation.