

LOW Carboning in not LAW Abiding Land use: The Case Study in Belgrade

Introduction

Over the last few decades Serbia is experiencing strong transitional impact, which is maybe the most „visible“ in the field of urban development – non-consequential urban plans, inadequate formulation of public needs, lack of strategic planning, complicated and long legislative procedures and administration, usurpation of natural goods and public land, informal and unplanned building, complying the private investors, low awareness of local communities responsibility, practice of not investing in public interest and education of citizens, irresponsible position against all aspects of recycling and sustainable development – are just some of the plays of bad transitional acting.

Regardless this transitional pressure, which Belgrade as major „urban system“ suffers intensively lately throughout its more than century-old urban planning praxis, one of the major natural potentials in the core of the city-on-two-rivers is preserved and „protected“ through urban plans – green „lungs“ of the city – river isles, wetlands, forelands, water-supply areas and fens. Some of them are urban-planned and physically urbanised, while most of them are assorted and preserved in their natural habitat and represents true natural wealth in central area of the city.

At the intersection of this two superposed tendencies and on the edge of visible urban life of the city lies the need of Belgrade citizens for temporal stay or dwelling at the river banks. This need isn't legally formulated nor supported through plans, but it has its physical „footprint“ in spontaneous building of the boat-rafts, log-cabins, pile dwellings and bungalows along river banks, isles and wetlands.

The main topic of this paper is urban planning and specific use of green areas developed and naturally grown along city's riverbanks. Its main thesis is that in specific, atypical conditions some of the informal dwellings can be seen as „low carbon“ in their social, economic and building aspect. In other words, exactly they can spontaneously reach the criteria of low carbon building, although perceived as informal and without proper infrastructure.

Low-carbon city and criteria for its assessment

Last few decades are marked with the notion of sustainable development, which evolves preserving the environment so that the human needs can be met in the present as well as for generations to come. This is followed by increasing threat of destabilising the life cycle, i.e. consumption of non-renewable resources and CO₂ emission into the atmosphere, which produces greenhouse effect. Cities have huge impact on carbon emissions, because of the numbers of people who live and work in them, and because of the example they can set. To sum up, they represent systems under resource-intensive stress, and play an important role in the battle against climate change.

The most common definition of low carbon city refers to a settlement which must reduce emissions of greenhouse gases and all practices that emit these gases must cease. This is related to economic, social and environmental resources, such as renewable energy, decarbonising electricity, low-emission transport, community awareness and behaviour, low-carbon way of life and consumption, etc. Of course, it must be supported by collaborations among government, the private sector and civil society.

As widely accepted, low-carbon city in planning is seen through a formulation of planning target. According to Liang (2010), these targets: „may cover various material levels ranging from macroscopic urban spatial layout and meso community design to microscopic

handling of energy-saving construction; it also involves such non-material levels as urban economy, mode of residents' social behaviour as well as common administration" and can be put in four scales: region, city, community and site. The following Table 1 presents these four scales, together with the aspects, criteria and goals, which should be respected in order to achieve imperative of low-carbon city.

scale	aspects	criteria	action/goals
region	planning of metropolitan districts and densely populated urban regions	establishing a metropolitan spatial structure of multiple centres of a 'compact city'	using the expressways, high-speed railways and telecommunications
			ensuring effective communication and operation between cities
			intensifying coordination and resource sharing between urban groups or metropolitan rings
city	urban pattern	establishment of a rational layout between functional regions, natural sceneries and ecological green lands of the city	extension of ecological green lands and ecological corridors and strict maintaining of a pattern of green ecological safety
	mode of land utilization	encourage effective mix of land	obtain balance between residence and employment, avoid huge districts of a uniform function
		reduce long-distance trips of cars	encouraging to planwork, residence and leisure in the same area
		promote industrial upgrading	adjusting industrial layouts in cities
	comprehensive transportation systems	reducing transportation energy consumption	implementing a transportation mode with predominance and priority of public transportation
			controlling the volume of private transport and reducing carbon discharge from private transportation
			promoting bicycle and pedestrian-friendly environment
	construction of infrastructures	adoption of technologies of cycle economy and clean production to achieve low exploitation, high utilization and low or zero discharge	reducing as much as possible the utilization of high carbon energy and discharge of carbon dioxide
community	social/cultural/ and material/development and construction/	introduce a mode of low-carbon conduct to create "green community"	citizens' education towards low carbon
			fostering initiation by local institution
			connecting in a participatory process with companies and government
			promotion of low-carbon behaviour mode among the residents and helping them in changing their life style
site and building	site and environment	assessing the relationship of building to the existing topography and greenery application in the environment	lower demand for space heating and cooling by using the orientation, form in relation to the solar and wind energy
	energy and water	assessing energy consumption and saving capability, use of the most efficient methods to cut down energy and water consumption within buildings, as well as the efficient measures in the treatment of wastes and their storage	services that the building is able to put under its control to be energy efficient; optimal use of day lighting to cut down use of electrical energy; less demand for energy; less hot and cold water consumption
	indoor environmental quality	assessing the indoor air quality and the other comfort conditions like the heat efficiency, humidity ratio, natural ventilation etc.	ensuring air ventilation is of a high quality
	materials-resources	assessing the sustainability value of building and service materials and their affect on human beings, both physically and psychologically in the buildings	materials within the building should not emit pollutants; materials used should be environmentally friendly

Table 1. Planning low-carbon city in four scales and criteria for their assessment [table was made in accordance with Lian (2010), Mutdoğan and Wong (2011), Thomas and Ritchie (2009), Barnett and Browning (1999)].

This case study shows that cities need to always find local solutions appropriate to their particular circumstances (Wong and Yuen, 2011). Having that in mind, the paper analyses existing sites in Belgrade, focusing only on green, recreation and resting areas in its „natural core“, and then assess their way to low carbon, as one of the steps towards making

guidelines for possible low-carboning in already urbanized areas or recommendations for future similar problems and sites. But, this process is inversive: instead of introducing completely new building types for low carbon future, the proposals and examples are derived from existing, **but informal**, forms and sites seen as already low carbon possible.

Low carboning as social implication

It can be said that majority of researchers and authors agree that the battle against climate change must be fought in cities. This is supported by the concept of low-carbon city, which evolves economic, social and environmental aspects. Some of them point out that the key role and responsibility belongs to the government and economic developers. Others are shifting the focus on low-carbon way of life and consumption mode, i.e. low-carbon life as a vision and behaviour characteristic. The basics lie in the premise that the cities are facing the rise in population, which is limited by increased demands and available resources. In order to reduce already unsustainable collective impact on the Earth's climate system, our society should awake its environmental responsibility.

Many companies and governments are trying to do campaigns about saving the planet, protection of the natural environment, 'green' use of energy, water and materials, etc. Nevertheless, the present constellation is such that the role is still on the other side - they will all continue to follow voters' demands and consumer tastes. Their climate initiatives have failed in action to slow the emission of greenhouse gases, so it is useful to explore local, community-based carbon reduction initiatives and consider ways that scholars and government officials can support and build on their efforts. Thus, this pyramid is upside-down: it begins with individual citizen. Individuals must provide the leadership that will eventually galvanize the rest of society. Of course, the actions of single individuals are mainly insignificant. But in acting as examples to others, and showing companies and governments the support for genuine changes in lifestyle, these actions can be powerful. Eventually, private companies will perceive a market for low-carbon products, and governments will come to see that real action on climate change is not electorally disastrous (Goodall, 2007).

In dealing with societal issues towards low carboning, there are several terms that are considered: low-carbon society, low-carbon community, ecovillages, community-based interventions, environmentally friendly behaviours, sustainable living and cultural change, etc. According to Burgess and Nye (2008), social support operates in the sense of reinforcing people's 'green' behaviour and reassuring people that their lifestyle choices are good through the presence of other similarly minded people. It further legitimizes behaviours through confirmatory information and other positive similar examples.

Having that in mind, Skea and Nishioka (2008) propose that the low-carbon society should:

- take actions that are compatible with the principles of sustainable development, ensuring that the development needs of all groups within society are met,
- make an equitable contribution towards the global effort to stabilize the atmospheric concentration of CO₂ and other greenhouse gases at a level that will avoid dangerous climate change, through deep cuts in global emissions,
- demonstrate a high level of energy efficiency and use low-carbon energy sources and production technologies,
- adopt patterns of consumption and behaviour that are consistent with low levels of greenhouse gas emissions.

In addition, the 'Sustainability Equation' by Ehrlich and Holdren describes the impact of human activity on the environment through a formula $I = P \times A \times T$. In other words, it describes how our growing **P**opulation (population of an area/world), **A**ffluence (i.e. levels of consumption), and **T**echnology (efficiency of production and consumption) contribute toward our environmental impact (**I**). While low-carbon societies are a long-term goal, there are

practical steps that can be taken today to put ourselves on the right trajectory. To sum up, following are the criteria for determining social actions towards low-carboning:

- (a) coexistence with nature: local communities should place importance on harmony and interaction with mother nature, and promote “nature-friendly behaviour”,
- (b) active participation: local residents should actively participate in the development of the community and the creation of a low-carbon society based on the consciousness that human beings are a part of ecosystem,
- (c) environment-conscious behaviour: conscious of purchasing and using environmentally friendly goods and services,
- (d) eco-awareness and knowledge: citizens should follow and practice an environmentally friendly lifestyle where they have accurate knowledge of the global warming issue and respect for nature, as well as other people, and assume responsibility for the next generation.

Crate and Nutall (2009, pp. 11) hold that the „public awareness has risen to such an extent that climate change is not just a topic of conversation but a call to action to make major changes in consumer lifestyles“. On one hand, this paper presents a planned environment that is not low-carbon. On the other hand, it also analyses a place in Belgrade, which is not legally supported, but is foreseen as low-carbon. Its advantage lies exactly in cultural shift, i.e. the people’s awareness and changes in their lifestyle towards low-carbon community and low-carboning in general.

Belgrade „natural core“ in urban plans

Belgrade natural core consists of the surfaces under the river flows Danube and Sava, together with river isles, coastal parks, forelands, lakes, ponds and wetlands, which are located right to these two rivers. Exactly this core occupies the central position of the city and is the unifying element of the historical city cores – Zemun and old Belgrade, New Belgrade, and settlements on the third coast – Krnjača and Kotež (Figure 1). The whole area is defined by *Master Plan of Belgrade 2021*. According to this plan, beside the river flows, this natural core is characterized by a river isles (“ada”), which are considered as forms of river sediment accumulation occurred in the lowland river basins:

- Big and Small War Island - foreseen for renewable measures of existing ponds and wetlands (deepening and connecting with the Danube), protection of existing riparian vegetation, and resolving problems with waste water treatment from beach facilities. It is also enjoying the status of precedent protection as a reserve and in the UNESCO process of obtaining the status of landscape of outstanding features;
- Ciganlija Isle (Ada Ciganlija) – recreational area of the city, which is planned for retaining the existing sports fields and facilities, with partial distribution of contents, increasing the attractiveness of Ada in Winter and solving the problem of waste water. Ciganlija Isle is registered by the Institute for Nature Conservation of Serbia as an area with natural values of significance for preserving the environmental quality;
- Medjica Isle (Ada Medjica) – recreational area of the city, planned for retention of existing activities. It is registered by the Institute for Nature Conservation of Serbia as an area with natural values of significance for preserving the environmental quality;
- New Čaplja Isle (Ada Čaplja), today foreland on the Danube left bank with sports, entertainment and recreational contents. Plan is maximal keeping and protecting local native vegetation, and existing marsh and wetland ecosystems, with a minimum ratio of forest area and the free surface of 60:40%. This new island is permeated by a regulated network of river channels and lakes, natural pools of protected river and wetland systems and caused by construction of embankments (“kubici”). It will remain on a natural level with anticipated flooding, except for limited tourist spots without flooding and plateaus of outdoor sports facilities that are on half-levels with periodic flooding.

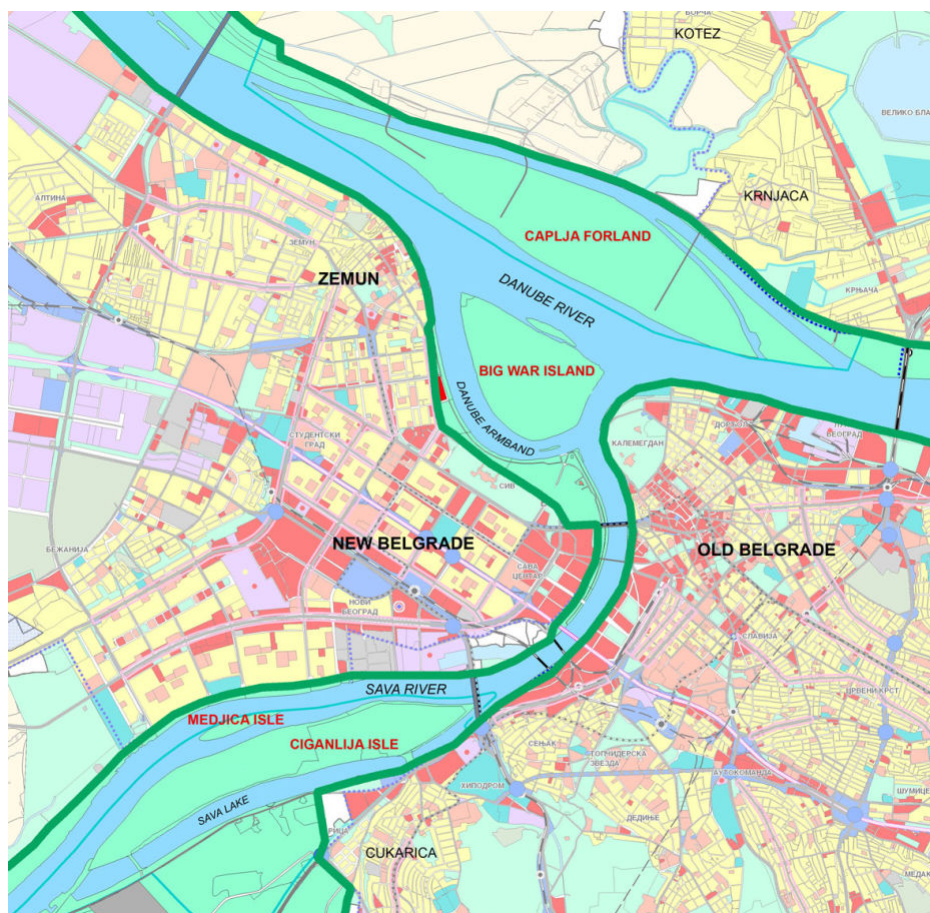


Figure 1. Belgrade natural core in existing *Master Plan of Belgrade 2021* (autor Ana Graovac).

This paper is based on research of Ada Ciganlija space (the only planned and urbanized river island) and Ada Medjica (island that is systematically kept in its natural form, but which is informally used by Belgrade residents) in terms of low-carbon emissions, i.e. criteria that can be potentially evaluated in order to reduce CO₂ emissions.

The aim of the research and comparative analysis that is following, is making a conclusion in the form of guidelines for future construction that can be applied and implemented during urbanization and detailed planning regulation of new river island Čapljja, as well as other similar places beyond Belgrade case.

A. The case study Ada Ciganlija

Ada Ciganlija (Ciganlija Isle) is located on the southern bank of the Sava River, 4 km away from its mouth, and entirely belongs to Belgrade's municipality of Čukarica.

Throughout the history of Belgrade development, Ada Ciganlija has preserved its natural resources, which form a dynamic ecosystem and represent an ecological oasis in the city center with parts of “untouched nature” covered with wild vegetation. However, with more than 50 sports fields and a center, Ada Ciganlija today is a largest sports center in Belgrade and is only planned and urbanized river island in the city.

With damming of the right Sava armband 1967, Ada Ciganlija has become a peninsula, surrounded by an embankment and bordered with Sava River on one side and Sava Lake on the other. Today, along with the lake and the Makiš fields, Ada Ciganlija covers an area of 700 hectares and has three interconnected functional zones – Urban zone, Lake zone and Natural zone (Figure 2).

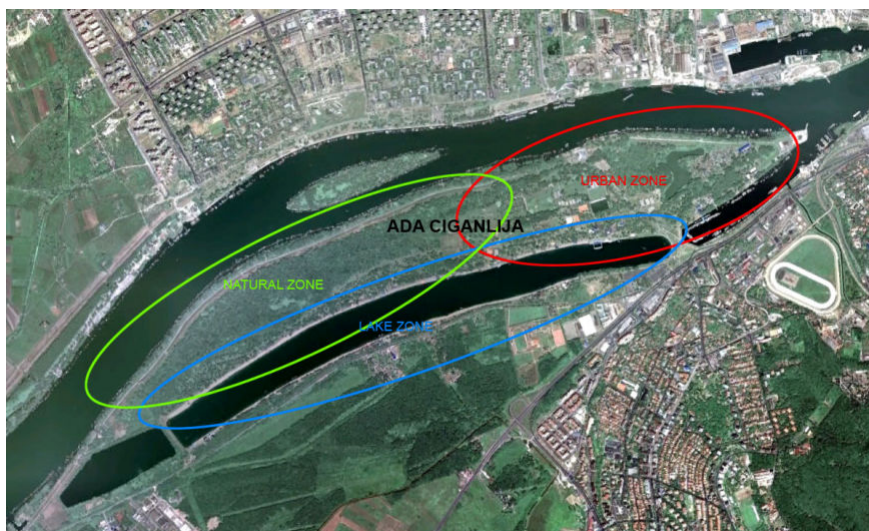


Figure 2. Aerial view of Ada Ciganlija and its functional zones: **natural**, **urban** and **lake** zone.

Sava Lake is long 4.2km and 200m wide with a largest city beach of 7.5km long, equipped with complete infrastructure, public bathrooms, showers and drinking fountains. Sports zone, greenery, pedestrian and cycling routes and commercial areas, consisting of over 70 restaurants and floats, are developed around the Lake (Figures 3, 4, 5, 6 and 7).

The Lake is connected with Sava River through the permeable dam on the upper embankment, the sump and purified enclosed lake, which are in the system of Belgrade's water supply sources. From the sump, Sava Lake is continuously fed with filtered water, while pump at the lower tip releases water in the Čukarički armband. This provides artificially flow of water through the Lake. The use of motor boats on the Lake is strictly prohibited, as well as pet allowance.

Sava Lake is the reservoir of city's drinking water and is part of the most stringent protection zone of Belgrade's water supply system, which has a strategic importance for Belgrade and, due to that, prohibits any extensive investments and construction. In the context of these facts and the need to fulfill all the potentials that this area has, City of Belgrade is preparing the new *Detailed urban plan for Ada Ciganlija* which will provide new facilities such as expansion of sports and recreation center, golf courses and new residential settlements.

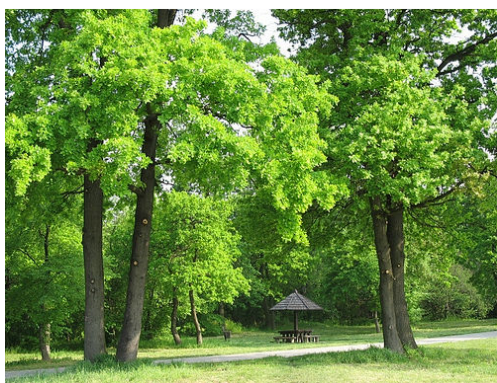


Figure 3. Natural ambient of Ada Ciganlija forest.

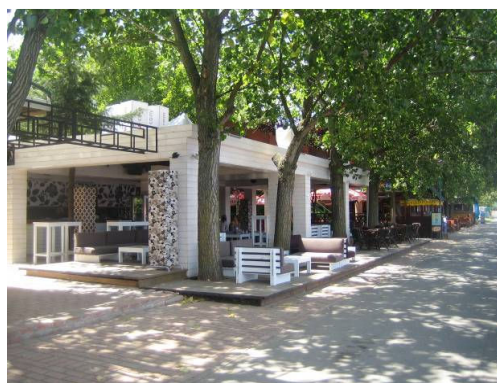


Figure 4. Commercial zone with restaurants.



Figure 5. Beach in the middle of the summer.



Figure 6. Sports center with pools.



Figure 7. Sava Lake in springtime.

At the entrance of Ada Ciganlija is a parking for 1000 vehicles, and in Čukarički armband a winter quarters for boats and marine is located. Traffic regime on the Ada Ciganlija is restricted, and only supplies-vehicles and VIP parking is allowed. Ada Ciganlija can be reached by regular bus lines of the city public transport, cycling lanes and boats. Nevertheless, its functional connection with urban fabric of the city is not satisfactory.

B. The case study Ada Medjica

Ada Medjica is an ovally shaped island in the Sava river, a kilometer long and 200m wide. It is located just north of the central part of the much larger Ada Ciganlija and belongs to the Belgrade's municipality of Novi Beograd (Figure 8).

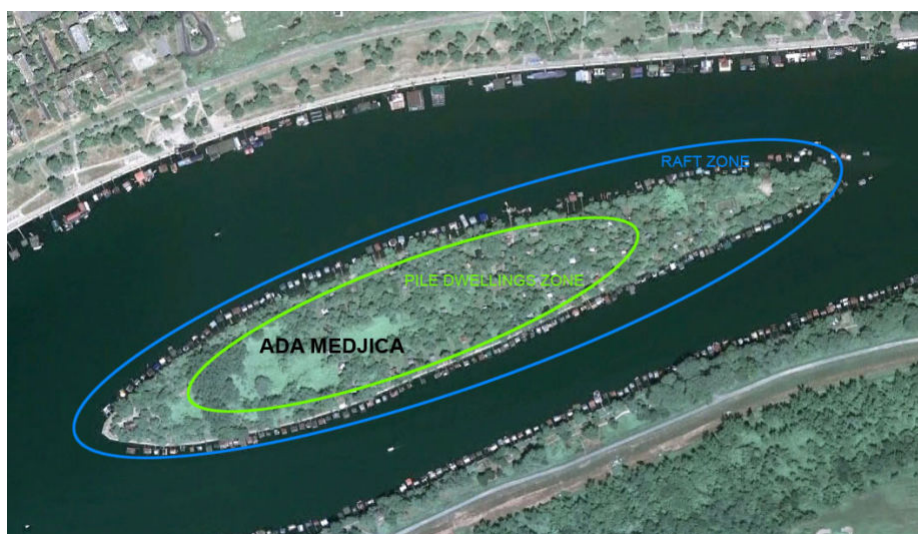


Figure 8. Aerial view of Ada Medjica and its functional zones: **pile dwellings** and **rafts**.

It is forested and has no resident population, but has many weekend-houses owned by the Belgrade residents. During summer, over 2,000 Belgraders spend weekends on Ada Medjica, which is accessible only by small boats (these boats are considered to be a public transport). Leisure activities include swimming, walking and resting, as the area is nearly intact and without touristic and commercial facilities. However, the nature on island is not „wild“ but rather cultivated and well maintained (Figures 9 and 10).

Ada Medjica is not officially planned, nor urbanized. It has no infrastructure or other facilities, so all its buildings and constructions can be considered as informal or unplanned. Seasonal settlement is spontaneously and dispersly organized by its residents and consists of pile dwellings and floating structures (like rafts), as Ada has no artificial embankment and can be occasionally completely flooded (Figures 11, 12 and 13).



Figure 9. Pile dwelling in the middle of the isle.



Figure 10. Pedestrian paths and gardens.

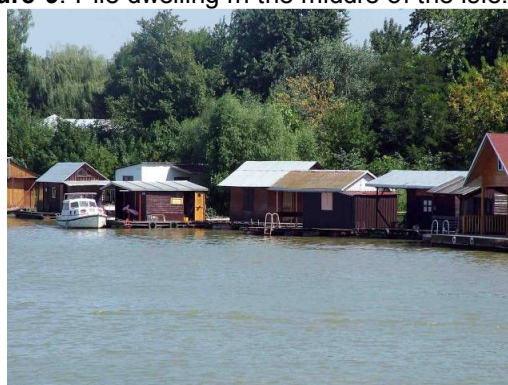


Figure 11. Rafts along water front.



Figure 12. Rafts in the flood season.



Figure 13. Ada Medjica – approaching view from the north.

Residents of Ada medjica forms a very organized social group, which is autoselective and oriented to preservation of the nature and island's natural habitat. Due to that, no „inconviniant“ buildings or activities are allowed.

C. Comparative review (Ada Ciganlija – Ada Medjica)

Relying on the conclusions of previous chapters as well as for the purpose of comparative analysis of these two natural green and recreational areas on river isles with significantly different way and intensity of use, the following comparative table is made:

Aspect	Specific criteria		Ada Ciganlija	Ada Medjica
Land use and urban functions	1	Functional connection with surrounding area	-	-
	2	Optimal mixture of functions (residential, commercial, recreation, etc.)	-	-
	3	Activities that pollute environment (exist/not exist = +/-)	+/-	+
Traffic	4	Traffic connections with different types of transport (by car, bus, train, boat, bicycle)	+	-
	5	Public transport to and on-site	+	-/+
	6	Car traffic regime (allowed/disallowed = +/-)	+/-	+
	7	Bicycle and pedestrian paths	+	+
Infrastructure	8	Use of the natural, on-site resources (technical water, bio-fuel, etc.)	-	+
	9	Use of the natural specificities of the site (river flow, wind, natural greenery, water, etc.)	+	+
Energy consumption	10	Use of renewable energy sources	-	+/-
	11	Use of natural ventilation, orientation, building form etc. to reduce need for heating and cooling	+	+
	12	Use of daylight, sun energy and wood debris to reduce the need of electrical power for artificial lightening, heating/cooling of water and food preparation	-	+
	13	Used-water and waste treatments	+/-	-
Building materials	14	Use of natural materials (for example wood)	-/+	+
	15	Use of recycled and on-site materials	-	+
	16	Recycling and using of obsolete buildings, materials and structures	-	+
Social impact	17	Coexistence with nature	+	+
	18	Active participation	-	+/-
	19	Environment-conscious behaviour	+/-	+
	20	Eco-awareness and knowledge	+/-	+

Table 2. Comparative analysis of Ada Ciganlija and Ada Medjica.

All this criteria are not weighted, so we cannot speak of simple sum of pluses or minuses where obtaining of one criteria compensates the loss of another. But, through comparative analysis of this two natural and recreational spaces – one urbanized, organized and planned, and another spontaneously generated, but also organized and guarded by the community that inhabits and uses it, we could speak of several general conclusions, such as:

- At the level of integration into the urban fabric of the city and functional relationship with the surroundings, both of these areas fall in the test of sustainability.
- The area that is planned, urbanized and utilized for its purpose is much better connected and equipped with traffic, than informal (unplanned), which could be reached with very limited number of options – by boat.
- The lack of classic infrastructure systems in informal, unplanned area causes much more reliance on natural and on-site sources, which is a paradox in a sense.
- Taking into account the lifestyle of people and activities that takes place spontaneously in informal, unplanned area, it can be said that it is a zone with very low power consumption and the biggest problem represents the treatment of used water and waste.
- Due to its low-cost, prefabricated and more family oriented buildings, unplanned area is more built with local and recycled materials and structures, while planned area faces much more consumerism.
- Community that represents unplanned area is a solid, naturally selected system with a very high level of awareness about preservation of the natural environment, while

among the visitors of the planned, urbanised area prevails awareness of being in a natural environment that somebody else actually takes care of.

As a concluding remark of this analysis it can be said that the study and the outcomes derived from it, refer ONLY to highly specific phenomenon of informal settlements and seasonal dwellings on the green river isles and forelands in the heart of Belgrade, and certainly cannot be applied to any other informal settlement or unplanned residential area at the outskirts of the city, or to any another type of usurpation of green and recreational areas with unplanned and inadequate facilities.

D. Furthermore – Ada Čaplja guidelines for development

Čaplja is wast forland with strong environmental and recreational potentials on the left Danube riverbank. It consists of woods, wetlands, fens, canals and wild beaches and covers the area of 900 hectares. In *Master Plan of Belgrade 2021* it's planned to be new river island, divided from the shore with new canal and beach zone. Currently, its a part of the *Study of the costal areas of Belgrade*, which gives the preliminary zoning of this area and general plot fot its future detailed planning (Figure 14).

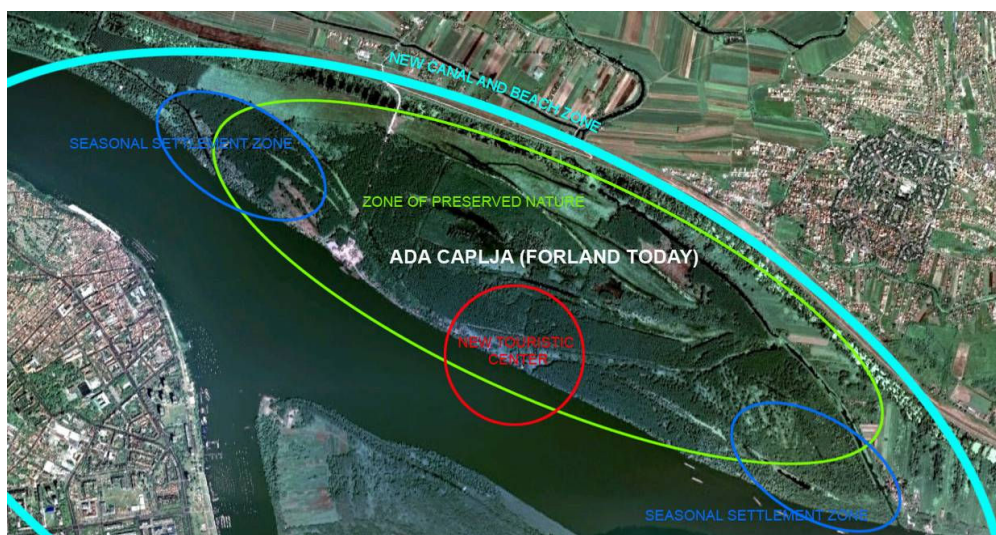


Figure 14. Ada Čaplja – preliminary zoning.

Having that in mind, this study tries to provide few guidelines for planning of new contents on Čaplja island, based on research of environmentally and low carbon potentials of isles of Ada Ciganlija and Ada Medjica:

- Whole area should be functionally connected with its surroundings – with the settlements and local centers in its hinterland as well as with Danube River basin and natural and urban zones on its other riverbank;
- All the activities and land-uses that pollute environment in any degree are not allowed (like golf-courses and parking lots);
- It should be easily reached with number of different kinds of traffic (public, private), but traffic on the site should be restricted as much as possible, based only on bicycle routes and hybrid cars;
- The natural, on-site resources, like tehcnical water, bio-fuel, termal springs below ground, river-flow, timber, wood debris, should be major infrastructure and facility basis for all further building and development;

- The big attention should be payed on used-water and waste treatments, because they need separate, well organized and expensive systems for collection and disposal;
- The building forms like pile dwellings and rafts are most suitable for construction because:
 - a) They represent a traditional type of settlements on Belgrade riverbanks,
 - b) They are produced from natural and often recycled materials with attention payed on good orientation and natural ventilation,
 - c) They are non-dependent on seasonal floods and don't need artificial embankment to protect them from it (like any other construction does);
- The new Island should be promoted like place for nature-lovers and eco-awakened people and tendention for their social coherence should be strenghtend.

In recent polls that are conducted with Belgrade citizens for the needs of *Study of the costal areas of Belgrade*, the major percentage of respondents (around 70%) expresses the need for new natural, green and recreational zones on Belgrade riverbanks, and not commercial, service and urbanized contents (Figure 15).



Figure 15. Ada Caplja as it exists today.

Conclusion

In planning low-carbon cities, economic and environmental aspects are often put on the first place. It is considered that well-organized, planned and strategically strong development is the key in achieving sustainable, low-carbon imperatives. Planning policy in Belgrade is rather strict, procedures very detailed, and methods are transparent and participative. Nevertheless, there are numerous problems that alienate us far from achieving this imperative. Despite of all, the action to address climate change goes not only on government and companies, but on people as well, their awareness, conscious and responsible mode of behaviour. It is the main reason why this kind of 'low-carbon attempts' should be supported and promoted, whether they are regular or what we consider possible.

Presented examples, which crucially differ in (un)planned framework, have one thing in common: they are eco-shelters for Belgrade's inhabitants. Analysing both cases, we realized that people play the key role and share the heaviest responsibility in undeniable climate change. Maybe the situation of informal settlements is a result of our country in transition or planning procedures' inefficiency and lack of mechanisms. It also does not mean that every land usurpation or posterior legalization should be allowed. However, attempts of this kind present people's positive stand and action towards nature and should be recognized and supported as they fulfil main social aspects of low-carboning.

In addition, in 1964 Bernard Rudofsky put on the exhibition *Architecture without Architects: a Short Introduction to Non-pedigreed Architecture*, at MoMA, New York. He

introduced architecture produced by the spontaneous and continuing activity of people with a common heritage, within a community experience. These spaces and structures demonstrate the significant human act dealing in coexistence with nature and its resources. It challenges our profession to question what makes a building or a city „legitimate“. It is also an alert tone towards contemporary (consumer-led) lifestyles and the ones we endanger. As he said in the exhibition book: „For want of a generic label, we shall call it vernacular, anonymous, spontaneous, rural, as the case may be“.

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