

## THE “VĂCĂREȘTI LAKE” PROTECTED AREA, A NEVERENDING DEBATABLE ISSUE?

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**Abstract:** “Văcărești Lake” represents an intra-urban area of Bucharest, perceived as a wetland that raises numerous controversies. The area constituted a part of a complex urban hydro-technical project designed to ensure flow for navigation on Dâmbovița River and to increase the city recreation potential. For more than 26 years, this space situated in the pericentral area of Bucharest faced abandonment, leading to its natural development as an area covered by secondary vegetation composed of opportunist vegetal species and adjacent fauna. The study aims to assess the impact of the newly adopted protected area status of Văcărești Lake on the urban quality of life and the sustainable planning of the city. The methodology included the assessment of the forest vegetation of the area using LiDAR technical instruments, the previous results of the authors’ research on the area and a community perception investigation through interviews with local inhabitants. The main findings reveal that the status of “natural protected area” granted to Văcărești Lake was given with no solid investigation on correlation of its features with its best possible usefulness for the city. Representing an encapsulated and abandoned man-made object, without a real and stable landscape value, Văcărești Lake should be planned as a public park, as demanded also by the inhabitants. The conclusions of the study raise skepticism on the evolution of Văcărești Lake as protected area although Bucharest City Hall offered to administrate it.

**Keywords:** Semi-natural wetlands, urban protected areas, ecosystem services, community perception, land-use conflicts, Văcărești Lake

### 1. INTRODUCTION

Bucharest represents a dense urban concentration of population and economic activities, which tried, over time, to capitalize all the opportunities to diversify its internal structure (Ianoș et al., 2016). In this regard, wetlands received special attention, considering their ability to improve the quality of urban life, if well managed. Wetlands have been analysed in many studies, being considered critical natural resources (Ng et al., 2013; Castro et al., 2015; Bosma et al., 2016; Davis et al., 2016; Garmendia et al., 2016; Petrović et al., 2016).

Besides natural wetlands, there are semi-

natural wetlands which resulted from changes made in the urban landscape (Manea et al., 2013; Ianoș et al., 2014; Munteanu, 2014; Laabassi et al., 2015; Ianoș et al., 2016; Manea et al., 2016) and which determined the increasing complexity of the land use.

Usually, wetlands are defined as areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing (RAMSAR Convention definition). In addition, wetlands are areas of high biodiversity (Polajnar, 2008; Boromisza et al., 2014; Manea et al., 2016; Petrović et al., 2016).

The presence of wetlands inside urban areas is important for providing ecosystem services (habitat

preservation for threatened species, climate regulation) (Polajnar, 2008; Ioja et al., 2010; Moudrý & Šímová, 2013; Ng et al., 2013; Cohen et al., 2014; Castro et al., 2015; Bosma et al., 2016; Manea et al., 2016; Petrović et al., 2016). This role is especially augmented by vegetation (Laforteza et al., 2009; Sirodoev et al., 2015; Davis et al., 2016), which ensures the quality of the environment (Cohen et al., 2014) and improves the quality of urban life (Ng et al., 2013; Feltynowski, 2015; Chen & Hu, 2015; Ambrey, 2016; Davis et al., 2016). Ecosystem services were less studied within cities (Gavriliadis et al., 2016), and mostly inside natural ecosystems (e.g., wetlands) (Gómez-Baggethun & Barton, 2013).

Wetland sites represent an intensely debated topic, being often controversial and generating conflicts between economic and public interests and conservationists (Polajnar, 2008; Ianoş et al., 2014; Petrović et al., 2016; Ianoş et al., 2017). Controversial issues of wetlands, either natural or semi-natural, relate especially to their land use. Most studies emphasize the scientific and ecological value of wetlands (Boromisza et al., 2014; Munteanu, 2014; Castro et al., 2015; Garmendia et al., 2016; Manea et al., 2016; Petrović et al., 2016; Simeonova & van der Valk, 2016), which implies their prudent use (Polajnar, 2008). Other studies, analysing the management of wetlands, offer solutions to integrating them within the city development (Colesca & Alpopi, 2011; Laforteza et al., 2013; Popovici et al., 2013; Ianoş et al., 2014; Jones, 2014; Feltynowski, 2015; Ianoş et al., 2016; Simeonova & van der Valk, 2016). In addition, the capitalising of their ecological value is envisaged, through educational (Ioja et al., 2014), socio-cultural (tourism) (Simic et al., 2014), and recreational purposes (Ianoş et al., 2014).

Although a part of biourbanism trends (Manea et al., 2015), as solution for the sustainable development of cities, the planning and management of natural or semi-natural wetlands located inside the urban environment raises controversy because of the current development context that is under the pressure of economic factors and urban sprawl (Li & Liu, 2016). This situation, specific also for post-socialist countries, generates sometimes quite opposite land use solutions (Simeonova & van der Valk, 2016; Niță et al., 2015a; Ianoş et al., 2017).

Analyses on the relationship between urbanization and urban protected areas highlight that urban development strongly affects protected areas. This happens either through their fragmentation (Bonthoux et al., 2014; Paul & Nagendra, 2015; Hüse et al., 2016; Niță et al., 2016; Ongoma et al., 2016), the destruction of biodiversity (Polajnar, 2008; Ng et al., 2013; Bonthoux et al., 2014; Petrović et al.,

2016), or by postponing the sustainable management decisions (Ianoş et al., 2014), because of their passive management (Ianoş et al., 2017).

Generally, wetlands are mainly assessed through the ability of natural protected areas to produce ecosystem services (Ng et al., 2013; Castro et al., 2015; Davis et al., 2016). Preserving and increasing the biodiversity (i.e. the number of plant and animal species) of these spaces are strongly linked to such factors as climate and topography, but also to the characteristics of the species inside the natural wetlands (Moudrý & Šímová, 2013; Petrović et al., 2016). Usually, the inventory of vegetation is done using multiple methods, Corine Land Cover (Petrişor, 2015) and remote sensing techniques (Sánchez-Loper & Lerma, 2014; Iordan & Popescu, 2015; Jovanović et al., 2015; Milanović et al., 2016) being preferred.

In this regard, Ioja et al., (2010) considered two important issues to achieving the conservation goals of protected natural areas: 1) their *conservation value*, which involves an optimal design and sufficient surface to preserve the ecosystem integrity, overlapping boundaries with biodiversity hotspots or threatened species ranges, and its self-sustainability in the face of financial scarcity, through optimal conservation strategies; and 2) their *resources for conservation*, based on the adequate implementation of the management activities within the enforcement law and the monitoring game theory (Walker, 2009).

For integrating land-use conflicts into the strategies for territorial planning, some authors used a multi-criteria analysis (Kamruzzaman & Baker, 2013) to create a tool based on ten main criteria, divided into two categories: spatial indicators and urban development indicators (Ioja et al., 2014).

The aim of this study is to assess the impact of declaring the "Văcăreşti Storage Reservoir" as a protected area (Governmental Decision no. 349/2016) on the quality of life and the sustainable urban development of Bucharest. The key question is whether the decision of the government transforms this semi-natural wetland into a less controversial urban space.

## 2. MATERIALS AND METHODS

### 2.1. Study area

Văcăreşti Lake is a part of a hydro-technical project designed to prevent the flooding caused by the Dâmbovița River, which crosses Bucharest, and to ensure the constant flow of water needed for river transportation (Ianoş et al., 2014). Although the project was 90% completed by the end of the

communist regime (1989), it has never been finished. This pericentrally located urban space was henceforth abandoned. Due to the lack of further interventions in the area, semi-natural marsh ecosystems (species of trees adapted to the local conditions; primary vegetation as temporary habitat for migratory birds and reptiles) have been formed.

In this context of natural development, Văcărești Lake became a space of dispute between the advocates of its ecological value and the developers planning a mixed land use of the wetland: residential, commercial, sports and recreational urban areas (Zonal Urban Plan, cited by Ianoș et al., 2014).

Further on, a legal controversy was added to the dispute related to the land use of Văcărești Lake. The owners of the land are in conflict with the national authorities, requesting compensations, as, during the communist regime, the state abusively took the property of their land for the hydro-technical project, while several houses were demolished, including the Văcărești monastery. Moreover, even after its declaration as a protected area in 2016, there are still landowners that hold individual parcels totalling 5 hectares inside the Văcărești Lake area.

The status of protected area involves keeping the area of Văcărești Lake within its former territorial characteristics, which are due to abandonment, lack of intervention and natural development.

## 2.2. Urban protected area assessment

In the analysis that we develop, the main issue is the valuation of the semi-natural wetland in terms of its ability to provide ecosystem services, contributing to the quality of the environment while producing direct and indirect benefits to the local community.

The multi-level assessment of Văcărești semi-natural wetland started with a biodiversity investigation, focusing on vegetation. To identify the number and position of the tree species in the study area, we used the LiDAR technology (Light Detection and Ranging). This technology has the advantage of being able to penetrate beyond the canopy, using filtering techniques. Through this technology, we obtained data related to the height and density of vegetation, due to high resolution, resulting in 3D vegetation information, but also on the average diameter of the tree trunks, the canopy volume or the interactions between vegetation and topography (Iordan & Popescu, 2015). The information resulted from the LiDAR measurements and the field-collected data was processed and mapped using a GIS software.

A second stage of the field research was conducted in October 2015 to assess the community

perception on the newly declared protected area in terms of its future specific land use impact on the quality of urban life. The survey included 40 inhabitants and the average duration of an interview was of about 50 minutes. The original intention of the research was to interview, in equal proportions, inhabitants from the three major age categories (under 30 y.o., 30-65 y.o. and over 65 y.o.), but this target could not be achieved. The highest share of those interviewed included inhabitants over 65 y.o. (42%), while the youth (inhabitants under 30 y.o.) was the least represented group (24%). Some of the interviews' results were already used for previous studies (Ianoș et al., 2017), but, a part of the local community investigation information represents the support elements of this research as well.

## 3. RESULTS AND DISCUSSION

Văcărești Lake represents the intra-urban space of Bucharest with specific dynamics from a built-up territory to a semi-natural wetland (Ianoș et al., 2017). The space underwent several transformations, from a residential and agricultural area, to being an excavation designed to prevent flooding, followed by an abandonment period that favoured the process of naturalisation, which eventually resulted, in May 2016, into the protected area accreditation. In this context, the analysis focuses on the assessment of the appropriateness of the decision taken by the public administration in relation to the potential side effects arising from the management of this semi-natural wetland as protected area.

The first level of assessment, focusing on the biodiversity of the area, included investigations on the distribution and density of the trees inside the Văcărești Lake territory. Within an encapsulated space, differently from a simple herbaceous environment, trees represent the biodiversity element capable of sustaining the characteristics of a complex natural reserve. The degree of natural reforestation may encourage the renaturalisation process of this area.

Our exhaustive analysis included the identification of the trees number, position and their quantitative and qualitative characteristics (density, species composition). Using the LiDAR technology, 999 trees were identified inside Văcărești Lake area (Fig. 1).

With the LiDAR technology, we located all the trees from the study area, but those being less than 3 m high. The results highlight an uneven density of the trees (Fig. 2), caused by the unfit natural conditions due to: the concrete adjacent surface, leading to excessive glare and a chaotically structured soil; and the areas with excess moisture.





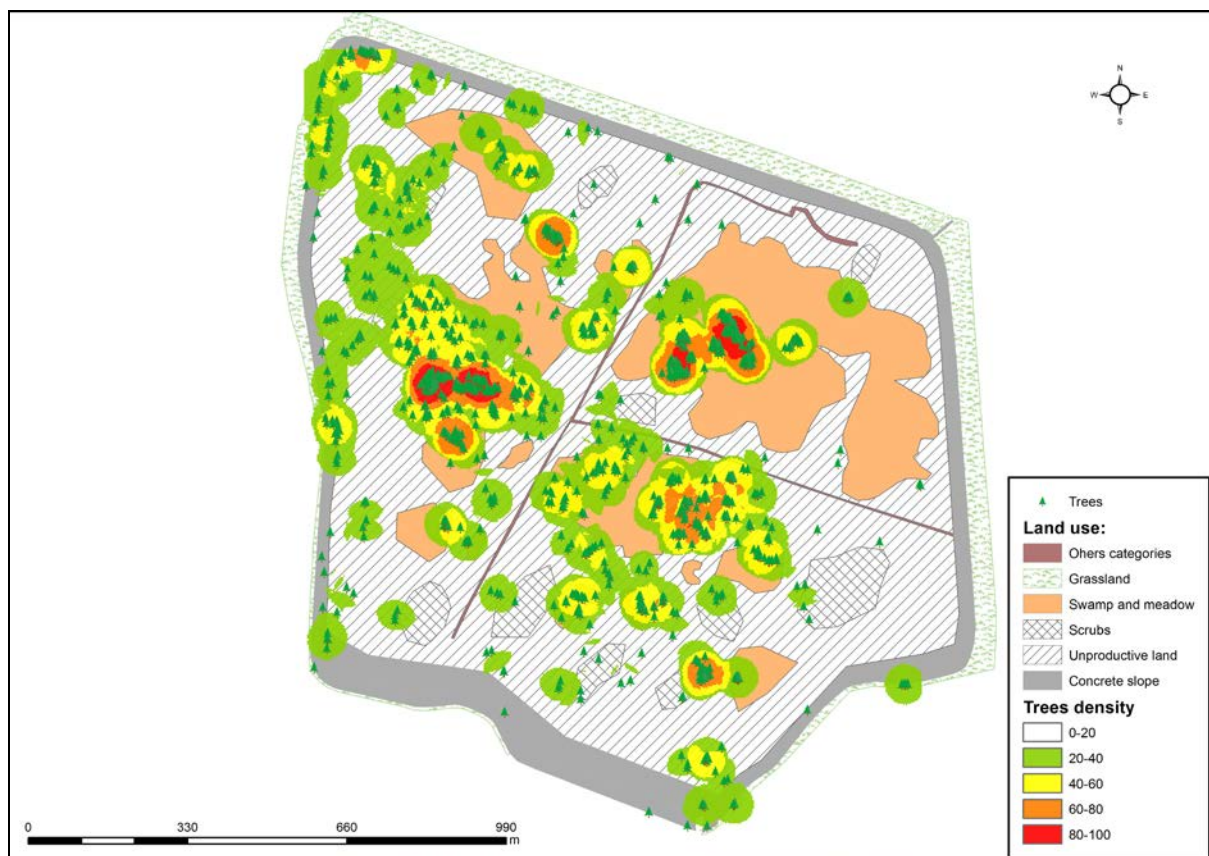


Figure 2. Land use and density of trees inside Văcărești Lake Protected Area

Table 1. The structure of Văcărești Lake trees

Tree species	North-West	North-East	South-East	South-West	TOTAL
Weeping willow ( <i>Salix babylonica</i> )	209	149	237	114	<b>709</b>
White willow ( <i>Salix alba</i> )	92	-	32	-	<b>124</b>
Field elm ( <i>Ulmus minor</i> )	11	-	5	5	<b>21</b>
Black elderberry ( <i>Sambucus nigra</i> )	9	-	8	-	<b>17</b>
Maple species ( <i>Acer</i> )	4	2	3	-	<b>9</b>
Poplar species ( <i>Populus</i> )	10	-	1	2	<b>13</b>
Oak species ( <i>Quercus</i> )	20	14	6	5	<b>45</b>
Plum species ( <i>Prunus</i> )	11	1	-	7	<b>19</b>
Other species	10	2	17	13	<b>42</b>
<b>TOTAL</b>	<b>376</b>	<b>166</b>	<b>309</b>	<b>146</b>	<b>999</b>

Source: Species identified by the authors

Most of the study area is covered by herbaceous vegetation (naturalised various species of flora), marshes and small depression areas flooded from time to time. In addition, there are only two species of birds that would be of interest: the red goose – registering five pairs in 2014 (without being reported later!), and the pygmy cormorant, totalling 10 pairs in the same year (it is the only bird that winters within the protected area). There are complex impediments that involve significant costs, such as special arrangements to ensure the independent evolution of the wetland and a consistent biologic production, in order to increase the biodiversity of the protected area.

On a second level of assessment, the

perception of the local community on the protected area status of Văcărești Lake (Table 2) differs depending on the age group of the respondents.

Only the age groups of over 30 years old expressed opinions on the characteristics of the landscape, prior to its transformation into a reservoir. For those under 65 years old, the dominant image was that of a rural landscape, and for elder respondents the former area was a "green oasis". The current state of the area is perceived rather differently: young respondents see Văcărești Lake as an abandoned land, while the adults consider it a dangerous place – because of stray dogs, homeless people, and drug users gathering there. The elderly associate the Văcărești Lake area with a ruined landscape.

Table 2. Community perception on the Văcărești Lake Protected Area

Age category (years old)	Perception on the former landscape	Perception on the current landscape	Knowledge on the land owners – authorities conflict	Perception on the future as the “Bucharest Delta”	Perception on the area renaturalisation
Under 30	–	Abandoned land	No knowledge	Great idea	Possible good recreational opportunity
30-65	Rural landscape	Dangerous area: homeless people, drug users, semi-wild dogs, wild vegetation	Yes, there is a huge problem with the rights of former land owners	Bad idea, without major intervention. Technically isolated, the area does not have the conditions to be a real delta.	It involves an ongoing natural process in an unknown direction. Bad management practices are likely to affect the entire surrounding area, both directly and indirectly.
Over 65	Green oasis	Derelict landscape	The future of the area depends on this conflict mediation	What does delta mean? Bad idea, as the costs are too high to transform the completely isolated artificial excavation into a natural protected area.	This wild area is very dangerous for our health. Surely, criminality, pollution and noise are likely to increase, which might affect the quality of life in the surrounding area.

Source: Interviews applied by the authors

In general, most of the population is aware of the property-related legal issues, emphasizing the idea that this is an emergency for the municipality to solve. In addition, the adults and the elderly believe that the area cannot be considered a "delta", as opposed to those under 30 y.o., who are excited about this analogy. The renaturalisation of Văcărești Lake, aiming at its functioning as a protected area, represented a crucial and debatable element of the community perception investigation. In contrast with the young respondents who support the idea of Văcărești Lake as a protected area, the adult population was somewhat reluctant, while the elderly considers that maintaining this functionality for the area would bring danger for the health of the population.

In such a context, the community was consulted on their opinion for the possible directions of evolution of Văcărești Lake (Table 3). The investigation outcomes highlight the dominant option of the local community for the conversion of the semi-natural wetland into a public park. The natural regeneration of the site is mostly disregarded by the respondents, but there is a great fear that the area would remain abandoned (currently, the protected area governmental decision and the involvement of the Bucharest administration exclude this threat).

The community investigation was conducted before the adoption of the Government decision declaring the controversial wetland as protected area. After Văcărești Lake receiving a new status, anything

has changed at territorial level, in the physiognomy and functionality of this space, excepting the disappearance of a few improvised shelters, the perception of the local community remains valid.

Table 3. The future development of Văcărești Lake (local community perception)

Age category (years old)	Public park (%)	Natural regeneration (%)	Risk of abandonment, resulting in a hotbed of infections (%)	Urban delta (without connection with Dâmbovița river) (%)
Under 30	44.4	22.2	33.3	55.5
30-65	82.2	14.3	71.4	7.1
Over 65	81.4	5.9	70.5	11.7

Source: Interviews applied by the authors

The renaturalisation of an artificialized space brings significant risks for the quality of urban life. In this context, an important issue arises on the opportuneness of declaring Văcărești Lake a protected area? Who are the real beneficiaries of this newly gained status? The semi-natural wetland became a natural reserve based on incomplete scientific studies that almost ignore possible risks for the population and the costs involved in maintaining such a natural park.

Among the risks that can affect, directly and indirectly, the population of a metropolis such as Bucharest, the spread of epidemics, through the vectors of disease transmission that can be birds or insects, is

the most significant, considering the restrictions imposed by the protected area regulation in acting appropriately. A recent study shows that infections caused by the West Nile virus may represent a real risk for Bucharest (Nicolescu et al., 2016). Every year, new cases of West Nile fever appear in Bucharest and to the south of the city (1 December commune), so that measures of prevention and control need to be taken (Nicolescu et al., 2016). The current frequency of long periods of drought, the high temperatures and the urban heat island effects can strongly affect the protected area ecosystems, encouraging the multiplication of pathogen agents with a highly likely impact on the population. Unfortunately, the governmental decision for the protected area status of the wetland does not provide measures for the protection of the population too. Obviously, the high possibility of the new natural reserve to act as a breeding and propagation ground for disease vectors still represents an issue. At first, the wetland appears to increase its ecosystem services through supporting it as a protected area, but, in fact, the gain for the community is low in comparison to the negative effects.

Additionally, referring to the protected area goal of maintaining and increasing the wetland biodiversity, a specific Bucharest local fauna represents a danger for Văcărești Lake in the coming years. So that, the recent dynamics of the population of seagulls in Bucharest shows a very strong pressure on the fish fauna and over the population of other small birds in the city, as these get attacked, especially during winter. With the projected increase of ponds surface within the protected area, these will become attractive for the seagulls to locate, fact that will parasite the expected ornithological and fish fauna.

The scientific substantiation study for the management of Văcărești Lake Protected Area mentions a special zoning of the semi-natural wetland. The included three types of areas are: 1) "a full protection area (the ponds fed by natural springs and the swampy area with specific vegetation); 2) "a buffer zone or of sustainable management (rest of the area inside the dam)"; and 3) "an area for the sustainable development of human activities (the dam and its embankments)" (Scientific substantiation study of the natural protected area Văcărești Natural Park 2014: 31). Analysing this structure, it follows a concentric pattern focused on the areas of swamps and marshes located in the northeast of the area. Given that, during the snowmelt, the area occupied by ponds is flooding the swamps too, exceeding 3-4 times its usual surface in summer and autumn, the full protection has very fluctuating boundaries. Hence, there results the inconvenience of developing protected area traditional activities in the established buffer zone.

Obviously, in the case of a developing ecosystem, the internal zoning has to be established outside the area, not within it. The future development of Văcărești Lake area is uncertain while seasonal variations are extremely high, and the protection of this encapsulated wetland landscape seems inadequate compared to the needs of the local community (Ianoș et al., 2014) and the requirements for maintaining a good quality of urban life in the area and the sustainable development of the city.

In addition, for the implementation of the protected area management plan, the proposed legal solutions for the property issues remain questionable, given that a significant surface of about 5 hectares still belongs to individuals, who will need expropriation because, by the Government Decision no. 349/2016, the entire space became of public interest. The expropriation process for public use would be the second one in the area, after the first one taking place in the '80s.

Among all these complex issues raised by managing Văcărești Lake semi-natural wetland as a protected area, the question of financial resources intervenes. The municipality of Bucharest expressed its support for the Văcărești Natural Park Association (the official administration body of the protected area), through a cooperation agreement with a term of 5 years. The city authorities guarantee the financial resources for the management of the protected area (Executive Order of the General Council of Bucharest, 2016).

The efficient management of Văcărești Lake protected area requires additional interventions, besides the already stipulated aspects of conservation, protection and prudent valorisation of the wetland resources. So that, the area asks for major investments in infrastructure to support, directly or indirectly, the purposes for which Văcărești Lake was declared a natural protected area in the first place.

Although not yet envisaged, the proper functioning of the natural area urgently requires complex systems of water circulation in the area of swamps and marshes (which cannot be implemented without high costs), otherwise, eutrophication will be extremely intense, with negative impact on the nearby residential areas and the population too. Even if in the case of ensuring the permanent flowing of the water (e.g. the lakes in northern Bucharest), regular dredging is necessary to reduce clogging and eutrophication. Alternatively, in the case of the protected natural area, any intervention may affect the naturalisation process of this artificial space, which gives birth to a new conflict between the protected area interests and the city needs for an adequate quality of urban life.

Additionally, given the position of the

protected area within an urbanized area, an efficient territorial management would have required the development of a Zonal Urban Plan (PUZ) before declaring it a protected natural area. Such a planning tool would have clearly established its territorial insertion, structure and functional compatibility within Bucharest.

From a functional perspective, the future infrastructure investments in the area should eliminate the effect of an urban capsule, determined by the concrete marginal slopes of Văcărești Lake. In such conditions, the proper functioning of the wetland as an urban natural reserve requires a feasibility study to identify solutions to eliminate the too high albedo generated by the current slopes and to reduce the partial isolation of the bottom of the area depression, which hinders the adequate maintaining of the swamps.

Given the analysis results, the main findings of the Văcărești Lake Protected Area assessment highlight the haste of the decision to declare it an urban reserve. In the context of multiple managing issues and in the absence of a concrete management plan to solve them, Văcărești Lake can be used for the benefit of third parties while it constitutes an area of conflict for the city sustainable development and the quality of urban life.

For the moment, the following stringent questions remain. Who has the responsibility to monitor the balance between the species of plants and fauna, in the conditions of promoting a natural process of "plant and animal populating"? Who will analyse the potential invasive species and their impact on the local biodiversity? Who will assess the carrying capacity of the extremely fragile substrate, given the thin layer of soil, the concentration of pollutants, including the settled particles, in this space of depression? Who will investigate the effects of the increasing frequency of droughts, mainly the shrinking of water table in the summer and the accelerated eutrophication? All these inquiries need to find a proper answer in the management plan of the protected area. At the same time, the sustainable development of the city imposes that the management plan of Văcărești Lake Protected Area to be correlated with the general management plan of Bucharest.

#### 4. CONCLUSIONS

The abandonment of "Văcărești Lake" hydro-technical project 26 years ago, has led to the naturalisation process of the formerly built space within the area, starting with the formation of the first thin layers of soil.

Obviously, this period of abandonment needs

to stop, and the huge excavation requires its territorial insertion within the Bucharest urban structure. For the present, the limited financial resources, the lack of an urban policy able to attract functionally this space into a coherent structure and the continuous legal land issues have made the wetland unattractive for a different destination. The Văcărești Lake assessment underlined the necessity of solving the issues imposed by the wetland protected area status for both the quality of urban life and the sustainable development of the city.

The main research question investigated the favourability of declaring Văcărești Lake a protected area, mostly under the pressure of NGOs and without a solid scientific basis, for the city and its inhabitants. Additional queries support the finding of uncertainty in relation to the long-term territorial impact of the decision to transform the Văcărești wetland into a protected area. The leading issues relate to the real benefits for the population of the new area status. Will the reserve have the ability to "oxygenate" the urban air or, conversely, will it favour an outbreak of epidemics, including tropical diseases, considering the global warming?

Our findings and previous studies (Ianoș et al., 2014) show that the population favours the conversion of the semi-natural wetland into an urban park, where the renaturalisation process could have been directed and the additional issues avoided or solved. More importantly, the related recreation facilities and the existence of the urban park in itself could have covered the existing deficit of green spaces for the Bucharest population and urban environment. Considering the current morphology of the area, including the southern part outside the enclosed perimeter, a Municipal Botanical Garden could have been established, including both attractive elements of flora and adequate urban facilities.

The lack of coherent urban policies and of studies developed in stages by researchers from different fields, including the urban, social and economic sciences, lead to the current functioning of Văcărești Lake as a protected area in the context of the prevalence of natural elements questionable in terms of value, and especially without considering the actual urban environment and population needs. In the end, we do not witness the situation of a natural area being declared a protected area due to its intrinsic value, but we notice a decision that restricts the concrete recreation possibilities of an urban population increasingly eager to enjoy well-managed green spaces.

Hopefully, the scepticism of the present study in relation to the convenience of Văcărești Lake as protected area will be contradicted by its future



development. Otherwise, we can only talk about an "ecological fad" financed from public funds that will require, at some point, the rethinking of its sustainable integration within the urban environment.

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