35. Semiquantitative functional analyses of Greaca landscape

ŞTEFAN Ionuţ, IORDACHE Virgil, BODESCU Florian

University of Bucharest, Dept. Of Systems Ecology and Sustainable Development, 91-95 Splaiul Independentei street, Bucharest 76201 sector 5, Romania

Address of author responsible for correspondence: Ionuţ Ştefan - University of Bucharest, Dept. Of Systems Ecology and Sustainable Development, 91-95 Splaiul Independentei street, Bucharest 76201 sector 5, Romania; e-mail: stefanionutdoru@yahoo.com

ABSTRACT. Functional analyses is the method used for evaluating the offer of goods and services of the natural capital's components. We firstly characterised the structure of the complex of ecosystems Greaca. Then we applied the FAEWE/PROTOWET procedure for a semiquantitative analyses of the natural services. The procedure was applied in a sector of the flooded area and also in the entire diked area. The results show that in the dam sector none of the original functions that where fulfilled before the banking is fulfilled at the maximum rate. In the whole landscape the only functions that are maximally fulfiled are the functions conditioned by the continuous input of nutrients from the socio-economic systems that use this area.

KEY WORDS: ecologic functions, Danube, LDRS

INTRODUCTION

The functional analyses of the ecological systems is the method used for evaluating (qualitatively, quantitatively or by modeling) the offer of resources and services provided by the natural capital [e.g.1]. It is the first step in the economic evaluation methodology, followed by the monetary evaluation. It is often used in the environmental impact assessment and in developing the plans for the management of the natural capital especially those where restoration is included.

The Lower Danube Wetlands System is very important, economically and ecologically, because of its ecological structure which keeps a very high diversity in animals and plants, which by the interactions between them provide important goods and services for the socio-economic system, giving them the chance to grow and evolve.

Many wetlands in the Lower Danube Wetlands System have been analized for their functions provided for the socio-economic system and in very few cases some wetlands revealed ecological functions that were provided at high levels. Many wetlands are located near agricultural systems and some of their functions have been lost or are realized at very low levels. Such diked wetlands have not been the focus of the analyses by now, despite the fact that knowledge about them is needed for the restoration project.

In this context we have decided to analize the functions of Greaca landscape, component of the Lower Danube Wetlands System, which was a wetland but after the Danube dam was built, it was drained and now it is being used for agricultural purposes.

MATERIALS AND METHODS

We applied the FAEWE/PROTOWET procedure [e.g.3] to investigate the Greaca landscape, component of the Lower Danube Wetlands System, located between Giurgiu and Oltenita towns (figure 1). We have made a comparative analyses for two periods of time (before and after the Danube dam was built). We have performed two visites in the Greaca area: the first in february with the purpose to corelate the aerial photographs with the situation in the field, and the second in may with the purpose to apply the FAEWE

procedure. The visits were in a sector of the dam area and in the diked area. The main functions that were analized are presented in **Table. 1**.

RESULTS

Firstly we have characterized of the structure of a sector in the dam area. The functional analyses could not be applied without a good knowledge of the structure of the area of analyses. We used GIS to obtain informations about the heterogeneity and diversity of the study area. We characterized the dam sector analyzing the following indicators: dominant species, productivity classes, age classes.

Table 1.

FAEWE/ PROTOWET functions and the processes that they depend on

FUNCTIONS	PROCESSES MAINTAINING FUNCTIONS
Hydrologic functions	
Flood water retention	Flood water retention
Groundwater recharge	Groundwater recharge
Groundwater discharge	Groundwater discharge
Sediment retention	Sediment retention
Biogeochemical functions	
Nutrient retention	Plant uptake of nutrients
	Storage of nutrients in soil organic matter
	Adsorbtion of N as amonium
	Adsorbtion and precipitation of P in the soil
	Retention of particulate nutrients
Nutrient export	Gazeous export of N through denitrification
	Gazeous export of N through ammonia volatilisation
	Nutrient export through land use management
	Nutrient export through physical processes
In situ C retention	Organic matter accumulation
Ecological functions	
Ecosystem maintenance	Provision of overall habitat structural diversity
	Provision of microsites for macro-invertebrates
	Provision of microsites for fish
	Provision of microsites for herpetiles
	Provision of microsites for birds
	Provision of microsites for mammals
	Provision of plant and habitat diversity
Food web support	Biomass production
	Biomass import via watercourses
	Biomass import via overland flow
	Biomass import via wind transport
	Biomass import via biological proceses
	Biomass export via watercourses
	Biomass export via overland flow
	Biomass export via wind transportation
	Biomass export via fauna
	Biomass export via anthropogenic means

As you can see in **Fig. 2**, the dominant specie is the willow, with a occupied surface of 92,12 ha, approximatively 30% of the studied area, poplar species ocupie a surface of 62 ha, approximatively 18% from the studied area and unplanted areas occupie 177,456 ha, 33,4% from the surface of the studied area. The high percentage of coverage with unplanted areas is due to the structural heterogenity and the instability of the land.

Analyzing the area by the productivity (**Fig. 3**), we observe that most of the species are a part of class III of productivity (little productive). Why aren't here planted any high productive species? Because the dam was built, not formed, and the quantity of nutrients aren't enough for a high productivity.

In figure 4 we can observe that in this area trees were planted in the last 10 years, the percent of trees between 1-9 years is the highest (36,3 %, 124,8 ha). This means that in the area have been biomass exploitations in the last 10 years.

After we've characterized the study area, we have applied the FAEWE procedure, first in the sector of the dam, and second for the entire diked area. The results are presented in **Table 2**, for the sector in the dam area, and in **Table 3** for the entire diked area. The results are presented as follows: 0 (the function is not performed), 2 (the function is performed to a small degree), 3 (the function is definitely being performed).

DISCUSSIONS

Inspecting the results of the functional analyses in the sector of the dam area from the Greaca complex, one can see that none of the analized functions is fulfilled at maximum level (score 3). The functions that are very close to the maximum value are provision of microsites for reptiles and amphibians and gazeous export of N through denitrification because of the redox conditions in this area.

Table 2

The results of the functional analyses applied in a sector of the dam area

Percent (%)	28.404	12.2	5.17	0.026	2.2	33	19	
Function / type of ecosystem	**Willow forest**	**Euroamerican poplar forest**	**Black poplar forest**	**White poplar forest**	**Ash forest**	**Clearing**	**Unused land**	**Dam area**
Short term flood water retention	2	2	2	2	2	2	3	**2.19**
Medium and long term flood water retention	0	0	0	0	0	2	3	**1.23**
Sediment retention	2	3	2	2	2	2	3	**2.312**
Nutrient retention	0	2	0	0	0	2	3	**1.474**
Gazeous export of N through denitrification	3	2	3	3	3	2	3	**2.548**
Nutrient export through land use management	0	3	0	0	0	3	0	**1.356**
Provision of overall habitat structural diversity	3	2	3	3	3	2	2	**2.358**
Provision of microsites for macro-invertebrates	3	2	3	3	3	2	2	**2.358**
Provision of microsites for fish	0	0	0	0	0	0	2	**0.38**
Provision of microsites for herpetiles	3	3	3	3	3	3	2	**2.81**
Provision of microsites for birds	2	2	2	2	2	2	2	**2**
Provision of microsites for mammals	2	2	2	2	2	2	0	**1.62**
Provision of plant and habitat diversity	3	0	3	3	3	2	2	**2.114**
Biomass production	3	3	3	3	3	2	2	**2.48**
Import and export	0	0	0	0	0	0	3	**0.57**
Antropic export of biomass	2	3	2	2	2	0	0	**1.082**

One can see that all the other functions are below the characteristic levels of the state of reference. The habitats for fish are restricted only to old pathways of some rivers, all this due to human activities related to the afforestation of the Danube dam.

Analyzing the complex of ecosystems in the entire diked area, one can see that this area fulfilles only the functions corresponding to what has been projected when the Danube dam to be built: production of biomass and human export of biomass (with **bold** letters in **Table 3**).

In this area some functions are fulfilled at a much smaller level than the primary functions of this system: gazeous export of N through denitrification and provision of microsites for macro-invertebrates, this functions are maintained only in some areas of the Greaca landscape which maintain the characteristics of the state of reference (the contact zone with the terrace, channels, etc.; with *italic letters* in **Tabel 3**).

Other functions are fulfilled in a much smaller level compared with the state of reference (with ***bold italic*** letters in **Table 3**).

Table 3

The results of the semi-quantitative functional analyses of the landscape Greaca

Percent (%)	0.0405	0.0049	0.1275	0.0322	7	92.7949		
Function / type of ecosystem	Near the terrace	Channels and ecotones	Swamp areas	Dam area	Rice plantation	Other agricol terrains	Greaca AS	Greaca RS
Short term flood water retention	0	0	0	2.19	0	0	***0.00071***	***3***
Medium and long term flood water retention	0	2	0	1.23	2	0	0.14049	3
Sediment retention	3	0	0	0	0	0	***0.00122***	***3***
Nutrient retention	3	0	0	2.312	0	0	***0.00196***	***3***
Gazeous export of N through denitrification	3	2	0	1.474	2	0	0.14179	3
Nutrient export through land use management	2	3	3	2.548	3	2	*2.07150*	*3*
Provision of overall habitat structural diversity	3	0	2	1.356	3	0	0.21420	3
Provision of microsites for macro-invertebrates	3	3	2	2.358	0	0	***0.00467***	***3***
Provision of microsites for fish	3	3	2	2.358	2	2	*2.00057*	*3*
Provision of microsites for herpetiles	0	0	0	0.38	0	0	***0.00012***	***3***
Provision of microsites for birds	3	3	2	2.81	2	0	0.14482	3
Provision of microsites for mammals	2	3	2	2	2	0	0.14415	3
Provision of plant and habitat diversity	2	0	0	1.62	0	0	***0.00133***	***3***
Biomass production	3	3	2	2.114	2	0	0.14459	3
Import and export	2	3	2	2.48	3	3	**2.99815**	**3**
Antropic export of biomass	0	0	0	0.57	0	0	***0.00018***	***3***
Short term flood water retention	2	0	2	1.082	3	3	**2.99756**	**3**

CONCLUSIONS

- ✓ none of the actual functions are fulfilled at the level that were fulfilled in the state of reference;
- ✓ the functions that almost reach the maximum level in the dam area are: provision of overall habitat structural diversity, provision of microsites for macro-invertebrates, reptiles and amphibians, retention of the sediment and export of N through denitrification;
- ✓ at the level of the entire complex of ecosystems Greaca, the only functions that are beeing performed at a very high level are Production of biomass and human export of biomass;
- ✓ the production of biomass is conditioned by the continuous input of nutrients and energy from the local socio-economic systems into the complex of ecosystems Greaca

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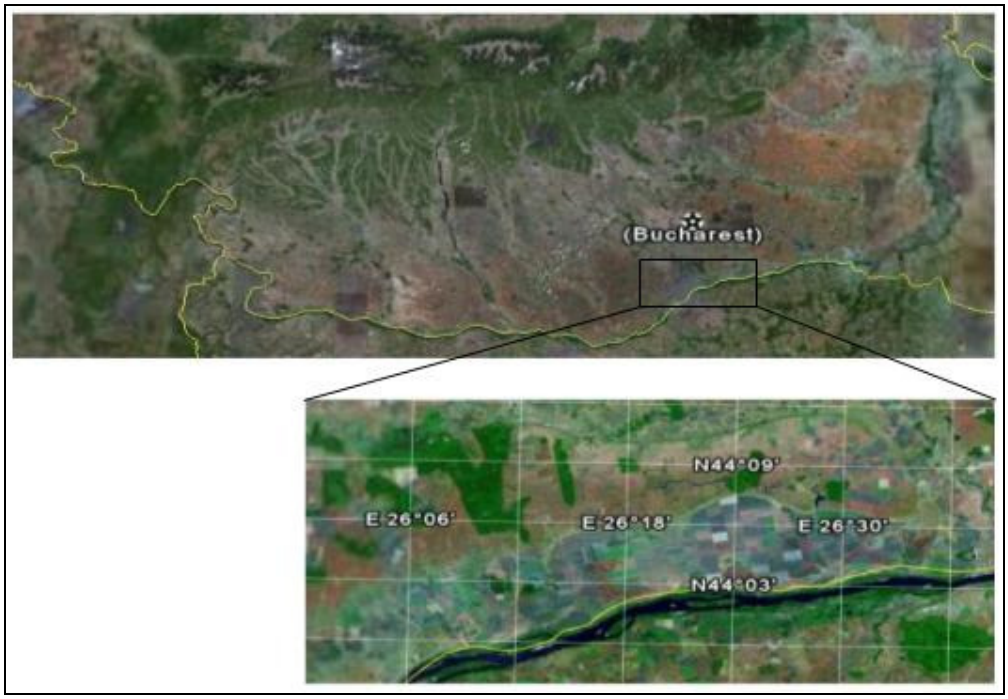

Fig. 1. The location of the Greaca area in the Danube floodplain

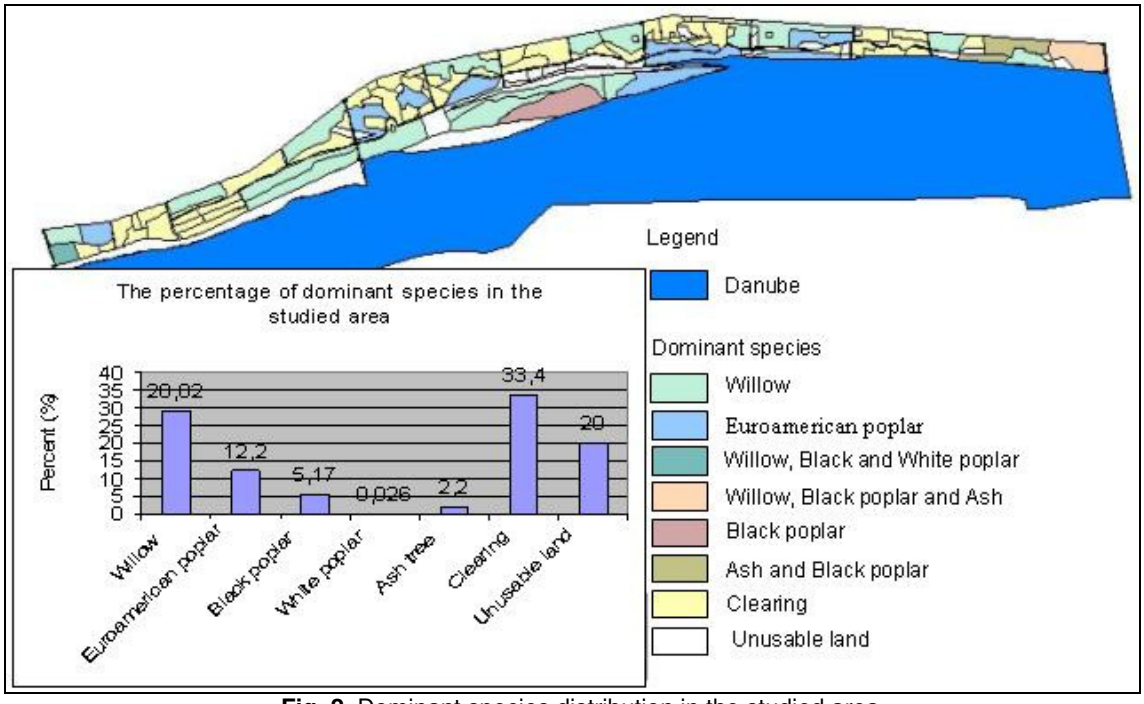

Fig. 2. Dominant species distribution in the studied area

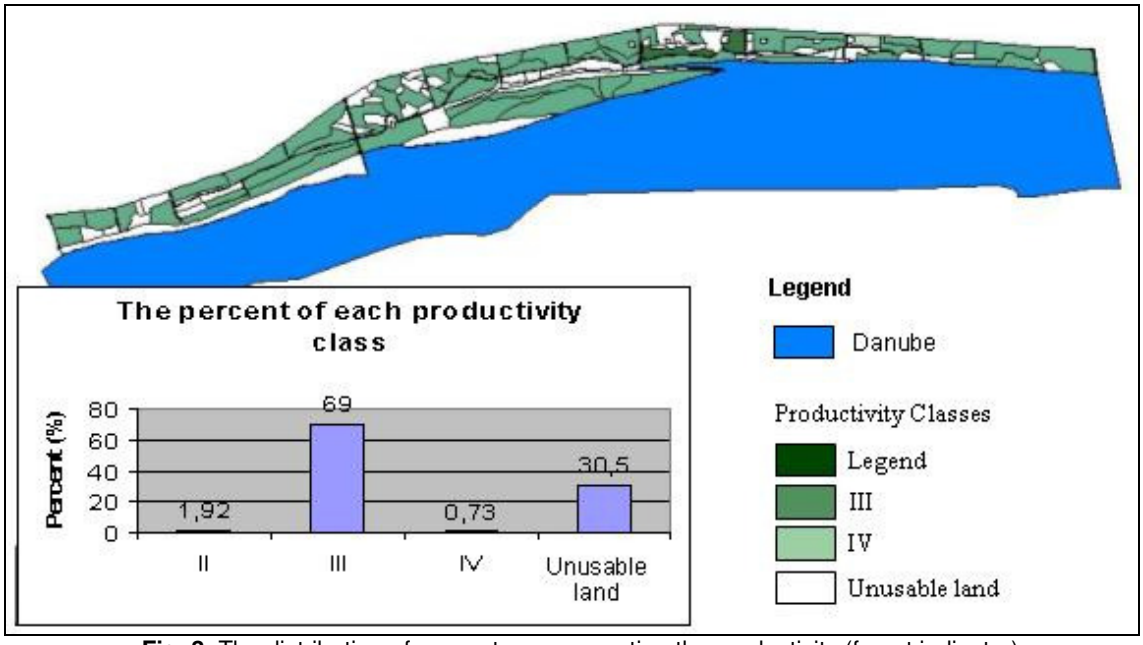

Fig. 3. The distribution of ecosystems accounting the productivity (forest indicator)

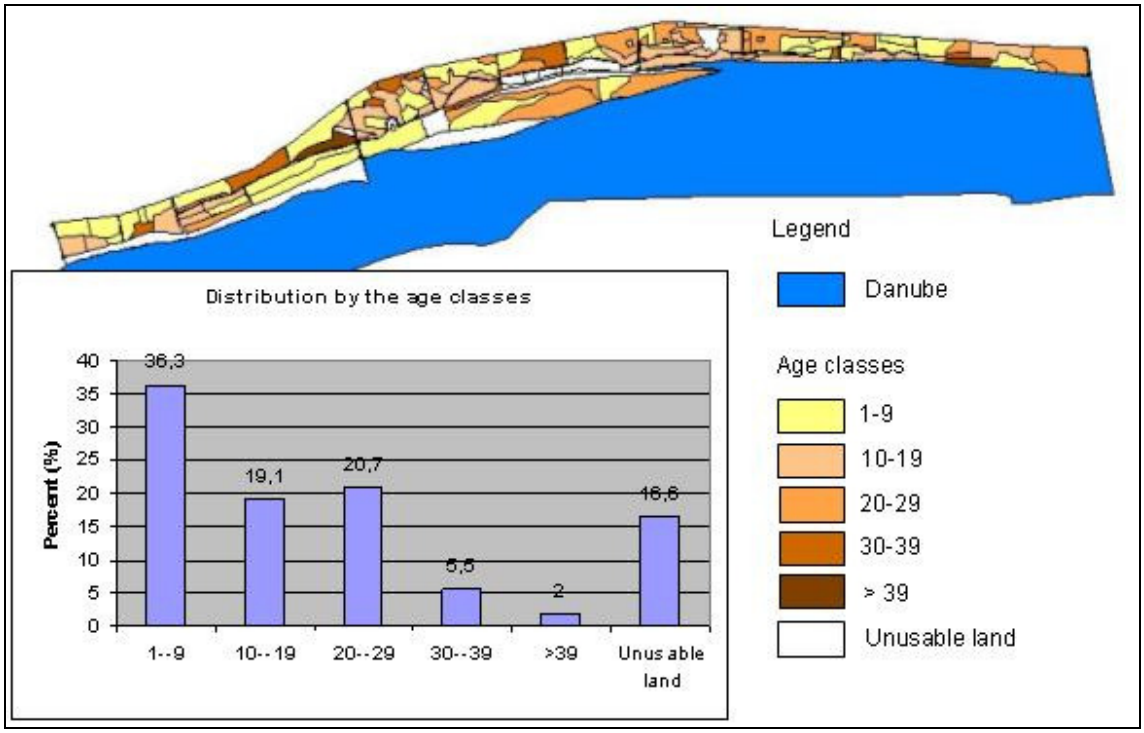

Fig. 4. The age of tree populations in the studied area

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