EVALUATING THE ECONOMIC IMPORTANCE OF FISHERIES SERVICES: THE CASE OF THE BELGARDE ECOSYSTEM

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Abstract
Sustainability is a core of any natural or social activity. Observing the forests' ecosystems, its complexity most often involves some additional services such are the hunting and fishery. In essence it relies on adequate managing and maintaining biodiversity of available wild animal and fish species at predefined area. The main goal of research is to evaluate the economic effects of ecosystems services linked to fishery activities at the territory of Belgrade in next several decades. Using the classic static and dynamic assessment methods, as well as assuming the certain change in gained incomes or made expenditures, derived results show strong positive economic trends within the sector of fishery at the territory of Belgrade.

Keywords: *fishery, forest services, ecosystem, economic analysis, Serbia.*
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Introduction

Observing to people known surrounding, everything starts and ends with sustainability. It is a motivator of life, even survival of human society, any kind of living organisms, or Earth for itself. It keeps people aware about renewability of elements and activities available in or out the nature, as well as program how to act responsible to them.

From its emerging as a concept, sustainability and further sustainable development basically deals with environmental issues, while nowadays it covers all segments of human behave and life (Giddings et al., 2002).

Its directed to optimal resource management, indicating their longevity and durability, as well as their resilience to external negative impacts. It takes care to former and future access to natural resources, researching and managing their formal presence in adequate but quality volume. It strives to maintain vitality of available biodiversity, cleanness and health within the existed ecosystems, conserving and restoring them towards to global trends and changes (Allen, Hoekstra 1993).

In essence, it is defined as a way of living and society development that fits the entire needs of current population, but avoiding to compromise the possibilities of future society to satisfy their needs in upcoming period (Holden et al., 2014; Shi et al., 2019; Ruggerio, 2021). Mainly, it's a story of taking from the nature and giving (care) to nature, trying to maintain reserves of available (non)renewable resources at constant, or even enlarged level (Auty, 2004; Peacock, 2008; Daly, 2017).

Although mentioned sounds easily achievable, it is really challenging in common world described with sharp increase in global population, and constant emergence of more and more new needs, expectations and activities, usually hardly dependent on available natural capital and humans' ability to be aware (Glasby, 2002; Holden et al., 2017). So, there is a solid

obligation to newborn generations, that is employing science and research involved in society progress, visible in impact of new tech-tech approaches (Krajco et al., 2019; Xu et al., 2020). Good example in striving to boost environmental friendliness in applying human activities could be seen in agriculture, i.e. organic agriculture, as it tries to preserve used natural resources (e.g. soil or water), not only for further use in food production, while for securing any ecosystem that could be impacted by agriculture (Tomas Simin et al., 2019).

There are several natural mediums, ecosystems or natural habitats that offers wide range of ecosystem services. They involve mainly forests, but also various types of grasslands, wetlands, deserts, seas and coastal areas, or hilly areas and mountain peaks, etc. (Sekercioglu et al., 2011; Nias, Mooney, 2013; Rawat, Adhikari, 2015). So, there is no doubt that the forests and accompanying ecosystems are part of nature that provides certain internal and external services to people and other living organisms (Mori et al., 2017). Except offering biomass (wood and fiber), forest fruits, wild and medicinal plants, wild animals, etc., they provide several long-lasting environmental services, such are air and water cleaning, landscape, recreation, hunting, or fishery and fishing, carbon sequestering, etc. Many of them don't enter the global market, lowering the general awareness of their presence (Bishop, Landell Mills, 2012; Pagiola, 2008).

It's obvious that current global changes in accessible natural resources, together with climate change, affect the environmental degradation and lowering ecosystems' capacity, and in bottom line endanger the normal life and wellbeing of human population (Pecl et al., 2017). So, constant re-mapping of available natural resources and economic assessment of ecosystem services they provide could be a crucial step in their sustainable managing throughout viable development policies and relevant investment decisions of local and global policy makers (Chan, Satterfield, 2020; Van Wensem et al., 2017). Meanwhile, it has to be aware that sustainable development assumes accurate harmonization of different developmental aspects, current ecosystems capacities and generally conflicting human needs and motives (Tomislav, 2018). Besides, in many countries worldwide there come to identification of several ecosystem services linked to different living ecosystems. Furtherly they are systemically and socially recognized, or paired with direct or indirect human needs, while their economic aspect is still challenging issue (Costanza et al., 2017).

The main goal of the research was economic assessment and forecasting of fisheries services provided as a part of forest ecosystem services made at the publicly governed forest properties located in Belgrade. Although the forests at the territory of Serbia's capital represents the main natural resource in exploitation, accompanying eco-services of fishery have small, but significant impact on expressing of overall forest services.

Methodology

In order to evaluate and foreseen the economic effects of existing ecosystem services (mainly fishery services) at the fishery area of Belgrade city, like in some previous research (Iarca et al., 2011; Jelocnik, Subic, 2020), there were used classic static and dynamic assessment methods. Static methods involve calculation of two indicators: a) Total output-total input ratio (i.e. the ratio between total income and total expenditure derived from estimated utilization of observed activity or ecosystem service. So, the object of exploitation, or fishery area under current capacity, would be economically driven, or performed business activity is profitable, if gained total income oversize overall expenditures); and b) Net profit margin

(i.e. the ratio between net profit and overall incomes derived from the utilization of ecosystem services. Object of exploitation would be profitable if the value of indicator is over the assumed cost of capital (i.e. the current interest rate was set to 4.5%, while the discount rate was set to 5%). Dynamic assessment assumes calculation of discounted values of net income from the economic flow derived from fishery utilization at the predefined area in observed period. In line to main research goal, assessment of incomes applied the method of direct market value (valid market prices), or assessing the quantity of fish fund and its market value potentially gained through the fishing activities.
Expecting to reconsider the degree of continuation in sustainable utilization of available fishery capacities, all indicators were calculated, or income potential of fishery ecosystem services were foreseen for the period up to 2100. Research was performed in 2022., while the used data linked to ecosystem services were gained from the managing authorities of the public fishery located at the territory of Belgrade city. All values are expressed in EUR, while presented in suitable tables. Research preforming consults several scientific papers from the observed topic.

Results

Conceptually economic evaluation of certain ecosystem services is still theoretic with any standardized framework. It's usually subject of experts' opinions, as valuing the recognized or grouped benefits given by nature (Gomez Baggethun et al., 2010). In basic, experts are trying to value in the best manner managing of the utilization and conservation activities of the certain ecosystem, or its integral part, such is the fishery within the forest ecosystem, adjusting the charging policy and income gaining of local or national government due to local and global sustainable goals.
In case of ecosystems including fishery and exercising fishing activities, this means the value of grown biomass of fish, and mass of caught and sold fish. At the observed public holding there is found high diversity in fish species (water area is inhabited by almost 60 fish species, while fishing of around 20% of them are strictly forbidden). In previous period, at the property there was stable production of the biomass of market-quality fish species, such are catfish, carp, pike, or perch, whose population is not endangered by professional fishing (e.g. in 2019., in total, it was caught around 90 t of different fish species by commercial fishermen). At the same time, around 6.5 thousand recreational (hobby) fishermen exercise fishing in Belgrade area, assuming that each person catches maximally allowed 5 kg of fish daily practicing annually ten fishing tours (i.e. they catch around 324 t of fish per year). In reality, fishing pressure on the property is about 414 t/year, increased in 10% for poaching and 30% for natural mortality, what means that overall annual losses count to 580 t of fish. Meanwhile, in average, estimated production volume in average annually reaches 1,160 t of fish. So, fish stock is currently not endangered at the fishing area of Belgrade (fishing pressure takes 50% of the estimated annual production), (Ratknic, 2022).
In line to previously mentioned, there could be evaluated the economic effects of ecosystem services derived from the Belgrade fishery area. Formed income is given due to average annual fish production and current price of fish (around 3 EUR/kg), while total expenditures involve material (costs of fishing pressure) and some nonmaterial costs. According to formed economic flow (Table 1.), there are gained positive net cash flow in any moment of business activity of forestry (segment of fishery) public enterprise.

Table 1. Economic flow derived from the utilization of fishery

No	Element	Business year				
		2022.	2030.	2040.	2050.	2100.
I	Total incomes	3,404,255.32	3,404,255.32	3,404,255.32	3,404,255.32	3,404,255.32
II	Total expenditure	2,590,756.78	2,590,756.78	2,590,756.78	2,590,756.78	2,590,756.78
III	Net cash flow	813,498.54	813,498.54	813,498.54	813,498.54	813,498.54

Source: IAE, 2022.

Facilitating the assessment of fishery services in observed area involves identical produced volume and prices of produced and sold fish biomass, as well as unique values of managing costs of common public natural assets and recreational areas, or overall production costs throughout the entire observed period (projections up to the 2100).
Given the specificity of performed research (managing the fishery holding), special attention has been directed to calculation of Total output-total input ratio and Net profit margin (Tables 2 and 3).

Table 2. Total output-total input ratio

Year	Total incomes (TI)	Total expenditures (TE)	TI/TE
2022.	3,404,255.32	2,590,756.78	1.31
2030.	3,404,255.32	2,590,756.78	1.31
2040.	3,404,255.32	2,590,756.78	1.31
2050.	3,404,255.32	2,590,756.78	1.31
2100.	3,404,255.32	2,590,756.78	1.31

Source: IAE, 2022.

Table 3. Net profit margin

Year	Profit (P)	Total incomes (TI)	P/TI x 100
2022.	813,498.54	3,404,255.32	23.90
2030.	813,498.54	3,404,255.32	23.90
2040.	813,498.54	3,404,255.32	23.90
2050.	813,498.54	3,404,255.32	23.90
2100.	813,498.54	3,404,255.32	23.90

Source: IAE, 2022.

Both indicators calculated (Table 2 and Table 3) show that running the fishery within the forestry holding in Belgrade is economically justified and very welcomed, as the value of the Total Output-Total Input Ratio is higher than 1, while the value of Net profit margin is higher than current interest rate active at national level (4.5%).
Incorporating the time value of money (including the impact of inflation), (Sarker et al., 1994), i.e. dynamic assessment of business activity in fishery at the forestry holding (Table 4.), there could be foreseen the profit potential of ecosystem services utilization in certain future moment.

Table 4. Final value of net cash flow at the end of observed period

No	Element	Year				
		2022.	2030.	2040.	2050.	2100.
I	Total incomes	3,404,255	3,404,255	3,404,255	3,404,255	3,404,255
II	Total expenditures	2,590,757	2,590,757	2,590,757	2,590,757	2,590,757
III	**Net cash flow (I-II)**	**813,498**	**813,498**	**813,498**	**813,498**	**813,498**
IV	Discount rate (in %)	5.00	5.00	5.00	5.00	5.00
V	Discount factor	1.0000	11.0266	30.5390	62.3227	924.0274
VI	Final value of total incomes	3,404,255	37,537,240	103,962,566	212,162,423	3,145,625,358
VII	Final value of total expenditure	2,590,757	28,567,146	79,119,131	161,462,988	2,393,930,374
VIII	**Final value of net cash flow (VI-VII)**	**813,498**	**8,970,094**	**24,843,435**	**50,699,435**	**751,694,984**

Source: IAE, 2022.

In addition, there are performed certain simulations of expected profitability towards the changes in gained overall incomes (decrease for 10%), or made expenditures (increase for 10%) during the utilization of fishery holding (Tables 5-8).

Table 5. Economic flow derived from the utilization of fishery due to decrease of incomes, or increase of expenditures for 10%

No	Element	Business years	
		2022-2100. (decrease in incomes)	2022-2100. (increase in expenditures)
I	**Total incomes**	**3,063,829.79**	**3,404,255.32**
II	**Total expenditure**	**2,590,756.78**	**2,849,832.45**
III	**Net cash flow**	**473,073.01**	**554,422.87**

Source: IAE, 2022.

Table 6. Total output-total input ratio after decrease of incomes, or increase of expenditures for 10%

Years	Total incomes (TI)	Total expenditures (TE)	TI/TE
2022-2100. (decrease in incomes)	3,063,829.79	2,590,756.78	1.18
2022-2100. (increase in expenditures)	3,404,255.32	2,849,832.45	1.19

Source: IAE, 2022.

Table 7. Net profit margin after decrease of incomes, or increase of expenditures for 10%

Years	Profit (P)	Total incomes (TI)	P/TI x 100
2022-2100. (decrease in incomes)	473,073.01	3,063,829.79	15.44
2022-2100. (increase in expenditures)	554,422.87	3,404,255.32	16.29

Source: IAE, 2022.

Table 8. Final value of net cash flow at the end of observed period after decrease of incomes, or increase of expenditures for 10%

No	Element	Year				
		2022.	**2030.**	**2040.**	**2050.**	**2100.**
(decrease in incomes)						
I	Total incomes	3,063,830	3,063,830	3,063,830	3,063,830	3,063,830
II	Total expenditures	2,590,757	2,590,757	2,590,757	2,590,757	2,590,757
III	**Net cash flow (I-II)**	**473,073**	**473,073**	**473,073**	**473,073**	**473,073**
IV	Discount rate (in %)	5.00	5.00	5.00	5.00	5.00
V	Discount factor	1.0000	11.0266	30.5390	62.3227	924.0274
VI	Final value of total incomes	3,063,830	33,783,516	93,566,310	190,946,181	2,831,062,822
VII	Final value of total expenditure	2,590,757	28,567,146	79,119,131	161,462,988	2,393,930,374
VIII	**Final value of net cash flow (VI-VII)**	**473,073**	**5,216,370**	**14,447,179**	**29,483,193**	**437,132,448**
(increase in expenditures)						
I	Total incomes	3,404,255	3,404,255	3,404,255	3,404,255	3,404,255
II	Total expenditures	2,849,832	2,849,832	2,849,832	2,849,832	2,849,832
III	**Net cash flow (I-II)**	**554,423**	**554,423**	**554,423**	**554,423**	**554,423**
IV	Discount rate (in %)	5.00	5.00	5.00	5.00	5.00
V	Discount factor	1.0000	11.0266	30.5390	62.3227	924.0274
VI	Final value of total incomes	3,404,255	37,537,240	103,962,566	212,162,423	3,145,625,358
VII	Final value of total expenditure	2,849,832	31,423,861	87,031,044	177,609,287	2,633,323,411
VIII	**Final value of net cash flow (VI-VII)**	**554,423**	**6,113,379**	**16,931,522**	**34,553,136**	**512,301,947**

Source: IAE, 2022.

So, it was done the sensitivity analysis of gained net income, concluding that the use of fishery services is more sensitive to decrease in incomes than to growth in expenditures.

Conclusion

It has to be underlined that the forests ecosystems, and their consisting elements, such are fishery activities as ecosystem services, generally represents one of the most important natural resource of biodiversity. In line to some global trends, as are the increase in population and impacts of climate change, or constant seeking for additional quality food and medical sources, environmental protection and sustainability concept have become one of the key issues, initiating quite complex managing of the available forest and fishery ecosystems. So, accepting that fishery ecosystem have certain complexity, providing several services (or products) mainly at disposal to human population, currently the most difficult challenge could be assessment of real economic value of derived ecosystem services.

Assessing the fishery services as a part of forestry ecosystem services of Belgrade fishery area, general conclusion is that overall managing of fishery could be economically justified and financially profitable for certain public or private enterprise. The justification (economic)

is viewed through the prism of ecosystem services, i.e. through the value of produced and partly sold fish biomass at defined property, whose economic assessment exposes profit sustainability of the holding during the observed period of its economic activity.

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