ENVIRONMENTAL PERFORMANCE OF AGRICULTURE IN SERBIA AND POLAND[1]

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Abstract

The aim of this paper is to present the achieved level of national economies' environmental performance, especially of the agricultural sector, for two countries: Serbia (non-EU country) and Poland (EU country). The analysis was based on the Environmental Performance Index (abbreviated EPI) reports and covered the period 2020-2024. According to the 2024 EPI, Serbia is ranked at the 64th place in the world, in terms of national environmental sustainability, while Poland is in a better position, at the 19th place. When it comes to the agriculture, according to the 2024 EPI, Serbia is at the 26th place, with the best result in sustainable nitrogen management, and the worst result in pesticide pollution risk. Comparing to Serbia, the ecological performance of Poland's agriculture is more unfavourable, considering that it is ranked at 35th place, with the best result in sustainable nitrogen management, and the worst result in regarding phosphorus surplus.

Key words: *environmental performance index; agriculture; Serbia; Poland.*

Introduction

Agricultural production, which is not based on the principles of sustainability, is a factor that degrades the environment, impairs the health of the population and causes global climate change (Alvarado et al., 2021; Lamb et al., 2021; Lykogianni et al, 2021; Rad, Ray & Barghi, 2022; Usman et al., 2022). During the last decades, in the entire world, the concept of ecological

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and sustainable agriculture is becoming more and more prominent in debates dedicated to agricultural policy (Latruffe et al., 2016). When it comes to the European continent, EU and non-EU countries do not have the same achievements regarding transforming the agriculture towards more sustainable and "greener" agricultural practices.

EU countries are successfully "paving the way" towards sustainable agriculture and reducing agriculture's environmental footprint, through adopting and implementing numerous directives, policies and strategies, based on the "*The European Green Deal*" initiative (European Commission, 2019; European Commission, 2020; European Union, 2021; Karamfilova, 2022). For example, in Poland's Strategic Plan for 2023-27, the focus of agricultural policy on environmental and climate objectives, has been expanded beyond rural development measures, so that now, it also includes the first pillar of direct payments, the so-called voluntary eco-schemes (European Commission, 2024). These schemes (with an allocation of 25% of the direct payments envelope) provide support to farmers for activities that go beyond legal requirements, and which are directed towards sustainable methods of production, especially in the segment of soil protection and preservation (European Commission, 2024).

In non-EU countries of the Western Balkans (according to the World Bank classification, all countries belong to the group of upper-middle-income economies) the environment and the protection of natural resources are still not in the focus of agricultural and rural development policies, and the level of sustainable, green and circular economy is lower, compared to EU countries (Volk, et al., 2017; Volk et al., 2019; Erjavec et al., 2021). In Serbia, support of agriculture and rural development is not sufficiently harmonized with the EU's common agricultural policy (CAP), neither in terms of the amount nor the structure of the support (Volk, et al., 2019; Erjavec et al., 2021). Agro-ecological measures have not yet been implemented, although the line ministry is aware of the need for increased policy focus on environmental and climate actions, as well as the problems in this segment (Government of the Republic of Serbia, 2022).

The aim of this paper is to present the impact of the agricultural sector on the environmental performance of two national economies: Poland (EU member) and Serbia (EU candidate status). At the same time, the authors provide practical guidelines and recommendations for policymakers, so that countries can more quickly and efficiently trace the path towards sustainable and green economy, in which agriculture has a central place.

Material and method

For the purpose of this paper, authors used *Environmental Performance Index* (abbr. EPI) reports, regularly published by the Yale Center for Environmental Law and Policy. The first EPI report was presented to the public in 2006, and over time the number and the name of the indicators within the EPI varied. Based on the 2024 EPI rank and score (3 policy objectives, 11 categories and 58 indicators), for totally 180 countries, it can be seen where they are regarding various aspects of the environment (Block et al., 2024), and where it is necessary to engage more intensively, in order to reach higher environmental quality standards.

One of the 11 EPI framework category is the Agriculture, within the third policy objective (*Ecosystem Vitality*). The EPI contribution of category Agriculture is measured using four indicators (Block et al., 2024, p. 112):

- *Relative Crop Yield* makes 40% of the category Agriculture. This indicator represents the average yield of 17 main crops, in relation to their maximum, historically speaking, possible yield, and in accordance with regional climatic differences. The logic behind this indicator is that yield-maximizing countries can reduce demands for expanding agricultural land. Indicator score is between 100 (full yield gap closure - the best result) and 0 (the worst performance).

- *Sustainable Nitrogen Management Index* (SNMI) makes 40% of the category Agriculture. This indicator represents the balance between the efficient use of nitrogen fertilizers and the achievement of satisfactory yields. Indicator score is between 100 (optimized application of nitrogen fertilizers - the best result) and 0 (the worst performance). This indocator is important because the excess nitrogen in the soil leads to eutrophication of waters.

- *Pesticide Pollution Risk* makes 15% of the category Agriculture. This indicator measures the level of accumulation of pesticides in the soil, in relation to assumed safe levels. Indicator score is between 100 (no risk - the best result) and 0 (the worst performance).

- *Phosphorus Surplus* makes 5% of the category Agriculture. Phosphorus is necessary for the growth and development of agricultural crops and can accumulate in the soil over time. Phosphorus surplus indicates the potential pollution of the soil with phosphorus, due to the irratio-

nal use of fertilizers. In essence, it represents the difference between the amount of phosphorus introduced into the soil by fertilization and the phosphorus content in the harvested crops. Therefore, this indicator indicates an excess of phosphorus fertilizers in the soil, which can lead to eutrophication of water bodies. Indicator score is between 100 (no surplus - the best result) and 0 (the worst performance).

The data were presented using descriptive statistics, and appropriate conclusions were drawn based on comparative analysis and inductive-deductive methods.

Environmental Performance Index and Agriculture: results from Poland & Serbia

According to 2024 EPI, out of a total of 180 countries, Serbia is ranked 64th in terms of environmental sustainability, while Poland is in a much better position, at 19th place (Table 1). Serbia's EPI score/rank in 2024 is lower than in 2020, in compare to Poland, which has a significantly better rank in 2024, than five years ago (Table 1).

Table 1. *EPI, score & rank, 2020-2024*

	Serbia						Poland					
	2020		2022		2024		2020		2022		2024	
	score	rank	score	rank	score	rank	score	rank	score	rank	score	rank
EPI Index	55.2	45	43.9	79	49,3	64	60.9	37	50.6	46	64.4	19
Agriculture	69.9	8	45.3	51	71.4	26	57.4	32	42.7	61	68.3	35
Sustainable Nitrogen Management	69.9	8	69.9	8	78.1	7	57.4	32	57.4	32	60.8	28
Pesticide Pollution Risk	-	-	20.7	115	46.3	138	-	-	28.0	84	72.0	58
Relative Crop Yield	-	-	-	-	77.1	49	-	-	-	-	76.3	51
Phosphorus Surplus	-	-	-	-	47.7	116	-	-	-	-	43.1	128

Source: *Yale Center for Environmental Law and Policy, online database.*

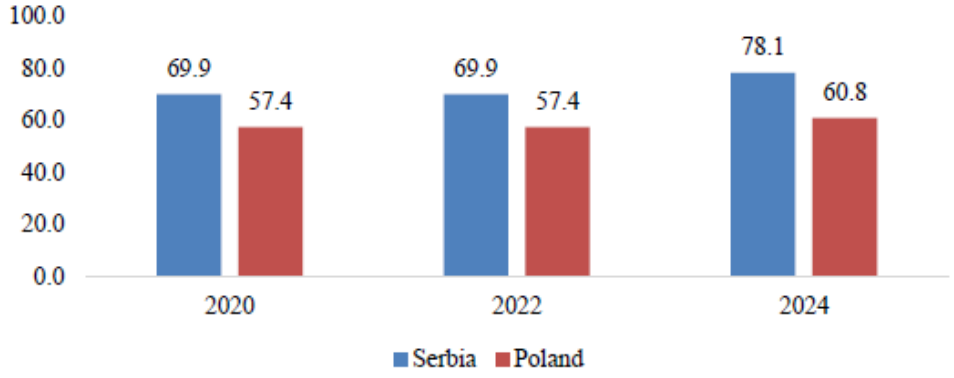
Lower EPI rank for Serbia, can potentialy be explained by: a) worsening situation regarding environmental quality and/or b) a greater coverage of environmental indicators that are observed in 2024, in which Serbia has poor performance (namely, the number of indicators in the 2024 EPI Report is 58, which is 26 indicators more, compared to 2020).

When it comes to the 2024 EPI category Agriculture, out of a total of 180 countries, Serbia is at 26th place, while Poland is at 35th place (Table 1). A significantly lower ranking for Serbia, compared to 2020 (8th place), can be explained by the introduction of two new indicators to this category (Pesticide Pollution Risk and Phosphorus Surplus), where Serbia has poor management. The position of Poland in this category for the period 2020-2024 has not been changed significantly (down two places, from 32nd in 2020 to 35th in 2024).

Below are the results of the indicators used to measure the environmental performance of the agricultural sector.

Sustainable nitrogen management (SNMI). If we observe the indicator's score in the period 2020 - 2024 (score from 69.9 in 2020 to 78.1 in 2024), it can be concluded that the Republic of Serbia has slightly increased the sustainable management of nitrogen fertilizers. Improvement in this matter has been achieved also in Poland, which went from 57.4 in 2020 to 60.8 in 2024 (Graph 1).

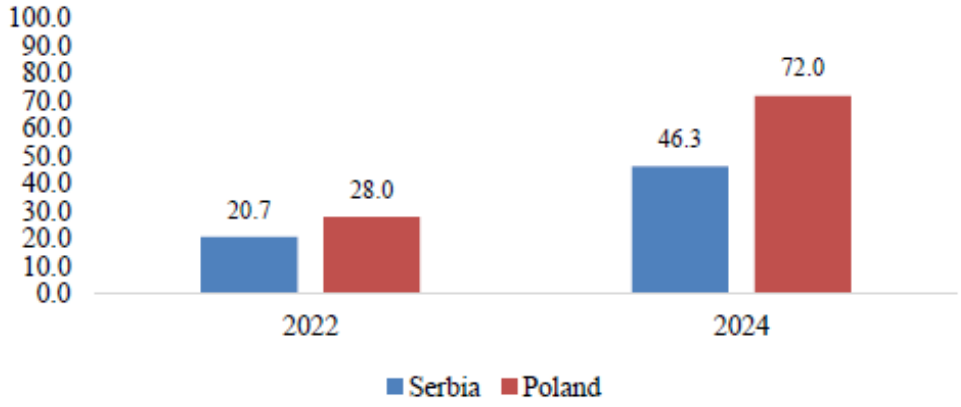
Graph 1. *Sustainable nitrogen management, score for years 2020, 2022, 2024*



Source: *Yale Center for Environmental Law and Policy, online database.*

Pesticide Pollution Risk. When it comes to the sustainable management of pesticides, Serbia has a score of 46.3 which puts her at 138th place, while Poland is in a much better 58th position (72.0 score).

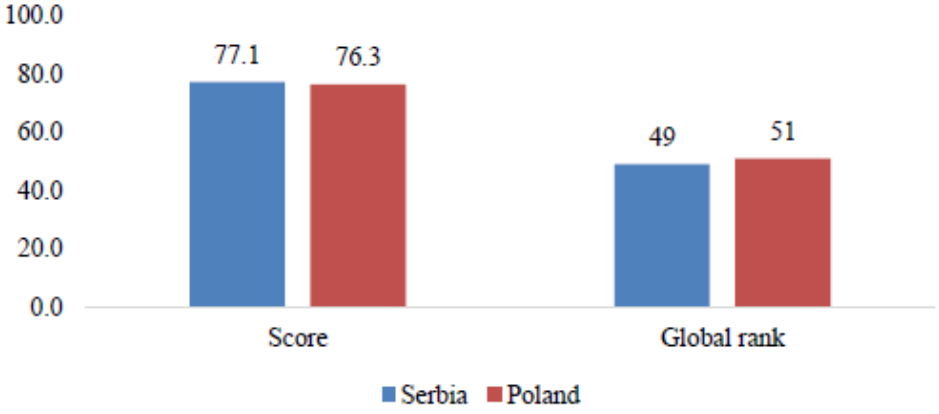
Graph 2. *Pesticide pollution risk, score for years 2022 and 2024*



Source: *Yale Center for Environmental Law and Policy, online database.*

Relative Crop Yield. Regarding this indicator, Serbia and Poland have similar results. The Republic of Serbia has a score of 77.1, which ranks it 49th in the world in terms of the relative yield of the main crops, while Poland is in a slightly lower 51st place (Graph 3).

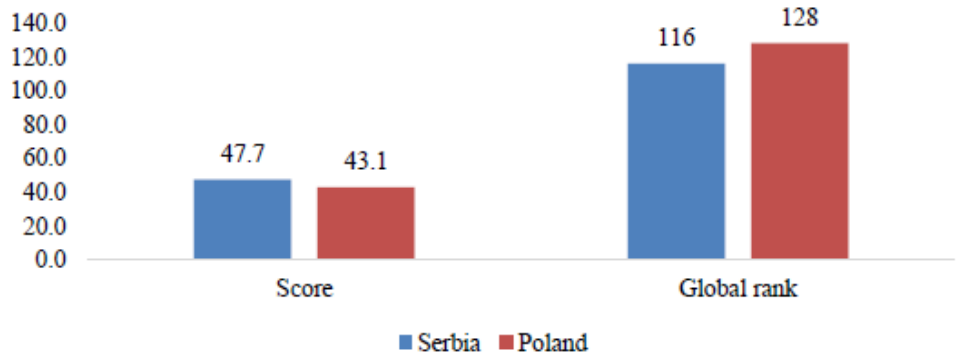
Graph 3. *Relative crop yield, score and rank for year 2024*



Source: *Yale Center for Environmental Law and Policy, online database.*

Phosphorus surplus. Serbia has a score of 47.7, which ranks it 116th in the world, in terms of phosphorus surplus in the soil, while Poland with a score of 43.1 is in a worse position, with the 128th position out of a total of 180 countries (Graph 4).

Graph 4. *Phosphorus surplus, score and global rank for year 2024*



Source: *Yale Center for Environmental Law and Policy, online database*

Conclusion and recommendations

In Poland, as a EU country, environmental and climate objectives of agricultural policy have been extended beyond rural development measures and they additionally include the first pillar of direct payments, within CAP Strategic plan for 2023-27. On the other hand, Serbia is still waiting for the accreditation of IPARD measure 4 "*Agro ecological climate measures and organic production*" (within the IPARD III program for 2021-2027), as well as the programming and implementation of the national measure "*Support to agro ecological measures, good agricultural practice and other environmental protection and preservation policies*" (within the national measures of rural development). For the implementation of agro ecological measures in Serbia, it is necessary to work on fulfilling numerous assumptions in the coming period, such as: passing and amending the appropriate laws (while ensuring their implementation), implementing Land Parcel Identification System (LPIS) and Integrated Administration and Control System (IACS), cross compliance, and strengthening the personnel and capacity of control/inspection services (Government of the Republic of Serbia, 2022).

Besides the previous one, according to the ecological performance of agriculture in 2024 EPI, Serbia is at the 26th place out of 180 countries, while Poland ranks at 35th place. Both countries have the best result in sustainable nitrogen management. The worst result Serbia has in pesticide pollution, while the biggest problem for Poland's agriculture is phosphorus surplus.

In general, all countries that want to transform their agriculture towards more sustainable solutions, and strengthen its ecological and climate component, must investment in innovation, R&D technologies, environmentally friendly pesticides, with simultaneous implementation of Integrated Pest Management principles and implementation and certification of different certification schemes for sustainable agriculture (FAO, 2018; Alvarado et al., 2021; Lykogianni et al., 2021; EU, 2022; Rad, Ray & Barghi, 2022). Additionaly, for less developed countries, numerous adjustments are needed, not only in agricultural and rural development policy, but also in environmental protection policy and macroeconomic policy (Uddin, 2020; Erjavec et al., 2021).

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