

The impact of riparian zones along rivers under the new CAP in Slovenia

Vpliv obrežnih pasov ob rekah v okviru nove SKP v Sloveniji

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ABSTRACT

This research primarily aims to investigate the implementation measures of the New Common Agricultural Policy (CAP) 2023-2027 in Slovenia, focusing on preserving and restoring riparian zones along rivers. Agricultural landholders near watercourses are obligated by the Water Act with the GAEC 4 standard to establish riparian areas as protective strips, with precise widths of 15 meters for first-order watercourses, 5 meters for second-order watercourses, and 3 meters for drainage ditches exceeding 2 meters in width. These protective strips are limited to vegetation comprising grass, clovers, alfalfa, indigenous plants, shrubs, or trees, with strict prohibitions on organic and mineral fertilizer use and plant protection products. Slovenia has approximately 13 471 hectares of riparian land, mainly with intensive agricultural use. The most extensive cultivatable riparian areas along primary and secondary watercourses are predominantly found in Slovenia's northeastern and northwestern regions. The case study focuses on a farmer cultivating land in the riparian areas adjacent to the Sotla River. The Sotla River, located at Croatia's border, is classified as a first-order watercourse. For the case study, main crop yield reduction and land area loss in the New Common Agricultural Policy (CAP) 2023-2027 were calculated. On protective strips, the analyzed farm, which cultivates 104 hectares of land, experienced a loss of 6.4 hectares, which accounts for 6.2% of cultivated land, and the total loss of income on first- and second-order areas in 2023 amounts to 7 448,0 €.

Keywords: agricultural policy, GAEC, agro-economy, agriculture land, width

IZVLEČEK

Študija obravnava izvajanje nove skupne kmetijske politike (SKP) 2023–2027 v Sloveniji, s poudarkom na ohranjanju in obnovi obrežnih pasov ob vodotokih. Kmetijski pridelovalci, ki obdelujejo površine v bližini vodotokov so zaradi Zakona o vodah in standarda DKOP 4 dolžni vzpostaviti obrežne varovalne pasove z določenimi širinami: 15 metrov ob vodotokih prvega reda, 5 metrov ob vodotokih drugega reda in 3 metre ob osuševalnih jarkih, ki so širši od 2 metrov. Varovalni pas je lahko zaraščen s travnimi mešanicami, deteljami, lucernami, grmovjem ali drevesi. Strogo pa je prepovedana uporaba gnojil in fitofarmacevskih sredstev na tem območju. Slovenija ima približno 13.471 hektarjev obrežnih zemljišč, kjer prevladuje intenzivna kmetijska raba. Največ obdelovalnih površin ob vodotokih prvega in drugega reda se nahaja predvsem v severovzhodnem in severozahodnem delu Slovenije. Študija se osredotoča na kmetijskega pridelovalca, ki obdeluje kmetijske površine v obrežnih območjih ob reki Sotli. Reka Sotla meji na Hrvaško in je opredeljena kot vodotok prvega reda. V študiji je izračunan izpad glavnega pridelka in izguba površine zaradi ukrepov nove skupne kmetijske politike (SKP) 2023–2027. Obravnavana kmetija, ki obdeluje 104 hektarov kmetijskih zemljišč zaradi DKOP4 standarda izgubi 6,4 hektare obdelovalnih kmetijskih zemljišč, 6,2 % celotne obdelovalne površine. Skupna izguba dohodka zaradi izgube obdelovalnih površin ob vodotokih prvega in drugega reda v letu 2023 znaša 7448,0 €.

Ključne besede: kmetijska politika, DKOP, agroekonomika, kmetijska krajina, širina

INTRODUCTION

The riparian zone forms a natural buffer between the surrounding land and waterways. They may be defined in various ways based on factors such as vegetation type, groundwater and surface water hydrology, topography, and ecosystem function (Swanson et al., 1982). Different authors have used a variety of definitions and terminology related to riparian buffer strips (Hickey and Doran, 2004; Ilhardt et al., 2000). Mostly in literature, buffer strips are defined as strips interposed between fields and streams that intercept and treat the waters leaving cropland and are a useful tool for reducing diffuse agricultural pollution in lowland areas (Gumiero and Boz, 2017). If properly vegetated and managed, they can also produce wood for burning, act as sinks for atmospheric CO₂, and enhance the landscape's diversity (Borin et al., 2010). Buffer strips may be composed of native vegetation (e.g., pre-existing native forest) that is intentionally left intact when land is cleared for other land uses (forest harvesting, agriculture or urban development), as well as vegetative buffers that are re-established where original vegetation has previously been removed. The terms buffer strips, riparian buffers and vegetative buffer strips are used interchangeably (Hickey and Doran, 2004). Riparian buffer zones are often considered one of the most optimal measures to improve surface water quality, as they are assumed to be responsible for large reductions in sediment and nutrient delivery from intensively cultivated areas to rivers (Verstraeten et al., 2006).

Since the beginning of intensive farming, society has markedly altered rivers' hydrology to establish optimal cultivation conditions. This has frequently come at the cost of both the riparian zones and the watercourses (Lind et al., 2019). However, agriculture must become economically efficient and environmentally sustainable, which is also in the core of European Agriculture Policy 2023-2027 (further EU CAP 2023-2027) and consumer expectations.

The situation and recommended widths of riparian zones can vary significantly across European countries, depending on national policies, regional regulations,

and specific environmental conditions. For example, riparian buffer zones in neighbouring European countries to Slovenia vary widely in regulation and width specifications. Austria mandates widths of 5 to 10 meters under the Federal Water Act (Wasserrecht, 2006), same as Croatia (Zakon o vodama, 2023), and Italy mandates widths of 3 to 5 meters. Notably, there are significant differences in the minimum width of buffer strips among European countries, and many other EU countries have less restrictive limitations under the GAEC standard than Slovenia. For instance, in Denmark, the minimum width of the buffer zone is 2 meters, with prohibitions on growing crops, soil cultivation, or planting within this strip. Similarly, in Greece, the buffer zone width ranges from 1 meter to 6 meters, depending on the slope and type of restriction, with prohibitions on growing crops within 1 meter and on nitrogen fertilizers within 2 or 6 meters. In France, the buffer zone must be 5 meters wide, with requirements for grass, shrubs, bushes, or trees within the strip and prohibitions on using mineral or organic fertilizers and pesticides. Similarly, in Spain, the buffer zone width ranges from 2 meters to 10 meters, with mandatory shrubbery and prohibitions on using fertilizers and pesticides. In the Netherlands, the buffer zone width varies from 25 centimetres to 9 meters, depending on the crop and specific technical specifications, with a general prohibition on using fertilizers within this strip. Lastly, in Slovakia, the buffer zone must be 10 meters wide, with a ban on the use of industrial or organic fertilizers (European Commission, 2024).

In Slovenia, the Water Act defines riparian zones as protective strips next to the first and second-order watercourses and prescribes riparian zone width established by Article 14 (Zakon o vodah, 2002). Farmers were restricted only by prohibiting fertilization and using plant protection products (further PPPs) in these areas since 2002, as defined by Article 65 of the Water Act (Zakon o vodah, 2002). Under the previous European Agricultural Policy 2015-2020, those zones had no specific restrictions (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2015). In contrast, today's EU CAP 2023-2027 continues to prohibit using fertilizers and PPPs

in these areas and imposes additional restrictions on agricultural activities. These include prohibiting ploughing and planting crops (except selected grassland mixtures), limitations on animal grazing under certain conditions, and others (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2023).

The case study focuses on a farmer cultivating land in the riparian zones adjacent to the Sotla River, located at Croatia's border. For the case study, crop yield reduction and land area loss in 2023 according to the CAP 2023-2027 were calculated.

MATERIAL AND METHODS

Water Act in Slovenia

The Water Act (ZV-1) is a law that regulates the management of surface and underground water, as well as water and coastal land and water infrastructure in the Republic of Slovenia. The impact of the Water Act on agricultural activity in Slovenia is mainly reflected in the determination of the width of riparian zones and related prohibitions. A key component of the law is the classification of inland waters into two categories: first-order watercourses requiring a 15-meter buffer zone and second-order watercourses requiring a 5-meter buffer zone by Article 14. This area is subject to specific interventions under certain conditions, regardless of property ownership, as outlined in the law. The primary objective is to safeguard riverbanks, prevent erosion, and facilitate access to public services responsible for maintenance or remediation work on watercourses (Zakon o vodah, 2002).

GAEC 4 standard in Slovenia

Good agricultural and environmental conditions are the minimum requirements for managing all agricultural land on the farm, as specified in the Standards for Good Agricultural and Environmental Conditions (further GAEC) with 9 standards (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2023). Content-wise, conditionality is more demanding than previous cross-compliance, as most standards have become stricter. Out of 9 GAEC standards, the standard GAEC 4 defines rules and restrictions

for establishing protective strips along watercourses (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2023).

To comply with the Water Act, coastal lands/riparian zones designated for GAEC 4 must be established as protective strips along watercourses. Strips are mandatory along first-order watercourses (15 m) and second-order watercourses (5 m), and in accordance with Regulation (EU) No. 2021/2115, strips are compulsory also along drainage ditches wider than two meters with a width of 3 meters (Uredba Evropskega parlamenta in sveta, 2021).

According to GAEC 4, agricultural surface cultivation of protective strips is allowed for seeding crops like alfalfa and grassland seeds (Uredba o pravilih pogojenosti, 2024) as well as mowing, mulching or grazing. Livestock may graze on protective strips but must not alter the structure of the watercourse. Drinking water for animals is allowed in specific locations in a controlled manner without causing excessive damage to the river banks. Feeding animals in the protective strips is not permitted (Ministrstvo za kmetijstvo, gozdarstvo in prehrano, 2023).

Slovenia has approximately 13 471.2 hectares of protective strips used by agriculture, mainly located on second-order watercourses. Table 1 presents the total land use of protective strips of all rivers in Slovenia. Although not evident from Table 1, the highest amount of arable land is located along watercourses in northeast (NE) and west (W) and along drainage ditches, mostly in NE Slovenia.

Study area

The study area is situated in the municipality Kozje (46°6' N 15°31' E), which covers 89.5 km² of the mostly hilly area of eastern Slovenia with altitudes of up to 500 meters. The area is located in the Savinjska region, with 10 274 agricultural holdings and 63 664 hectares of agricultural land in use. The average size of a farm in the Savinjska region is 6.4 hectares, and the average age of agricultural owners is 57 years. In comparison, the national average farm size in Slovenia is 8.8 hectares, and the average age of agricultural owners is 58 years (SURs, 2023).

Table 1. The land use on protective strips of first and second-order watercourses and drainage ditches (in hectares) in Slovenia in 2023 (Table created by Jajtić, 2023)

Riparian zone type		1 st order watercourse (ha)	2 nd order watercourse (ha)	Drainage ditches (ha)	Total (ha)
Agriculture land	Arable land	500.1	1 367.8	7.1	1 875.0
	Permanent crops	78.6	467.8	0.1	546.4
	Grasslands	1 358.6	5 633.1	3.7	6 995.3
	Other agri. lands	686.3	3 351.2	17.0	4 054.5
Non-agricultural land	Forest	1 706.1	23 881.7	1.0	25 588.8
	Other non-agri. lands	1 218.8	2 916.9	6.0	4 141.6
Total (ha)		5 548.4	37 618.4	34.8	43 201.6

The case study focuses on a farmer cultivating land in the protective strips adjacent to the Sotla River, located at Croatia's border. The farm is located in Kozjansko and cultivates an area of 104 hectares. Fields dominate, followed by permanent grasslands, vineyards and meadows. They also raise cattle and fattening pigs. The majority of the agricultural land is located along watercourses (rivers, streams), including the Sotla River (Figure 1), classified as a first-order watercourse, and

the streams Buča, Gruska, Riblik, and Svinjski graben, all classified as second-order watercourses. In managing these areas, the agricultural economy faces problems and issues similar to most agricultural economies in Slovenia, which have their agricultural land next to surface watercourses. For the case study, main crop yield reduction and land area loss in 2023, according to the CAP 2023-2027, were calculated.

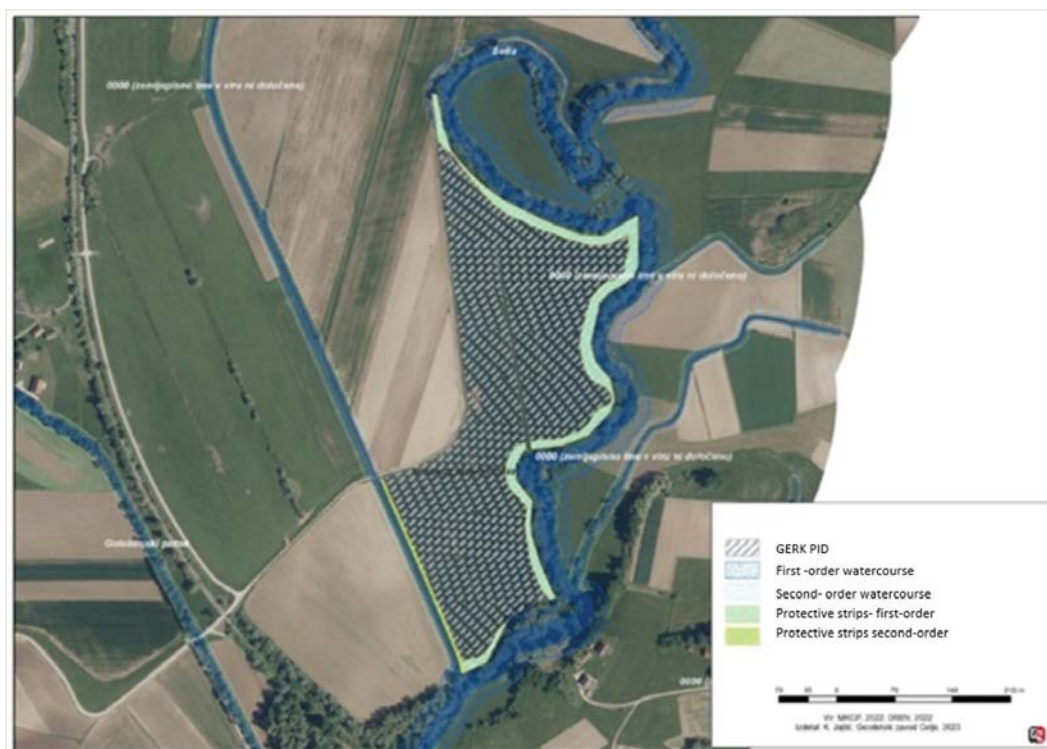


Figure 1. Section of the protective strips of the first-order watercourse Sotla (Map created by Jajtić, 2023)

Area loss and crop yield reduction

The farm registration data for the year 2022 was derived from the KMRS_2022 input layer. To comply with the Water Act, the entire surface of cadastral parcels (GERKs) located within 15 meters of the first-order watercourses was examined, while for second-order watercourses, the study area was within a 5-meter zone from the watercourse. Analysis of actual use on protective strips of watercourses of the first and second order and drainage ditches was performed. The input layer (coastal lands) is a buffer for water lands. The layer of water lands is obtained from MKGP. The layer of coastal land, which therefore includes the buffer and the course of water land, is then cut with the help of the Erase command (ArcMap 10.8).

The analysis of main crop yield loss was calculated for crop quantities for the year 2022 in the Savinja region, where the analysed farm is located. Data for 2023 was not yet available at the time of the study. Data from the Statistical Office of the Republic of Slovenia gathered information on average crop yields and purchase prices (SURS, 2024). Additionally, the farmer provided us with a list of yield crops for the 2023 season.

RESULTS AND DISCUSSION

Area loss

Figure 2 shows the total area of GERK along first and second-order watercourses, categorised as grassland and arable land for analysed farm. The data indicates that arable land covers 4.49 hectares along first-order watercourses, while second-order watercourses cover 1.41 hectares of arable land and 0.52 hectares of permanent grassland. On protective strips, the analysed farm, which cultivates 104 hectares of land, experiences a loss of 6.4 hectares, which accounts for 6.2% of cultivated land. This substantial loss of agricultural area can also be concluded from the fact that the average size of a farm in Slovenia is 7.0 hectares, considering pastures and arable land (SURS, 2023).

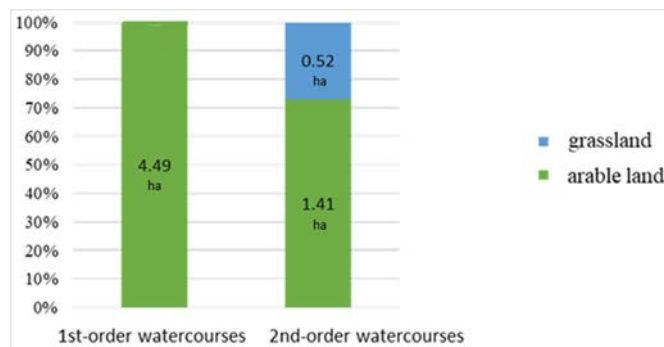


Figure 2. Land use area of the protective strips along first and second-order watercourse for the analysed farm (in hectares and %)

Arable crop area in 2023

Figure 3 shows the arable crop area grown in the protective strips along first and second-order watercourses in 2023. The following crops were planted on the protective strips along first-order watercourses: winter wheat on 1.6 hectares, maize for grain on 1.1 hectares, maize for silage on 0.8 hectares, winter barley on 0.7 hectares, and multiple crops (winter wheat and maize for silage) on 0.3 hectares. Meanwhile, protective strips along second-order watercourses featured maize for silage on 0.5 hectares (0.2 hectares maize for silage and 0.3 hectares maize for silage and winter wheat), permanent grassland on 0.5 hectares, wheat on 0.3 hectares (0.2 hectares winter wheat and 0.1 hectares maize for silage and winter wheat) and barley on 0.7 hectares (0.6 hectares winter barley and 0.1 hectares maize for silage and winter wheat). Additionally, a small area of coastal lands (0.2 hectares) had multiple crops, such as spring barley, winter barley, and mixed-use lands.

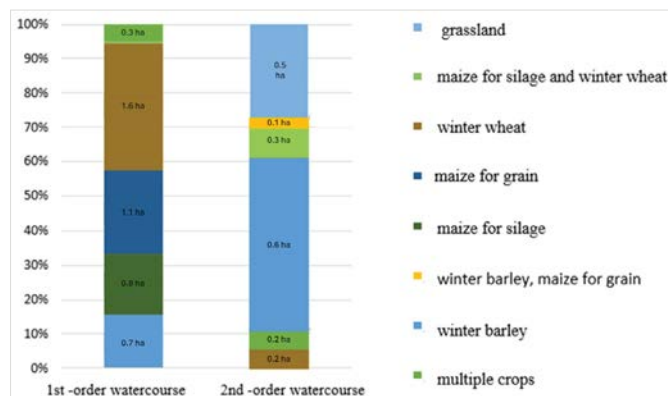


Figure 3. Arable crop area in the protective strips along first and second-order watercourses on the analysed farm (in hectares and %)

Thus, the total area of protective strips is distributed among various crops and land uses, reflecting the diversity of cultivation and management practices in these zones.

Table 2 shows the estimated agricultural yield in tons per hectare for the Savinjska region in Slovenia in 2022. Additionally, it shows the average purchase prices of agricultural products in € per ton for each agricultural crop. According to that, the arable crop area loss (ha), main crop yield reduction (t/ha) and income loss (€) for the analysed farm were calculated.

The loss in revenue due to arable crop area loss in 2023 amounted to 5 675,1 € for the agricultural area

adjacent to the first-order watercourses and 1 772,9 € for the second-order watercourse. The highest yield loss occurred for wheat on 1.7 hectares of land, resulting in 2 302,1 €; maize for grain on 1.1 hectares of land, resulting in 1 420,1 €; and maize for silage on 1 hectare of land, resulting in 1 173,8 €.

The loss of area along the second-order watercourse is 0.7 hectares or 779,1 € on the land where there is barley, 0.5 hectares or 587,5 € on the land where there is maize for silage, and 0.3 hectares or 406,3 € on the land is wheat. The total loss of income on first- and second-order areas in 2023 amounts to 7 448,0 € for the analysed farm.

Table 2. Crop yield reduction and arable crop area loss along the first and second-order watercourses

	Estimated yield per year (t/ha) and estimated Price (€/t)*		Arable crop area loss (ha), main crop yield reduction (t/ha) and income loss (€) in the analysed farm**		
	t/ha	€/t	ha	t/ha	€
1st Order W.					
Barley	4.0	278,3	0.7	2.8	779,1
Maize for Grain	4.4	293,4	1.1	4.8	1 420,1
Wheat	4.3	314,9	1.7	7.3	2 302,1
Maize for Silage	30.6	38,4	1.0	30.7	1 173,8
Total					5 675,1
2nd Order W.					
Barley	4.0	278,3	0.7	2.8	779,1
Wheat	4.3	314,9	0.3	1.3	406,3
Maize for Silage	30.6	38,4	0.5	15.3	587,5
Total					1 772,9
Total (1 st and 2 nd Order W.)					7 448,0

* Estimated yield per year and estimated price for the Savinja region in Slovenia (SURs, 2023)

** Arable crop area loss and main crop yield reduction for the analysed farm

CONCLUSIONS

Many farmers in Slovenia face obstacles due to restrictions on their agricultural land that encroach on protective strips, putting them in an unequal position and resulting in a decline in arable crop area loss and crop yield reduction. Those challenges underscore a complex dynamic between the ecological value of riparian zones and their economic impact on agricultural productivity. The issue is quite common, considering the extensive agricultural areas along those watercourses. Agricultural producers are dissatisfied with the European agricultural policy 2023-2027, which has tightened environmental and climate demands compared to the European agricultural policy between 2015 and 2020.

To address this issue, one proposed solution involves the government repurchasing the land and compensating farmers for their loss of income or for transitioning the land's use, whereby the width of protective strips remains unchanged (15 m, 5 m, 3 m). Our opinion is that the strategy of one-size-fits-all is inadequate and not economically and environmentally sustainable in the long run. We suggest, changing and adjusting the width of protective strips to local conditions. The width of strips should be considered after agricultural land use near watercourses (use of PPPs and mineral fertilizer), slope to watercourse, soil characteristics, current water quality and morphology of riverbed and existing riparian vegetation (hedgerow). It is also important to mention that Slovenia has limited high-quality arable land available for agriculture, making it essential to adopt strategies that ensure the efficient use of these scarce resources. Unfortunately, implementing such strategies would require significant changes to legal frameworks, agricultural policies, and broader social consensus. However, by encouraging collaboration among farmers, environmentalists, and policymakers, it is possible to develop innovative, context-specific solutions that balance agricultural productivity with environmental conservation, thereby securing both the economic viability of farms and the preservation of ecosystems.

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