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THE VIEW OF AGRICULTURAL PRODUCERS ON THE LOSS OF AGRICULTURAL LAND IN THE PROCESS OF HYDROPOWER PLANT CONSTRUCTION IN SLOVENIA

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Abstract

On the one hand the demands for energy are rising, and on the other hand agricultural production and food self-sufficiency have been emphasised. In our study we analysed the views of agricultural producers on the loss of productive agricultural land due to the Brežice and Mokrice hydropower plant (HPP) construction on the lower Sava river in Slovenia and eastern highway construction within HPP Mokrice construction. The study included socio-economic analysis (semi-structured interviews with farmers and land owners) and spatial analysis of the available natural resources in the study area, using geographic information system (GIS). In total 188 questionnaires were analysed, 51 (Brežice), 102 (Mokrice), and 35 (eastern highway-HPP Mokrice). Socio-economic analysis revealed that agricultural producers have low interest in protecting their agricultural land. Based on the available information, we expect that the combination of purchase and replacement of agricultural land will allow those farms for which farming is an important source of revenue in the study area to focus in more development-oriented farming in the future. Therefore the development of appropriate agricultural and rural development programs is necessary.

Keywords: Agricultural land management, GIS analysis, hydropower plant construction, food self-sufficiency, natural resource protection.

Introduction

Usefulness of geographic information systems is perceived in many scientific fields, both in natural and social sciences. In general, the use of geographic information system using satellite imagery and aerial photography is as well widely represented in agriculture. This is evidenced by numerous studies from the agricultural field, such as studies in the research of precision farming (Zhang et al., 1999), determining the suitability of soil for agricultural production (Kalagirou, 2002), evaluation of agricultural conservation policies on the farmer’s practices (Lant et al., 2005) and evaluation of biomass potential from energy crops at the regional scale (Fiorese & Guariso, 2010). Combining the knowledge of geographic information system with other scientific disciplines is recently gaining in importance. One of the reasons is that spatial representation allows rapid display of land use information to each land parcel precisely, provided that spatial data on land use and land parcels is of good quality. Spatial research in the field of agriculture is also important starting point in the environmental impact assessment studies and evaluation of various environmental interventions on the loss of best productive agricultural land.

Materials and methods

Spatial and statistical data

For the purposes of spatial analysis various geospatial data needed to be acquired from different sources, such as the database of agricultural land use per individual agricultural holding from Slovenian ministry of agriculture known as the database of Graphical units of agricultural parcels (GERK database), administrative municipality borders from Slovenian ministry of infrastructure

and spatial planning and official borders of the area of permanent land occupation due to the construction of hydropower plant (IBE d.d.-engineering and consulting company) and eastern highway (PNZ d.o.o.-consulting and designing company). Collected data of farm subsidy applications for agri-environmental measures in the year 2007 acquired from the Slovenian agency for agricultural markets and rural development (Farm agency) was used in the case of the detailed agricultural analysis, such as the number of active agricultural households (those receiving subsidies in the agri-environmental payment programme), the size of agricultural parcels, the type of agricultural plant sown on the parcels etc. Agricultural holdings farming land within the area of permanent land occupation were identified from GERK database using ArcMap tools. Agricultural parcels of individual agricultural holding within the case study area were selected with Selection by location tool, meaning that all the parcels, those completely within the boundaries of permanent land occupation due to the construction and those containing only a part of their area inside, were selected and further analysed. In order to extract the non-spatial data of Farm agency for the selected case study, this data needed to be imported into ArcMap and related to the spatial data in attribute table of GERK database using the parcel identification number (GERK PID) from both databases (spatial and non-spatial) as a relation key.

Field survey and socio-economic analysis

On the identified agricultural holdings semi-structured interviews were conducted in December 2007 (HPP Brežice), January and February 2008 (HPP Mokrice) and in March 2013 (eastern highway-HPP Mokrice). Interviewing was conducted with the co-operation of agricultural advisors from Agricultural institute of Novo mesto (HPP Brežice and HPP Mokrice) and MSc students from the Agronomy department of Biotechnical faculty in Ljubljana (eastern highway-HPP Mokrice). In total 188 questionnaries were completed and further analysed using Microsoft Excel. The questionnaire was divided in four sections, e.g.: (a) general information about agricultural holding and family members, (b) information about agricultural production, (c) the impact of HPP and highway construction on agricultural holding and (d) information about supplement on-farm activities. In addition selected statistical data of agricultural census 2002 collected by the Statistical office of the Republic of Slovenia was analysed in order to complement the study which was commissioned by the Holding Slovenske elektrarne group (HPP Brežice and HPP Mokrice) and Brežice Municipality (eastern highway-HPP Mokrice).

Case study area

In this paper the analysis is focused on the areas of permanent land occupation due to the hydropower plant (HPP) construction on lower Sava river and eastern highway construction within HPP Mokrice construction. In the case of HPP Brežice the area of permanent land occupation is located in two municipalities, Krško and Brežice, whilst in the case of HPP Brežice and eastern highway this area is solely located within the administrative borders of Brežice municipality, bordering Croatia on southeastern part of Slovenia (figure 1). HPP Brežice and HPP Mokrice are the last two in the chain of six HPPs on the lower Sava river in Slovenia with a total average annual production of 281 GWh. Moving towards the more sustainable development in the future the impacts of HPP need to be carefully considered, especially if the loss of best productive agricultural land is involved. The major impact of HPP construction is related with dams and reservoirs, which can permanently occupy bigger areas of actively farmed agricultural land and therefore can have a wider impact on agricultural production and consequently farmers’ income.

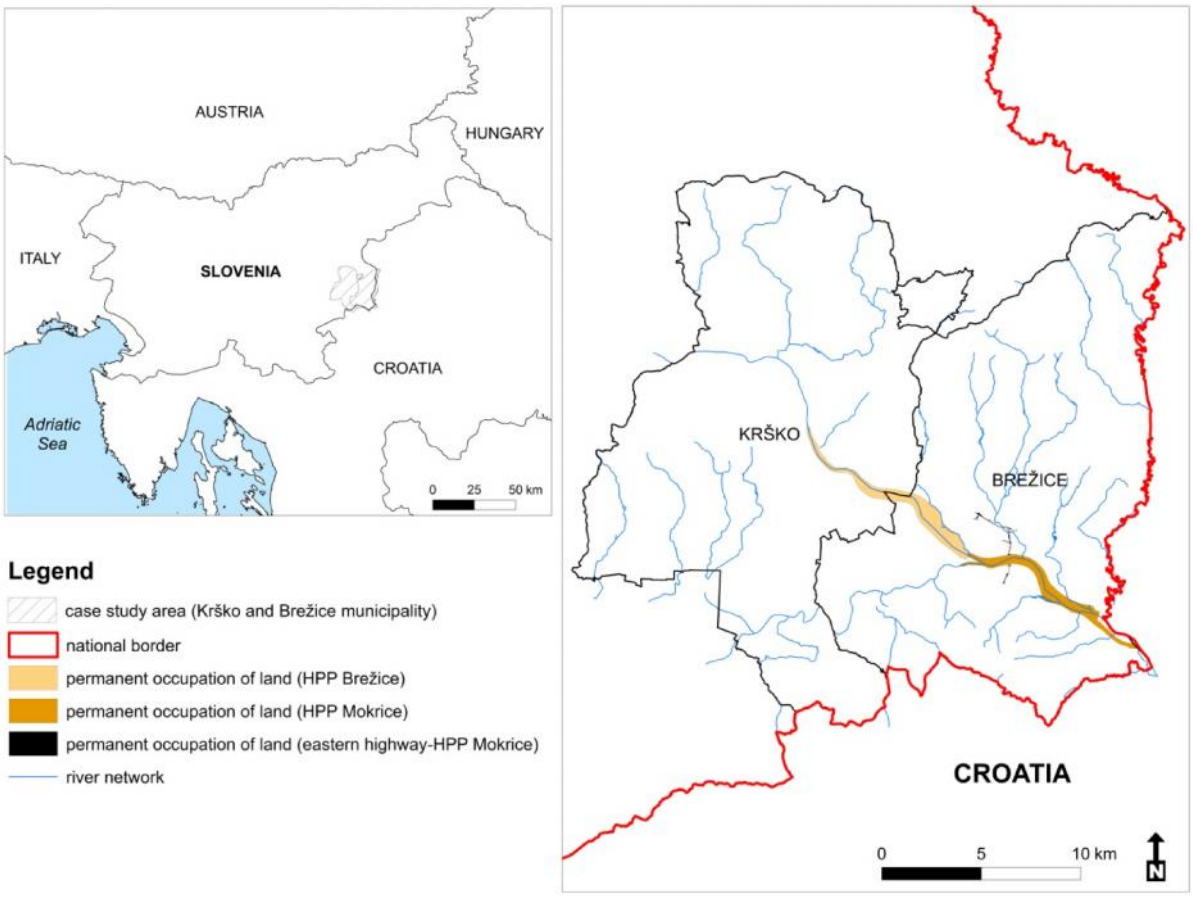

Figure 1. Geographical position of case study area and the area of permanent occupation of land due to the hydropower plant (HPP) and highway construction (Miličić, 2013).

Results and discussion

Agricultural holdings and main land parcels characteristics

The spatial analysis of GERK database (2007) revealed that in total 602 land parcels of total 266 agricultural holdings in Krško and Brežice municipality will be permanently affected due to the HPP and highway construction (table 1). It should be noted that all the analysed parcels are actively farmed and farmers or land owners submit claims for agri-environmental measures and claims for less favoured areas on these parcels. Other actively farmed parcels not officially registered in the Register of agricultural holdings cannot be included in the analysis. More detailed analysis revealed that in the study area small land parcels, up to 1 ha, prevail (figure 2). Land parcels bigger than 20 ha are owned by two agricultural companies identified in the area. According to the information of agricultural advisors from Brežice, 90 % and 83 % of land parcels permanently lost due to the construction of HPP Brežice are state owned, in Krško and Brežice municipality respectively. In the case study area of HPP Mokrice construction (in Brežice municipality) the share of state owned land parcels is 25 %. High share of state owned land parcels is related with the farmers' views and future farmers' decisions about farming, that were expressed within the semi-structured interviews.

Table 1. Number of agricultural holdings and land parcels in 2007 according to the GERK database within the permanent land occupation due to the hydropower plant (HPP) and highway construction.

Number of ...	HPP Brežice	HPP Mokrice	Eastern highway (HPP Mokrice)	Total
... agricultural holdings	58	164	44	**266**
... land parcels	122	402	78	**602**

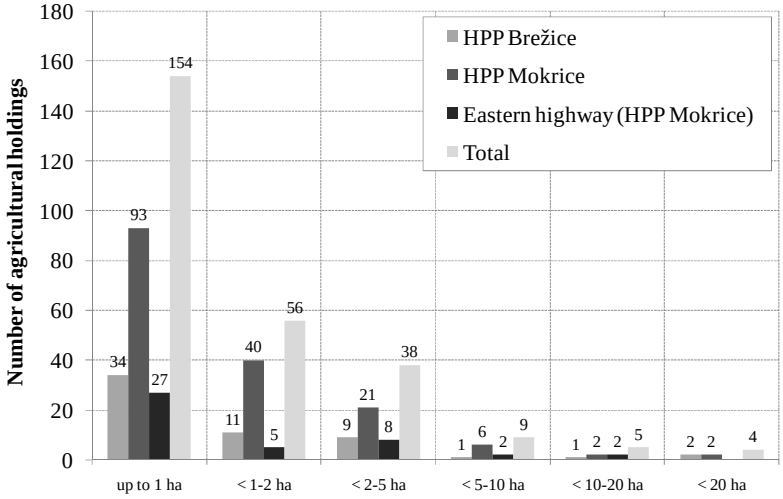

Figure 2. The size of individual agricultural land parcels belonging to one agricultural holding in 2007 according to the GERK database within the permanent land occupation due to the hydropower plant (HPP) and highway construction.

Actual land use in 2007

Spatial analysis of land use shows that in 2007 arable land was accounted for the largest area within permanently occupied land due to the HPP and highway construction (table 2). After arable land, the second largest permanently occupied area in the case of HPP Brežice is covered by forest plantations, mainly owned by the HPG Brežice agro-forest company. In the case of HPP Mokrice and eastern highway the second largest land use are meadows and pastures, owned mainly by individual land owners. Bigger land parcels are occupied by arable land and forest plantations, whilst smaller by meadows and pastures (figure 3).

Table 2. Actual land use in 2007 according to the GERK database within the permanent land occupation due to the hydropower plant (HPP) and highway construction.

Actual land use (2007)	HPP Brežice	HPP Mokrice	Eastern highway (HPP Mokrice)
Arable land	264,62	165,84	71,36
Other permanent crops on arable land	9,12	0,00	0,00
Green houses	0,00	0,03	0,00
Intensive orchards	29,75	0,00	0,00
Meadows and pastures	28,13	104,67	11,60
Overgrown areas	2,95	0,75	0,16
Forest plantations	222,36	19,24	0,00
Riparian overgrowth and forest hedges	0,06	0,09	0,00
Total (ha)	**556,99**	**290,62**	**83,13**

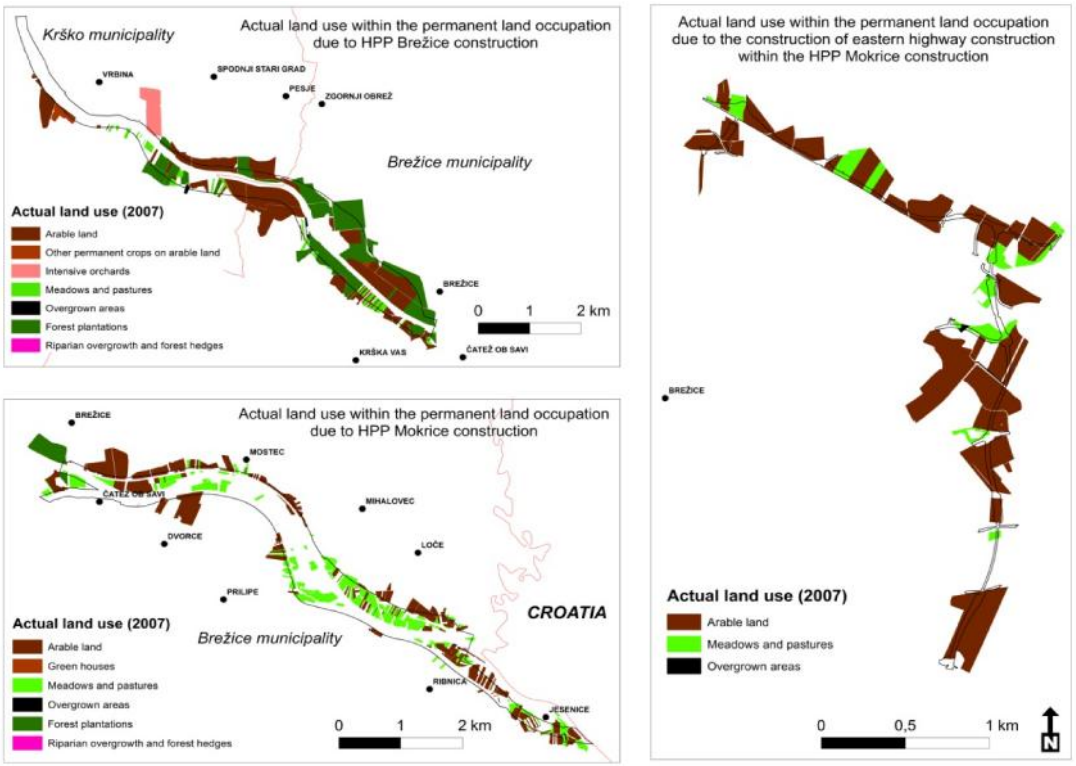

Figure 3. Map of actual land use in 2007 according to the GERK database within the permanent land occupation due to the hydropower plant (HPP) and highway construction (Miličić, 2013).

Type of agricultural production in 2007

The relation of non-spatial data from Farm agency and spatial data from Ministry of agriculture reveals that in 2007 farmers were mainly producing wheat and grain maize. This fact is supported by the data of Agriculture census (Statistical office, 2000), where it is stated that agricultural holdings in Krško and Brežice municipality are mainly crop and livestock oriented (figure 4). After wheat and grain maize permanent grassland and clover cover most of the land parcels within the affected area.

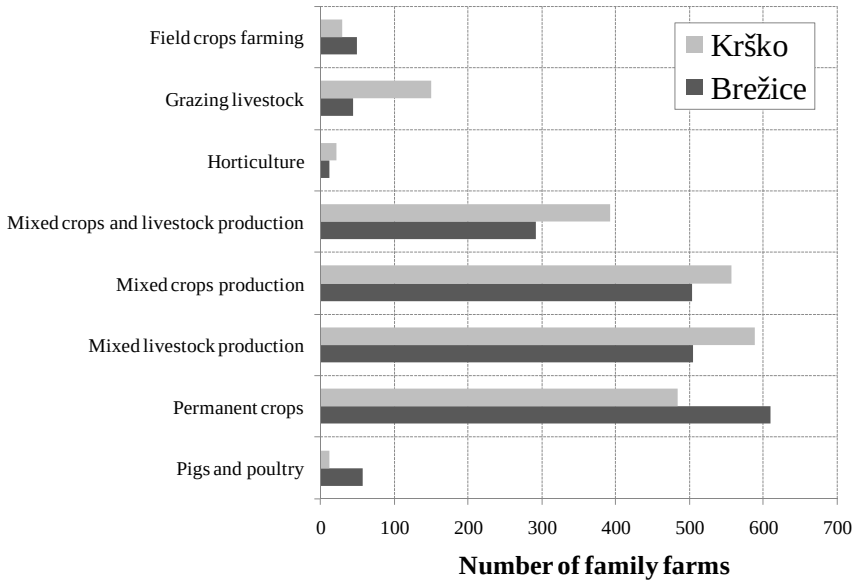

Figure 4. Number of family farms by agriculture type in Krško and Brežice municipality according to the Agricultural census in 2002 (Statistical office, 2002).

Socio-economic type of agricultural holdings

The results of semi-structured interviews indicate that most of the interviewed agricultural holdings are supplementary (hobby) farms. In the case study area of eastern highway most of the farms are part-time farms (table 3). The definition of each socio-economic farm type was set be Kovačič (1996) and it defines full-time professional farm as generally one in which one of the active members of the core family (farm manager or his spouse or successor to his or her spouse) is not regularly employed outside the farm. Farming therefore represents the main source of income. Part-time farm has at least one active member of the core family, who is fully employed outside the farm and at least one that is fully employed only on the farm. In the case of supplementary farm all active members of the family are regularly employed outside the farm. On the aged farms all household members are older than 64 years.

Table 3. Socio-economic structure of interviewed agricultural holdings.

Socio-economic farm structure	HPP Brežice	HPP Mokrice	Eastern highway (HPP Mokrice)
Full-time professional farm	39	28	21
Part-time farm	12	25	76
Supplementary (“hobby) farm	49	46	0
Aged farm	0	0	3
Total (%)	**100**	**100**	**100**

Farmer’s views on the loss of agricultural land

One of the most important questions to farmers and land owners in semi-structured interviews was the one on their intention on replacement of lost agricultural land due to the planned construction in the case study area. The highest share of farmers and land owners who do not have any intention to replace the lost agricultural land was in the case of HPP Mokrice construction. Farmers and land owners in HPP Mokrice study area do not have strong intention to protect their land, because they mainly own small agricultural plots up to 2 ha which does not represent economically important income for them. The main income for them represents work outside the farm, therefore they do not see any purpose in protecting their land in long term. Apart from that, the other reason is the amount of compensation they will get in return if they will be willing to give away their plot of land within the area of HPP and highway construction. The other group of farmers does not worry about losing their land, because they say they will buy new agricultural land elsewhere and they will continue farming on other location. Our study revealed that farmers’ view on protecting agricultural land is strongly related with socio-economic structure of the farm. If farming does not represent the main household income, the lower the intention of replacement of agricultural land is. The third group of farmers would like to get a substitute agricultural land, because they would like to continue farming in the future. A few farmers said that they will increase the intensity of production on the other agricultural land they own elsewhere. Based on the available information, it is expected that the combination of purchase and replacement of agricultural land will allow to those farms which farming is an important source of revenue in the future, that they will be able to continue with farming. The assistance to those affected by the loss, with appropriate development programmes will play an important role. Within that it would be also reasonable to consider about converting from economically less intensive agricultural production (crop and forage production) to more intensive irrigated agriculture (vegetables, strawberries, etc.) and introducing of supplementary activities on the farm, such as (processing of plant and animal products, agro-tourism, social services etc.).

Conclusions

In this paper the analysis was focused on the areas of permanent land occupation due to the hydropower plant (HPP) construction on lower Sava river and eastern highway construction in Krško and Brežice municipality. The study included socio-economic analysis (semi-structured interviews with farmers and land owners) and spatial analysis of the available natural resources in the study area, using geographic information system (GIS). The spatial analysis of GERK database (2007) revealed that in total 602 land parcels of total 266 agricultural holdings in Krško and Brežice municipality will be permanently affected due to the HPP and highway construction. Spatial analysis of land use showed that in 2007 arable land was accounted for the largest area within permanently occupied land due to the HPP and highway construction, followed by forest plantations, mainly owned by the HPG Brežice agro-forest company, and meadows and pastures, owned mainly by individual land owners. On the affected land parcels farmers mainly produce wheat, grain maize, permanent grassland and clover. This is connected with the type of agricultural production in the area which is more crop and livestock oriented. The results of semi-structured interviews indicates that most of the interviewed agricultural holdings are supplementary (hobby) farms, what is in relation to low intention for replacement of lost agricultural land due to the HPP and highway construction. For them farming does not represent the main household income, therefore their interest of protecting agricultural land is low. For the farmers who are willing to continue with farming it would be reasonable to consider about converting from economically less intensive agricultural production (crop and forage production) to more intensive irrigated agricultural production (vegetables and strawberries). Furthermore introducing of supplementary farm activities (processing plant and animal products, agro-tourism and special social services) need to be considered in the future, for the long term success of farming in the area. To achieve this appropriate agricultural and rural development programmes need to be carefully planned to encourage farmers to continue with appropriate farming practices in the future in order to achieve sufficient food self-supply in the region.

Acknowledgements

The results of the study presented in this paper were conducted within the environmental impact assessment (EIA) study which was commissioned in 2008 and 2013, by the HSE group and Brežice municipality respectively. The EIA study in this case was done only for the agricultural sector with the emphasis of HPP and highway construction on the loss of productive agricultural land in the case study area.

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