RELATIONS BETWEEN LAND-USE AND SOCIO-ECONOMIC STRUCTURE ON FARMS WITH AND WITHOUT AGRICULTURAL LAND ABANDONMENT

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ABSTRACT

Agricultural land abandonment and forest expansion is becoming a serious problem in Slovenia. Spontaneous forest expansion has a negative effect on natural and social conditions. Thus the consideration of natural and social conditions is of high importance when taking measures to prevent forest expansion. In the article, the comparison of farms with and without abandonment of agricultural use regarding land-use and socio-economic characteristics was made. The results of χ^2 test show no statistically significant differences at the level of $p < 0.05$ between farms with and those without abandonment of agricultural land regarding socio-economic structure. Analysis of variance ANOVA was used for estimating the difference between various socio-economic structures on farms with abandoned agricultural land. The results of ANOVA show a statistically significant difference ($p > 0.05$) between socio-economic structures on the farms with abandonment of agricultural land. The ANOVA results pointed out that aged farms have the largest abandoned land areas. In order to ascertain the differences between farms with and those without abandoned agricultural land regarding their land use structure, t-test was carried out, and its results have shown no statistically significant differences between farms with and those without abandoned agricultural land regarding land-use structure.

Key words: land-use, socio-economic structure, abandonment of agricultural land

COMPARAZIONE TRA FATTORIE CON O SENZA SUPERFICI AGRICOLE ABBANDONATE RELATIVAMENTE ALL'USO DEL SUOLO E ALLE CARATTERISTICHE SOCIO – ECONOMICHE

SINTESI

L'abbandono dei terreni agricoli ed il loro rinselvatichimento è in Slovenia un problema serio che si riflette negativamente sia sull'ambiente sia sulla società in generale. Le peculiarità naturali e la situazione sociale assumono perciò grande importanza nel proporre misure atte ad arrestare il fenomeno. Il presente contributo fa un confronto tra fattorie con o senza superfici agricole abbandonate relativamente all'uso del suolo e al tipo socio – economico di fattoria. I risultati χ^2 ottenuti nel test con $p < 0,05$ non mostrano differenze rilevanti nella struttura socio – economica delle fattorie con terreni coltivabili abbandonati o prive di essi. L'analisi della varianza ANOVA (con $p > 0,05$) rivela una differenza statistica notevole nella struttura socio – economica delle fattorie con terreni agricoli abbandonati. I risultati di quest'ultima analisi confermano l'ipotesi che le superfici agricole abbandonate più grandi appartengono alle fattorie più antiche. Per scoprire le differenze tra le fattorie con o senza terreni coltivabili abbandonati relativamente all'uso del suolo si è ricorsi al t-test, i cui risultati non rivelano differenze statisticamente rilevanti.

Parole chiave: uso del suolo, tipo socio – economico di fattoria, abbandono delle superfici agricole

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INTRODUCTION

Slovenia is one of those European countries with the smallest share of total and cultivated agricultural land. Only 33% of its surface area is covered by agricultural land and more then 59% is covered by forest (Official Gazette, 116/2004).

In Slovenia, forest expansion in the last 47 years has increased by 16%, and according to official data the forested area is still increasing (Krajnc, 2003). According to the stated data, abandonment of agricultural land and spontaneous forest expansion is a serious problem in Slovenia (http://ats.agr.gc.ca/europe/e3222.pdf, news link, 2004). According to Cunder (1998), the agricultural land is being abandoned in the entire country, particularly in the Alpine region. With the abandonment of agricultural land and spontaneous forest expansion are in fact faced many EU countries, although the reasons for such state of affairs in separate countries are not the same (Priska, 1995; Peterson & Aunap, 1998; Talvik, 2002; Krajnc, 2003; http://www.humangeo.su.se/eng/publications/abstracts/2003-54.htm, news link, 2004).

Regarding the research based on the 1991 census data, Perpar (2002) pinpointed the most important reasons for the abandonment of farm activities in Slovenia: young farmers do not see the future in farming, income from agriculture is too low, farms are small and agricultural land is too widely spread, the natural conditions for agricultural production are poor, and there is deficiency in farm successors as well as generally low reputation of farming. At the same time, giving up the agricultural cultivation has a negative effect on bio-physical and socio-economic structure of farms (Perpar, 2002).

Cunder (1998) and Golob (1994) stated that unfavourable natural conditions for agriculture, inconvenient socio-economic characteristics of farms and political circumstances of the past are the main reasons for agricultural land abandonment in Slovenia.

Different authors define many negative outcomes of agricultural land abandonment and spontaneous forest expansion: less cultivated agricultural land, abandonment of cultural landscapes (Perpar, 2002), changes in panoramic landscapes, game animals moving to valleys and to the cultivated landscape, low quality of young forests and lesser economic interest in them (http://www.radiokobarid.si/news/; news link, 2004), and a serious loss of biodiversity (http://www.ieep.org.uk/reportsandpubs/Ruralareasnav.htm; news link, 2004).

Regarding CORINE land cover map (http: //www.gu.gov.si/gu/predstav/predstav-p.asp), the forest expansion in Slovenia can be found largely in the Less Favoured Areas (hereinafter referred to as LFA) (Official Gazette, 116/2004). Regarding the land-use, abandoned areas are mostly spread on pastures and grasslands (SAZU – Slovene Academy of Sciences and Arts, 1989).

Irrespective of the fact that forest activities predominate in LFA, agriculture production in them still has an important role for the preservation of the sustained presence of population in rural areas and for maintaining cultural landscape (Ministry of Agriculture, Forestry and Food, 2004; Ministry of the Environment and Spatial Planning, 1997; Juvančič, 1996; Borec, 2003; Flambard, 2004).

In the article, the socio-economic farm structure as criteria for social conditions that could cause agricultural land abandonment was assessed. The socio-economic typology of farms structure is based on economic efficiency and reproductive ability of farms (Kovačič, 1996; Kerbler, 2003). Kovačič (1996) concluded that there are many important differences regarding socio-economic types of farms: the size of annual work unit (AWU), the age structure, the expanse of the families and the farm size.

As far as natural conditions are concerned, the land-use structure of farms is dealt with. Regarding land-use, some research work on the correlation between land abandonment and agricultural land use pointed out that there was a positive correlation particularly between forest and pastures (Čas, 1990; Mrakič, 2001). Lately, different projects have been proposed in Slovenia against agricultural land abandonment (Kompan *et al.*, 1997; Šalehar *et al.*, 2004), but quantitative results are still missing.

When dealing with forest expansion and abandonment, the areas that are still in the process of affecting the forest ecosystem must also be taken into account. Such areas are described as areas being abandoned and where all agricultural activities have already been stopped (Official Gazette, 30/1993). Simončič *et al.* (1999) considered such areas as areas where the abandonment process began 20 or fewer years ago.
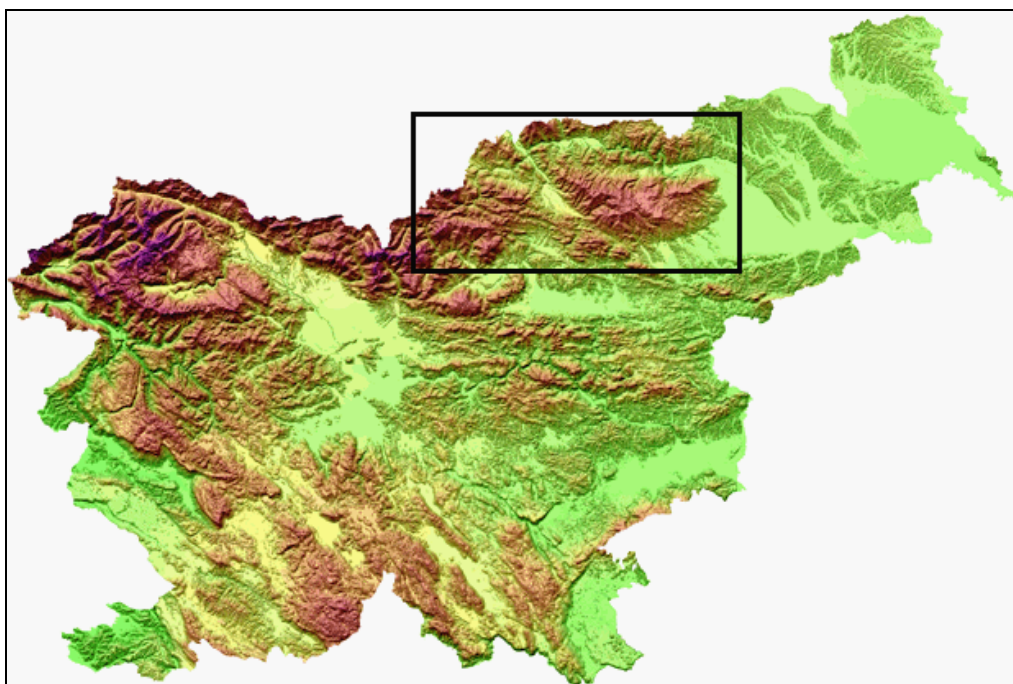
The article analyses the differences between farms with and those without abandoned agricultural land regarding land use and socio-economic farm structure is made. The variables used for the statistical analysis were selected from similar research activities (Čas, 1990; Kovačič, 1996; Mrakič, 2001; Kerbler, 2003).

The final objective of the carried out research is to establish the most suitable farm profile in the struggle against the abandonment of agricultural land.

MATERIAL AND METHODS

Studied region

The farms in the mountainous region of northeast Slovenia were studied (Fig. 1) (Official Gazette, 18/2003).

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Fig. 1: Location of the studied region (scale: 1 cm = 15 km) (Source / Vir:
http://gis.zrc-sazu.si/zrcgis/?(164.8.66.95)).
Sl. 1: Lokacija obravnavanega območja (skala: 1cm = 15 km).
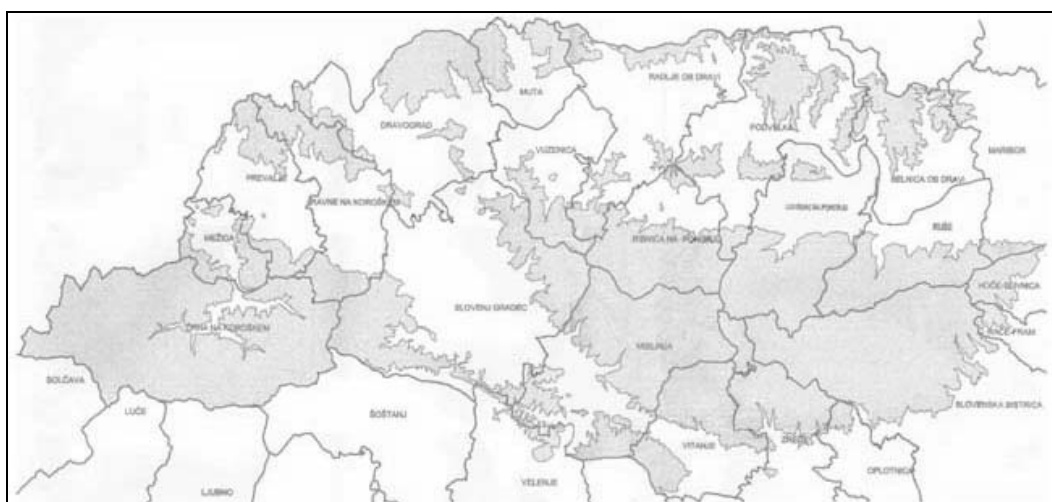
Fig. 2: Upland areas in the studied region (scale: 1cm ≈ 7 km).
Sl. 2: Visokogorsko območje v obravnavani regiji (skala: 1 cm ≈ 7 km).

All municipalities of the studied region are classified as municipalities in LFA (EC Regulation 1257/99). In figure 2, the mountainous areas in the studied region are coloured green, whereas the municipalities' boundaries are in red.

The studied area encloses 22 municipalities. There have been some projects carried out only for single municipalities, and as only a couple of studies have been made at the regional level, a wide range of current data regarding the studied area is missing.

Sample of farms

According to the limitations mentioned in 2.1 and according to the TTN 1:5000 (Basic Topographic Map), 1410 farms are located in the studied area. The selection

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of farms was random, with the representative sample comprising 140 farms in the studied area.

Questionnaire

The questionnaire is divided into six parts: basic data about the farm, land-use and abandonment of agricultural land, livestock production, plant production and investments in farms. Each part has a different number of questions. Questions are of open and closed type. For the analysis, the questions related to the basic data of the farm, questions about land-use and abandonment of agricultural land and questions regarding livestock production were applied. For the sake of questionnaire validity, the questions were checked and analysed in accordance to many similar questionnaires, methodological explications and research activities (Kovačič, 1996; Brancelj, 1999; Kerbler, 2003; Krajnc, 2003; Glauben *et al.*, 2004; popisni list: http: //www.agroport.si/download/pl_1-3.doc).

Procedure

The questionnaires were carried out in June and July 2004. The filling-in lasted approximately two hours for each farm. Farmers were well acquainted with the filling in of the questionnaire. No questionnaires were eliminated owing to incorrect filling. The questionnaires were performed by well-qualified questioners. The questions were answered by farm owners or their near relatives.
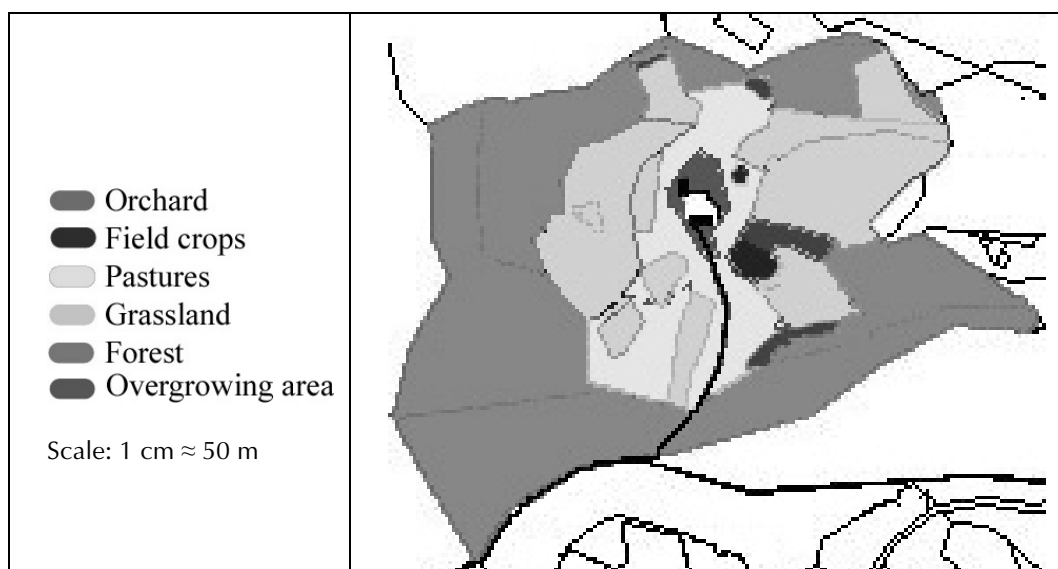
Analysis

On the basis of questionnaires, two farm clusters were defined: farms with and those without abandoned agricultural land. In order to establish the differences between the two farm clusters according to their land-use and socio-economic structure, first the basic descriptive statistics were carried out. In order to understand the differences between farms with and those without abandoned agricultural land regarding their socio-economic structure, the χ^2 test was used. In order to see the differences between farms with and those without abandoned agricultural land regarding their land-use, the t-test was carried out. Statistical significance was set at α level of 0.05. Analysis of variance ANOVA was used for estimating the difference between various socio-economic farm structures concerning the abandonment of agricultural land. The ANOVA was carried out only on farms with abandoned agricultural land. The results are represented in tables and graphs.

RESULTS AND DISCUSSION

Farms in the studied area are mostly large; on average they cover 9 ha of agricultural land and 31.5 ha including forest, while the Slovenian average in 2003 was 6.3 ha of agricultural land and 12.0 ha including forest (Statistical Office of the Republic of Slovenia, 2004). Of the 140 surveyed farms, 71 are faced with land abandonment, which is more than a half of them. In the farms with abandoned agricultural land, the average size of forest expansion is almost 2 ha. The figure 3 shows that forest replaces mostly grassland and pastures on the periphery of the farm estate.

Fig. 3: Localisation of abandoned agricultural land on Grizolt farm.
Sl. 3: Opuščene kmetijske površine na kmetiji Grizolt.

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Land-use analysis

For the land-use analysis, four variables were created. The selected variables are the main land-use structures in the studied area. Pastures and orchards are taken together, as the extensive orchards are, without exception, also used for grazing. The basic land-use analysis of farms indicated that farms with abandoned land are larger than farms without it, mainly due to forest and pastures with orchards areas (Fig. 4).

area (ha)
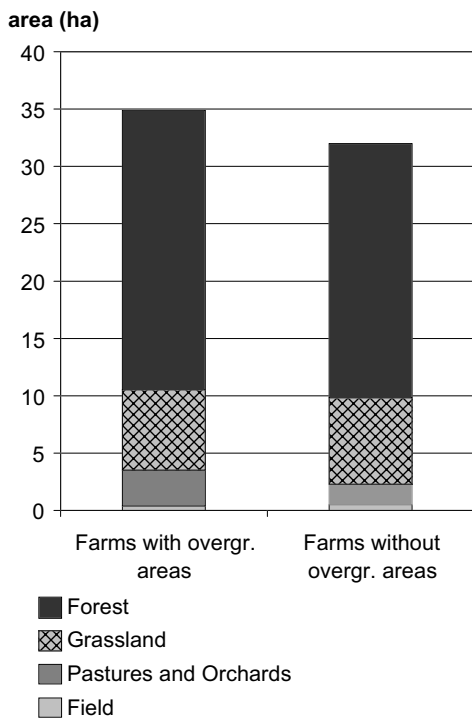
Fig. 4: Land-use structure of farms.
Sl. 4: Struktura rabe tal na obravnavanih kmetijah.

In order to establish statistical differences between farms with and those without abandoned agricultural land regarding their land-use structure, t-test was applied (Tab. 1).

The results in Table 1 show that standard deviations are very high, with the exception of grassland, which indicates a huge dispersion of results in the sample of farms. The average size of grassland area on farms with abandoned land is 6.96 ha, and 7.48 ha on farms without abandoned land. The difference between two farm clusters is not significant. The results of the next variable show that farms with abandoned land occupy, on average, 2.48 ha of pastures and orchards, and farms without such areas only 1.65 ha. The difference between two farm clusters regarding the areas of pastures and orchards is statistically significant (p <0.05). By the variable Field, the average size of field area on farms with

abandoned land comes to 0.47 and on the farms without such areas to 0.53 ha. The difference between the two farm clusters regarding the size of field area is not significant either. The average size of forest on farms with abandoned land is 24.36 ha, and 22.29 ha on farms without abandoned land. The difference for forest is also not significant.
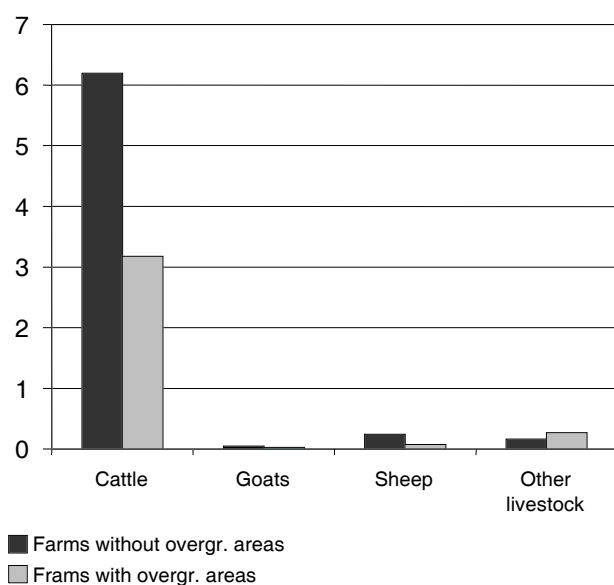
Tab. 1: T-test applied to assess the differences between farms with (n = 71) and those without (n = 69) abandoned agricultural land with regard to their land-use structure.
Tab. 1: Rezultati t-testa za kmetije z (n = 71) in brez (n = 69) opuščenih kmetijskih površin glede na strukturo rabe tal.

Land-use	Farms with abandoned land mean ± SD (ha)	Farms without abandoned land mean ± SD (ha)	p
Grassland	6.96 ± 3.73	7.48 ± 4.12	0.442
Pastures and orchards	2.48 ± 2.45	1.65 ± 2.18	0.037[*]
Field	0.47 ± 0.69	0.53 ± 0.56	0.583
Forest	24.36 ± 17.98	22.29 ± 28.26	0.607

[*]p <0.05

The important role of livestock production should not be overlooked due to its role in land-use structure on farms (especially the size of pasture and grassland areas). The variables used for the basic analysis are gathered upon livestock food behaviour. Grazing livestock like cattle (suckling cows, milk cows, young cattle, calf, and bulls), goats and sheep are due to their importance against abandonment (Pogačnik *et al.*, 1995; Kompan *et al.*, 1997; Šalehar *et al.*, 2004; http: //www.ilbis.com/ spark/st7cl5.htm) treated independently, all granivores are dealt with as other livestock (poultry, pigs etc.). Figure 5 represents the livestock pressure on pastures (pastures and orchards). In 2003, the Slovenian average agricultural holding bred 6.9 livestock size units (LSU coefficient) per ha (Statistical Office of the Republic of Slovenia, 2004), whereas farms of the studied area bred 9.5 LSU per ha. Figure 5 shows that farms without abandoned land have doubled cattle pressure on pastures, which could partly explain why there is no spontaneous forest expansion. The pressure of small grazing livestock (goats and sheep) on pastures is also greater on farms without abandoned land than on farms with abandoned land. Farms with abandoned land have greater LSU coefficient only due to other livestock (granivores).

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Fig. 5: Livestock pressure on pastures (LSU/ha).
Sl. 5: Obremenitev z živalmi na pašnikih (GVŽ/ha).

Regarding the production orientation on farms in the studied area, those with abandoned land have more diversified production (large number of various crops and livestock) than those without abandoned land (Tab. 2). Indeed, more than three quarters of farms with abandoned land (78.6%) practice a combined production of various crops and livestock. On the opposite, more than a half of farms without abandoned land are oriented only in grazing livestock production.

Tab. 2: Comparison of the farms' main production orientation (in%).
Tab. 2: Primerjava glede na proizvodno usmeritev kmetij (v%).

Farm cluster	Various crops and livestock production	Grazing livestock production	Field crops production	Total
Farms with abandoned land	78.6	21.4	0	100
Farms without abandoned land	40.7	55.6	3.7	100

The main conclusion after the analysis regarding land-use structure on farms with and without abandoned agricultural land is that farms without abandoned land are smaller, more focused on a single agricultural production, i.e. livestock production and greater grazing livestock pressure on pastures.

The results obtained from land-use analysis are expected to consider the previous research carried out into the importance of grazing livestock breeding against the abandonment of agricultural land (Kompan *et al.,* 1997; http: //www.rtd.si/slo/6op/podr/trajraz/globeko/gradivo/; http://www.nordgen.org/english/publications/articles.htm, link 2004).

Čepin *at al.* (1995) indicate that regarding the agricultural land-use structure in Slovenia (64.5% of grasslands), at least 230,000 cows or 580,000 cattle will be needed to prevent forest expansion on agricultural land and to preserve the settlements and landscape.

Analysis of socio-economic farm characteristics

The classification according to Kovačič (1996) was used to determine the socio-economic farm structure. In the studied area, the so-called living farms (agriculturally non-active farms, where all the family members live on the farm, but the agricultural land is leased) were also included in the analysis.

Tab. 3: χ^2 test for estimating the differences between farms with and those without abandoned agricultural land regarding socio-economic farm structure.
Tab. 3: Ocene χ^2 testa med kmetijami z in brez opuščenih kmetijskih površin glede na socio-ekonomski tip kmetije.

Socio-economic farm structure		Farms with abandoned land	Farms without abandoned land	Total
Full-time farm	f	24	35	57
	f (%)	40.7	59.3	100
Part-time farm	f	39	24	63
	f (%)	61.9	38.1	100
Living farm	f	2	2	4
	f (%)	50	50	100
Aged farm	f	3	5	8
	f (%)	37.5	62.5	100
Supplementary farm	f	3	3	6
	f (%)	50	50	100
Total	f	71	69	140
	f (%)	50.7	49.3	100
χ^2 outcome	χ^2 =6.146, p = 0.189, V =0.209			

The results of χ^2 test show (Tab. 3) no significant differences at the level of p <0.05 between farms with and those without abandoned agricultural land regarding socio-economic farms structure.

However, Table 3 indicates a high portion of part-time and full-time farms against living, aged and supplementary farms. Among full time farms, farms without abandoned land predominate with 59.3%, followed by farms with abandoned land (40.7%). Among part-time farms, more than half are faced with abandonment

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(61.9%). Living and supplementary farms have equal distribution between farms with and those without abandoned land. Among aged farms with only 8 farms in the studied area, farms without abandoned land predominate (62.5%).

The analysis of farms with abandoned land shows (Tab. 4) that more than half of the farms (54.9%) are part-time farms. Among the farms without abandoned land, full-time farms predominate (50.7%).

Tab. 4: Analysis of socio-economic farm structure of farms with and those without abandoned agricultural land.
Tab. 4: Analiza socio-ekonomskih tipov na kmetijah z in brez opuščenih kmetijskih površin.

	Socio-economic farm structure (%)					
	Full-time	Part-time	Living	Aged	Sup pl.	Total
Farms with abandoned land	33.8	54.9	2.8	4.2	4.2	100
Farms without abandoned land	50.7	34.8	2.9	7.2	4.2	100

To further discuss the relations between socio-economic farm structures regarding abandoned land, the ANOVA was used (Tab. 5), for which only farms with abandoned agricultural land were taken into account.

Tab. 5: ANOVA for estimating the differences between socio-economic farm structures regarding abandoned agricultural land only on farms with abandoned areas.
Tab. 5: ANOVA za oceno razlik med socio-ekonomskimi tipi kmetij glede na površino opuščenih kmetijskih zemljišč samo za kmetije z opuščenimi površinami.

Socio-economic farm structure	N	mean ± SD	F	p
Full-time farm	24	1.74 ± 1.49		
Part-time farm	39	1.45 ± 2.29		
Living farm	2	1.75 ± 0.35	4.508	0.003
Aged farm	3	6.90 ± 5.37		
Supplementary farm	3	2.60 ± 0.54		
Total	71	1.84 ± 2.37		

The results of ANOVA show a significant difference (p <0.05) between different socio-economic farm structures concerning the abandonment of agricultural land. Post hoc analysis revealed significant differences between full-time and aged farms and part-time and aged farms. The mean values show that aged farms have most abandoned land (6.9 ha). In Table 5, high values of SD are also recognized, which indicates a high dispersion of results.

Aged farms have the highest portion of abandoned

land probably due to the lack of labour. The reasons for more abandoned land at supplementary farms are most likely associated with predominance of non-agricultural activities on these farms. The expenses of abandoned land at full-time, part-time and living farms are almost the same; however, the SD at all tree farm types differs substantially.

The results concerning the farm profile with abandoned agricultural land could be explained as follows: compared to farms without abandoned land, those with such land are more expansive, with larger forest and pasture areas and with lower livestock pressure on pastures. Comparing the socio-economic farm structure of both farm clusters with farms with abandoned land, part-time farms and farms with various crops and livestock combined production orientation predominate. The biggest portion of abandoned land is also associated with aged farms. The profile of farm without abandoned land could be explained by the fact that such farms are smaller compared to farms with abandoned land, with double livestock pressure on pastures. At farms without abandoned land, full-time farms predominated, with farm production focusing on grazing livestock.

CONCLUSIONS

In the mountainous areas of northeastern Slovenia, natural conditions are not suitable for agriculture mainly owing to the rough relief of the territory and its unfavourable climate. For the last hundred years, this region has faced problems of depopulation and consequently a falling number of livestock and the abandonment of agricultural land. As a result, the spontaneous forest expansion has continuously progressed on farmlands.

Based on a sample of 140 farms, first the distribution of farms in two clusters was made: farms with and farms without any abandoned agricultural land. For the comparison between the two farm clusters, different variables were selected with regard to land-use and socio-economic characteristics.

The analysis of land-use structure on farms shows that farms with abandoned land are larger especially due to forest and pastures. In order to compare the farms with and those without abandoned land regarding land-use, t-test was applied. The results showed no statistically significant differences between farms with and those without abandoned land regarding land- use.

By supposing that grazing livestock production is of great importance for the size and diversity of land-use (Pogačnik, *et al.*, 1995; Kompan *et al.*, 1997; Šalehar *et al.*, 2004; http://www.ilbis.com/spark/st7cl5.htm), additional analyses were carried out. They indicate that farms without abandoned land have fewer pastures, but more then double grazing livestock pressure on it (counting in LSU). Irrespective of the fact that production of various crops and livestock predominates on farms,

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the farms without abandoned land are much more focused only on grazing livestock production (especially cattle breeding).

The analysis of the differences between farms with and those without abandoned land regarding the socio-economic farm structure was carried out with basic statistical analysis, χ^2 test and ANOVA.

The basic conclusion is that part-time farms predominate before full-time farms in the studied area (amounting together to 85.7%). The remaining three farm structures jointly occupy only 14.3% of total farms in the studied area. Among part-time farms, those with abandoned land predominate (61.9%), while among full-time farms those without abandoned land are predominant (59.3%). Irrespective of the noticeable differences among some farm structures regarding land abandonment, no statistical differences with χ^2 test (p >0.05) could be stated. The additional analysis pointed out that among farms with abandoned land, part-time farms are predominating (54.9%), and full-time farms (50.7%) among farms without abandoned land. To estimate the differences between socio-economic farm structure regarding size (ha) of abandoned agricultural land, the ANOVA was used, for which only farms with abandoned land were taken into account. The results indicate a statistical significance at the p <0.05 level, which is in a way not surprising at all. On aged farms, which are faced with the largest share of abandoned land, lack of labour was also established.

The results of all the carried out analyses are expected and understandable. In order to better understand both farm clusters, several research activities, especially concerning natural conditions, must be carried out. Last but not least, the richness and complexity of handling data would enhance a global perspective on the abandonment problem.

PRIMERJAVA KMETIJ Z OPUŠČENIMI KMETIJSKIMI POVRŠINAMI IN BREZ NJIH GLEDE NA RABO TAL IN SOCIO-EKONOMSKE ZNAČILNOSTI

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POVZETEK

V Sloveniji je opuščanje kmetijskih površin in zaraščanje z gozdom resen problem, saj oba procesa negativno vplivata tako na okolje kot na družbo nasploh. Naravnim danostim in družbenim razmeram se zato pri načrtovanju predlogov za zmanjševanje oziroma zaustavitev procesa opuščanja in sprotnega zaraščanja kmetijskih površin pripisuje velik pomen. Prispevek obravnava primerjavo kmetij z opuščenimi kmetijskimi površinami in brez njih glede na rabo tal in socio-ekonomski tip kmetij. Pri p <0,05 rezultati χ^2 testa ne kažejo statistično značilnih razlik v socio-ekonomski strukturi kmetij pri kmetijah z opuščenimi kmetijskimi površinami in brez njih. Rezultati analize variance ANOVA kažejo na statistično značilno razliko (pri p >0,05) v socio-ekonomski strukturi kmetij z opuščenimi kmetijskimi površinami. Rezultati analize variance potrjujejo predvidevanje, da so večje kmetijske površine opuščene na starih kmetijah. Za ugotavljanje razlik med kmetijami z opuščenimi kmetijskimi površinami in brez njih glede na strukturo rabe tal je bil uporabljen t-test, katerega rezultati ne kažejo statistično pomembnih razlik.

Ključne besede: raba tal, socio-ekonomski tip kmetij, opuščanje kmetijskih površin

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