ARTICLES

CHANGE IN LAND USE IN HALOZE IN THE PERIOD 2000-2015 WITH SPECIAL REFERENCE TO WINE-GROWING AREAS

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ABSTRACT

Change in land use in Haloze in the period 2000-2015 with special reference to wine-growing areas

Haloze is among demographically most vulnerable Slovenian regions. The unfavorable demographic and economic development is also reflected in the revised land use. The processes of change in land use over the past decade indicate extensification of agricultural production due to a significant process of greening and afforestation. The article presents changes in land use between 2000 and 2015. Having in mind that Haloze, especially its eastern part, was already in the Middle Ages known for the best vineyard sites, a high share of winegrowing areas and good wine, we paid special attention to changes of winegrowing areas and utilization of wine-growing potential.

KEY WORDS
land use, natural geographic features, Haloze

1. Introduction

Haloze is the typical hilly Subpanonnian landscape of northeastern Slovenia. Moreover, the landscape is special in both natural geographic and socio-geographic view. Among the natural factors, it is necessary to highlight the superior diversity of relief. Haloze is among hilly regions in northeastern Slovenia with maximum steepness of slopes. Great diversity is also noticable in a vertical sense, since the relative height difference is by far the highest when compared to other hilly Subpanonnian landscapes. According to the formal morphological criteria, certain areas in western Haloze already belong to the low hills. Haloze were settled since the most ancient times often on the outskirts of migration flows (Belec, 1994). On the period following the Second World War, Haloze was marked by processes of deagrarisation, depopulation, greening and afforestation. The last two processes were only added during the last decade due to the coincidence of some unfavorable circumstances.

Figure 1: Haloze divided into Western or wooded Haloze and Eastern or wine-growing Haloze.
Vir: DTK50, GURS, 2005

2. Methodology

The article is dealing with changes in land use between 2000 and 2015. Data on land use were taken from the Ministry of Agriculture, Forestry and Food (MAFF). It annually publishes data on agricultural land use in SHP format (Ministry of Agriculture, Forestry and Food, 2015). Vector data for each category are changed into a raster image, the cell size of 5m x 5m. The methodology of acquisition of land use has changed in the meantime, so that all forms of land use for the year 2000 entered into 21 categories, for the year 2015 into 26 categories. By combining classes, we have created eight categories of land use: arable land and gardens, orchards, vineyards, other permanent crops, grassland pastures, land for afforestation and forests etc.
Data on land use were compared to positions (elevation, relative height, gradient of slope and aspect of the slopes), and global solar radiation. Data on positions were demonstrated with the help of a digital elevation model with a cell size of 5 mx 5 m (Archive SMA, 2011). Global solar radiation for each cell was modeled with the help of the program ArcGIS. In Haloze we relied on Bračič's regionalization (Bračič, 1967; Bračič, 1982). Data on land use were compared for the years 2000 and 2015 and there was established the direction of changes in land use, the intensity of these changes and their relation with positions. In doing so, we paid special attention to more intensive forms of land use, mainly arable land and gardens, vineyards and orchards.

For the analysis of utilization of wine-growing potential, we analysed Haloze area according to topoclimatic suitability of the position of viticulture. We used two main criteria: relative size and global solar radiation. In higher elevations, the phenomenon of salt and frost is scarcer due to less frequent fog and there is also increased insolation (sunshine duration). Major global solar irradiation means a greater amount of energy for annual vines. In the modeling of global solar radiation, in addition to geographical and astronomical factors (geographical latitude, the height of the sun, which depends on the day of the year and time of day), there were also considered relief characteristics (slope and aspect of slopes). Elevation has a greater importance in the night time and global solar radiation during the day (Žiberna 1992, pg 129-130). According to topoclimatic quality, vineyards were divided into four classes, with the first-class position representing the highest quality wine-producing areas (Table 1).

Table 1: Topoclimatic quality of vineyards.

GSO (kWh/m2) / Altitude (m)	above 1200	1000 – 1200	under 1000
above 50 m	1. class	1. class	2. class
25 – 50 m	2. class	2. class	3. class
under 25 m	3. class	3. class	4. class

3. Changes in land use in the area of Haloze between 2000 and 2015

In 2000, in Haloze area we had 1473.1 ha (5.9%) of fields and gardens, 1453.9 ha (5.8%) of vineyards, 494.8 ha (2.0%) of orchards, only 0.1 ha of other permanent crops, 6789.3 ha (27.0%) of meadows, 758.1 ha (3.0%) of abandoned land, 12,851 ha (51.2%) of forests and 1278.6 ha (5.1%) of other areas. The structure of land use in East and West Haloze is shown in Table 2.

Table 2: Land use in the area of Haloze in ha, 2000.

Category	Eastern Haloze	%	Western Haloze	%	Total	%
Arable land	962.9	6.9	510.2	4.6	1473.1	5.9
Vineyards	1227.8	8.8	226.0	2.0	1453.9	5.8
Orchards	232.6	1.7	262.1	2.3	494.8	2.0
Other perm.crops	0.1	0.0	0.0	0.0	0.1	0.0
Meadows	4120.6	29.6	2668.7	23.9	6789.3	27.0
Overgrown areas	517.1	3.7	241.0	2.2	758.1	3.0
Forests	6022.7	43.2	6828.6	61.1	12851.2	51.2
Rest	843.7	6.1	434.9	3.9	1278.6	5.1
Total	13927.5	100.0	11171.5	100.0	25099.0	100.0

The comparison between eastern and western Haloze shows that the first had 47.0% of arable land, while the other only 32.8% of arable land. This is the first time since 1824 that the proportion of arable land in eastern Haloze fell below 50%. In this context, the arable land in eastern Haloze from 1900 decreased by 2,111 ha (or 16.1%), an in western Haloze by 919 ha (or 8.3%). In 2000 Haloze recorded 40.7% of arable land, wherein it decreased by 3030 ha (or 12.6%) since 1900. In 2015, the largest share of Haloze was covered with forests (13,846 ha or 55.2%), with an increase of 995 ha or 4% more than in 2000. The second most common category of land use were grasslands (6344 ha or 25.3%). Interestingly, when compared with the year 2000, meadow areas decreased to 444.9 ha or 1.8%. Followed by other areas (2,038 ha or 8.1%), arable land (1213 ha or 4.8%), vineyards (936 ha or 3.7%) and orchards (464 ha or 2.9%). The structure of land use in 2015 is displayed in Table 3.

Table 3: Land use in the area of Haloze in ha, 2015.

Category	Eastern Haloze	%	Western Haloze	%	Total	%
Arable land	837.3	6.0	375.7	3.4	1213.0	4.8
Vineyards	810.7	5.8	125.2	1.1	935.9	3.7
Orchards	464.4	3.3	257.9	2.3	722.3	2.9
Other perm.crops	2.5	0.0	2.9	0.0	5.4	0.0
Meadows	3659.0	26.3	2685.4	24.0	6344.4	25.3
Overgrown areas	653.8	4.7	318.8	2.9	972.5	3.9
Forests	6802.6	48.8	7043.1	63.0	13845.7	55.2
Rest	697.2	5.0	362.5	3.2	1059.8	4.2
Total	13927.5	100.0	11171.5	100.0	25099.0	100.0

Source: MKGP, 2015; own calculations, 2015.

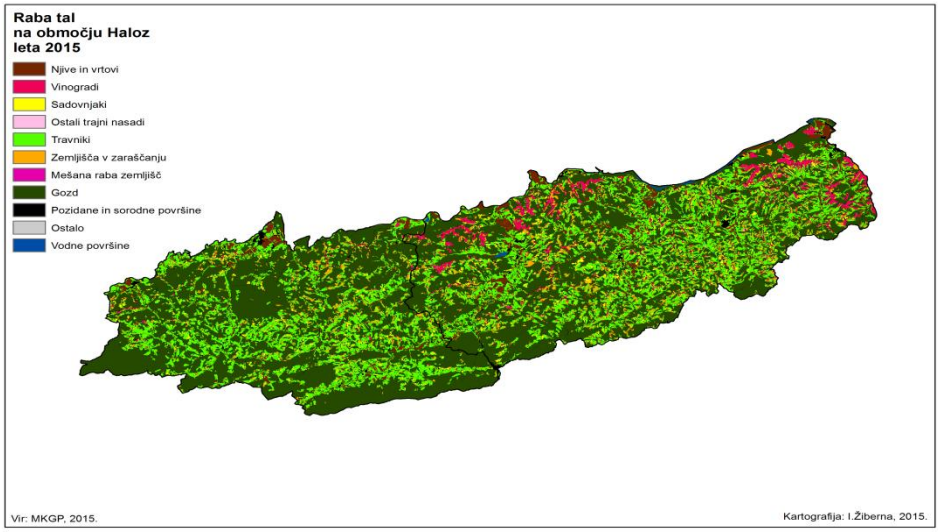

Figure 2: Land use in the area of Haloze in 2015.
Source: MKGP, 2015.

Cultivated areas in the area of Haloze in 2015 decreased to 9215 ha and thus covered only 36.7% of the surface. In eastern Haloze there were 5771 ha of arable land (41.4%) while in western Haloze there were 3444 ha (30.8%). This is a far lower proportion of arable land since 1824. In the period 2000-2015 the total arable land in Haloze decreased by 997 ha or 4,0%. Most of this reduction (77.6%) was in eastern Haloze (a reduction of 774 ha or 5.6%), while in western Haloze arable land decreased by 223 ha or 2.0%.

Unfortunately, we can say that there was a reduction of arable land that was also the largest in the area which in the past was known for its greater utilization of the natural potential of land use - that is, in eastern Haloze. The largest reduction in cultivated areas in the period 2000-2015 was recorded at Belski Vrh (14.6 ha or 10.7%), followed by Gorenjski Vrh (17.2 ha or 9.6%), Kozminci (14.5 ha or 9.0%), Meje (5,6 ha or 8.9%), Gruškovec (22.2 ha or 8.4 %), Turški Vrh (33.4 ha or 7.9%), Goričak (13.1 ha or 7.6%), Veliki Vrh (17.6 ha or 6.5%), Gradišča (30.4 ha or 6.3%), Pestike (8.6 ha or 6.3%) and Hrastovec (24.1 ha or 5.8%). Only then it is followed by the first cadastre Western Haloze - Nadole (25.0 ha or 5.8%). There is a concern particularly in the area of eastern Haloze that greater complexes cause reduction of arable land, mainly in the valley Rogatnice and in the east of the eastern Haloze (Figure 3).

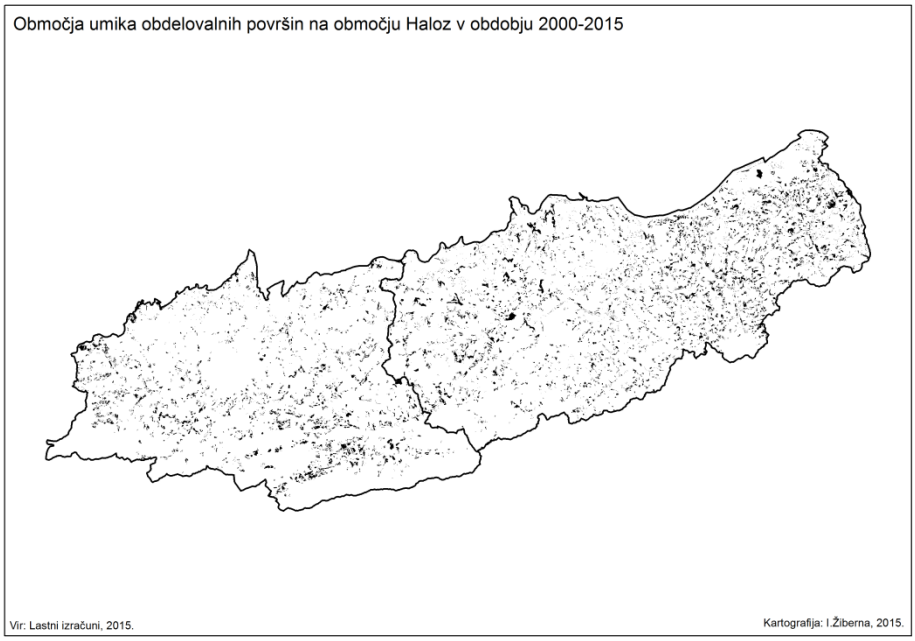

Figure 3: Areas of reduction of arable land in the area of Haloze in the period 2000-2015.
Source: Own calculations, 2015.

In the period 2000-2015, in the area of Haloze total arable land decreased to 260.1 ha (index 82.3), in eastern Haloze to 125.6 ha (index of 87.0), in western Haloze to 134.5 ha (index 73.6). Similar to arable land, the highest percentage of fields and gardens was in eastern Haloze, especially in the cadastre a large percentage of surface is located along watercourses at the bottom of valleys. The highest percentage of fields and gardens was in 2015 in Zavrč (46.1 ha or 29.2%), followed by Dravci (53.1 ha or 21.5%), Stanošina (56.0 ha or 16.9%), Mala Varnica (35.9 ha or 16.4%), Cirkulane (41, 7 ha or 16.3 %), Skrblje (84.2 ha or 16.0%) and Dolane (37.6 ha or 16.0%), to name just a cadastre with over 15% of arable land and gardens. Between 10 and 15% of arable land and gardens was in the cadastre of Dravinjski Vrh, Sp. Leskovec, Podlehnik, Zakl and Zg. Leskovec.

In the region of Haloze, wine-growing areas in 2015 covered 935.9 ha (3.7%), out of which 810.7 ha (5.8%) in eastern Haloze and 125.2 ha (1.1%) in western Haloze. Interestingly, in 2000 eastern Haloze covered 84.5% of all Haloze vineyards, while by 2015 this percentage rose to 86.6%. In 1824 this percentage in eastern Haloze amounted to 71.2% and in 1900 71.1%. Despite the absolute and relative reduction of wine-growing areas in Haloze, we may find that these are concentrated in the area of eastern Haloze, where are the best natural conditions for wine growing (Figure 4).

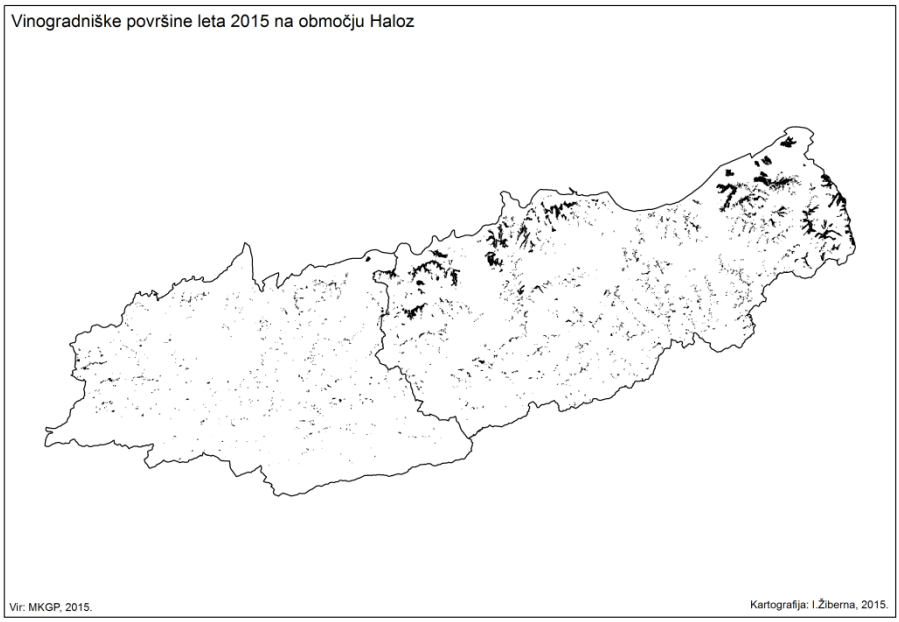

Figure 4: Wine-growing areas in Haloze 2015.
Source: Own calculations, 2015.

The highest percentage of wine-growing areas was in the cadastre of Goričak (50.2 ha or 23.8%), Majski Vrh (60.3 ha or 23.3%), Belski Vrh (42.3 ha or 18.8%), Veliki Vrh (58.8 ha or 17.2%), Turški Vrh (82.8 ha or 16.2%), Hrastovec (79.8 ha or 15.7%) and Drenovec (13.1 ha or 12.0%). Bračič (1967, pg 52) mentions that eastern Haloze is considered as one of the 5% highest quality vineyard sites in the world based on a combination of relief, climatic and soil conditions. In recent decades, a great natural potential is becoming less and less utilized. For the analysis of topoclimatic potential utilization in eastern Haloze, vineyard bonuses were compared to the actual land use. The first-class vineyards in an area of eastern Haloze cover 2,189.0 ha or 15.7% of the surface, the second-class vineyards 5644.4 ha (40.5%), the third-class vineyards 2892.3 ha (20.8%) and the rest 3201.8 ha (23.0%) of the surface. The first-class winegrowing sites in 2015 were dominated by meadows which accounted for 655.4 ha or 30.4% of these surfaces, followed by forests (655.1 or 29.9%) and only in the third place vineyards with only 438.9 ha or 20% of the first-class surface. In the fourth place was overgrown land with 186.8 ha (8.5%). In 2015 meadows, forests and overgrown land together covered 1497.3 ha or 68.4% of the first-class winegrowing sites. On the second-class winegrowing sites it was even worse. Forests covered 3,343.3 ha (59.2%) of these sites, meadows 1143.9 ha (20.3%), vineyards 338.0 ha (6.0%) and overgrown land 298.8 hectares (5, 3%) of the second-class winegrowing sites.

Although as many as 54.1% of all vineyards in eastern Haloze are located on the first-class sites, the structure of land use in these locations was mainly poor in terms of utlization of topoclimatic potential.

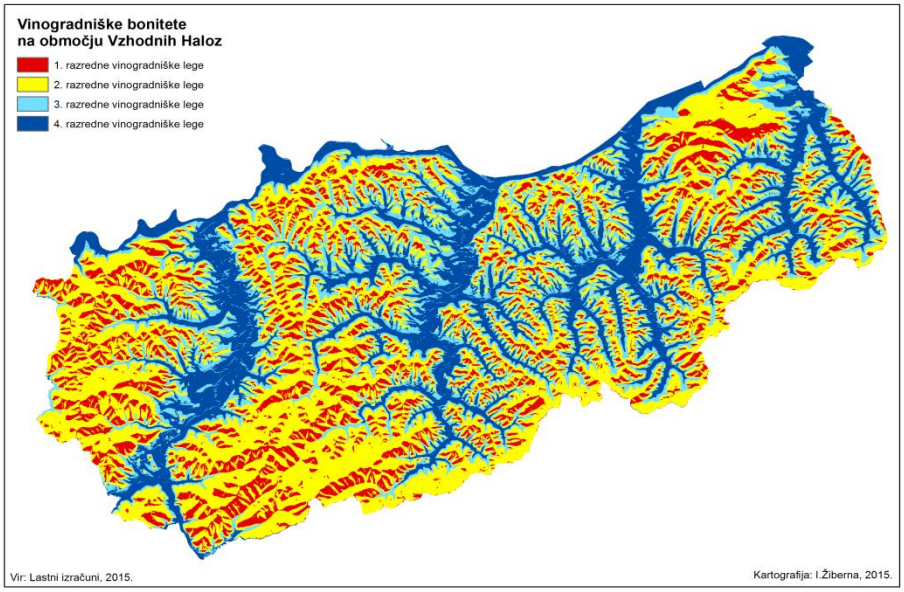

Figure 5: Vineyard bonuses in the area of eastern Haloze.
Source: Own calculations, 2015.

The situation is further weakened by the fact that trends in utilization are unfavorable due to the abandonment of vineyards, greening and afforestation. Comparison between 2000 and 2015 indicates that we have wine-growing areas in the first-class sites declined by 205.0 ha or 9.4%, while forest area in these sites increased by 119.7 ha (or 5, 5%) and overgrown land by 103.9 ha (or 4.7%). Meadows in these sites declined slightly (6.8 ha or 0.3%), which can leads us to think that the process of abandonment of the vineyards was in this period very fast or that the vineyard areas passed directly into the overgrown land or forest. To summarize, trends in the reduction of wine-growing areas are unfavorable and especially in recent times very fast. On the other hand, we can see that the area of eastern Haloze has remarkable but unfortunately untapped wine-growing potential. If only meadows and overgrown land on the first-class wine-growing sites changed into the vineyards, today's wine-growing areas in eastern Haloze would more than doubled.

Among the specific cultures in the area of Haloze, we certainly cannot ignore the fruit, although the fruit-growing area in the past never reached wine-growing areas. In 2015, in Haloze was 722.3 ha of fruit-growing areas (2.9%), out of which in eastern Haloze 464.4 ha (3.3%) and in western Haloze 257.9 ha (2.3%).

Compared to 2000, the orchard areas increased by 227.6 ha (index 146.0), out of which in eastern Haloze by 231.8 ha (index 199.6), but in western Haloze decreased by 4.2 ha (index 98.4). Moreover, in the fruit-growing areas we can note the concentration of only those in eastern Haloze. In 2000, eastern Haloze covered 47.0% of all Haloze orchards. By 2015, this percentage rose to 64.3%. The category of orchards, according to the methodology of the Ministry of Agriculture, Forestry and Food, includes both intensive (plantation) and extensive (meadow) orchards.

The latter in the structure of fruit-growing areas distinctly dominates, and its percentage increased over the period 2000-2015. In 2000, among all fruit-growing areas there was 82.2% of extensive orchards, and in 2015, their percentage grew to 98.7%. In 2000, major areas of plantations were located in areas of Veliki Vrh, Pristava and Dolena, partially in Zavrč, Hrastovec and Gruškovec, while in some parts of eastern Haloze orchards were in very small patches. Field trips to the extensive orchards in the summer of 2015 showed that many of them can already be ranked as overgrown land. Other perennial crops in Haloze were only a sample: 0,1 ha in 2000, 5.4 ha in 2015, while they were evenly distributed in both parts of Haloze.

Figure 6: Terraced vineyard-*overgrown areas in Majski Vrh in Haloze. Photo by I. Žiberna, 2015.*

Meadows in 2015 covered 6,344.4 ha or 25.3% of the surface. Out of these, 57.6% was in eastern Haloze. Meadows in eastern Haloze covered 26.3%, and in western Haloze 24.0%. Interestingly, meadows in 2000 decreased by 444.9 ha. This decrease is mainly due to a reduction in eastern Haloze (by 461.6 ha), while in western Haloze meadow area increased by 16.7 ha. A detailed analysis

of cause of the reduction of the meadows shows that this was the reason for the process of afforestation. Among 6789.3 ha of meadows in 2000, up to 2015 remained 67.8%, out of which 788.7 ha (11.6%) were forests, 590.6 ha (8.7%) outgrown land. Data suggest that the process of abandonment of arable land slowly passes from the process of greening to the process of afforestation, unfortunately, in eastern Haloze. The focus of cadastre with higher percentage of grassland in 2015 was in the central part of eastern Haloze. The cadastre Pristava covered 46.1% of meadows, followed by Repišče (44.9%), Paradiž (43.0%), Skorišnjak (42.2%) and Pestike (39.9%).

Overgrown land in Haloze in 2015 covered 972.5 ha or 3.9% of the area of Haloze (even more than wine-growing areas), while 67.2% of all Haloze overgrown land was in eastern Haloze. In eastern Haloze overgrown areas covered 4.7% of the total surface and in western Haloze 2.9%. Among the cadastre with the highest percentage of overgrown land were Gradišče (12.4 ha or 8.6%), Trdobojci (8.8 ha or 8.3%), Sedlašek (51.1 ha or 8.2%), Goričak (14, 1 ha or 8.1%), Gruškovec (21.2 ha or 8.0%) and Meje (5.1 ha or 8.0%). Overgrown areas therefore occured on a larger scale in the eastern and northern part of Haloze (Figure), which also has several fields and gardens and vineyards and arable land.

Forest area accounted for a predominant form of land use since at least 1824, since there are reliable statistics on land categories for the entire area. If forests in 1824 covered 11,949 ha or 47.4% of total Haloze, up to 2015 this value rose to 13,846 ha or 55.2%. Forests in 2015 covered 6803 ha (48.8%) in eastern Haloze, and 7043 ha (63.0%) in western Haloze. Interesting is also the analysis of the changing percentage of forests located in eastern Haloze when compared to the total forest area of Haloze. In 1824 and 1900 in eastern Haloze there were 44.5% of all Haloze forests, by 2000 this share rose to 46.9, and in 2015 it amounted to 49.1%. The data tell us two things: the dynamics of the spread of forest land in eastern Haloze is more intense than in western Haloze (1), the process of afforestation in recent years has intensified (2). The idea that there is more forest land in western Haloze is true, but it is also true that its share is increasing in eastern Haloze. Other areas that we ranked as masonry, water surfaces and other infertile surfaces in 2015 in Haloze covered 1,059.8 ha (4.2%), an increase of 218.8 ha or 0.9% less than in 2000. Among the cadastre with the highest percentage of other areas dominated those with a higher proportion of built-up areas. It is therefore a municipal center or area with larger agglomerations in the case of cadastre Dolane by industrial areas. The highest percentage of other areas in the cadastre Dolane (29.4 ha or 12.5%) over 8% of the surface is occupied by Cirkulane, Zavrč, Skrblje, Zg. Leskovec, Dravci, Zakl and Dežno.

Below we look at the direction of changes in land use over a period of 2000-2015 in the area of Haloze. From a total of 25,099.0 ha of land, Haloze forms of land use remained at 19,571.3 ha or 78.7% of the total surface. Changes in land use have been intensified in eastern Haloze, where the land use has changed to 25.2% of the surface, and the less intense have been in western Haloze (16.4%). If we take as a starting point those areas where there have been a change of land use (5,347.6 ha in total area of Haloze, out of which 3,513.4 ha in the area of eastern Haloze and 1,834.3 ha in western Haloze), then we can conclude that in the area of whole Haloze in 102.3 ha (0.4% of the total Haloze surface) changes have occured in land use within arable land use categories. The changes have taken place on 2862.9 ha (11.4%) within unfertile categories. On 918.6 ha (3.7%) there have been a process of intensification and on 1463.9 ha (5.8%) a process of extensification. The ratio between the last two processes is therefore 1: 1.59 in favor of the process of extensification. In other words, for every hectare of land with the process of intensification, we had 1.59 hectares of land with a process of extensification. This ratio is less favorable in western Haloze (1: 1.84), while in eastern Haloze it is 1: 1.48.

Since Haloze - particularly its eastern part - in the past, was most famous for its wine, let's look at the changes from the period of 2000-2015 experienced by the vineyard areas. Wine-growing areas in the area of whole Haloze in 16 years decreased by 518.0 ha (index 64.4), in eastern Haloze to 417.1 ha (index of

66.0), in western Haloze 100.8 ha (index 55.4). Out of the 1,453.9 ha of vineyards in 2000, by 2015 the vineyards remained at 935.8 ha. The share of vineyards in the mentioned period decreased from 5.8% to 3.7% (in eastern Haloze from 8.8% to 5.8%, while in western Haloze from 2.0% to 1.1%). Vineyards were in the area of Haloze in this period frequently evolving into meadows (351.8 ha or 24.2% of wine-growing areas in 2000), overgrown land (103.3 ha or 7.1%) and forests (45.3 ha or 3.1%).

The reverse process of transition in the vineyards were considerably rarer. Arable land is transferred into vineyards on 4.0 ha, orchards on 9.7 ha, meadows on 34.3 hectares, overgrown land on 3.8 ha and forests on 8.5 ha. There is a special concern about the processes of withdrawal of wine-growing areas in eastern Haloze. These are decreased by 417.1 hectares during the 16-year period, out of which 275.6 ha (66.1%) on account of changes in meadows, 89.6 ha (21.5%) due to changes in overgrown land and 35.8 ha (8.6%) on account of changes in forests. In the case that these processes continue, the name of the wine-growing Haloze as a synonym for eastern Haloze will no longer be appropriate.

4.Conclusion

Haloze has historically been known primarily for its excellent vineyard sites. In particular, the wine-growing Haloze is in conjunction with the fruit growing on the one hand found a major part of the income within the agrarian activities, on the other hand, built identity and external visibility of this region. The processes of greening and afforestation of this region, which began after the Second World War, have over the last decade continued to escalate. Despite the traffic remoteness, unfavorable demographic processes and fragmentation of possession, natural conditions allow quality viticulture, which together with the fruit growing may allow more income to the domestic population. Intensive forms of production have not demonstrated evidence to understand the context of conventional agriculture. On the contrary. At a time when healthy food is gaining in importance and cost to organic production of agricultural products, they may represent one of the possibilities for the future development of Haloze. Declarative establishment that supply of agricultural products in Slovenia is reducing and that it is necessary to stop the transition of arable land into built-up or extensive forms of land use will certainly not be enough. In this context Haloze represents perhaps the most clear metaphor for processes that can be monitored in other parts of Slovenia. Great damage would be made if over several decades observed Haloze missed opportunity for a sustainable agriculture that gives effect.

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