(NE)USKLAJENOST URADNIH PROSTORSKIH EVIDENC PRI UGOTAVLJANJU KRČITVE GOZDOV V SLOVENIJI

(IN)CONSISTENCY IN THE OFFICIAL SPATIAL DATA IN ASSESSMENTS OF DEFORESTATION IN SLOVENIA

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IZVLEČEK

Neusklajenost prostorskih podatkov, na katero naletimo v posameznih uradnih prostorskih bazah podatkov različnih institucij in v različnih obdobjih, je splošno znana težava, ki se rešuje počasi in stihijsko. Razlike med podatki lahko vplivajo na odločitve, načrte in politike, ki so povezane z izračuni sprememb tal v nekem obdobju. V članku je obravnavano neskladje med različnimi uradnimi podatki o krčitvah gozdov v Sloveniji. S prekritjem vektorskih baz podatkov Evidence dejanske rabe kmetijskih in gozdnih zemljišč, ki jo upravlja Ministrstvo za kmetijstvo, gozdarstvo in prehrano, avtorici ugotavljata površino krčitev gozdov v obdobju 2002–2012. Ta je bila desetkrat večja od površine v evidenci, ki jo po uradni dolžnosti vodi Zavod za gozdove Slovenije. V raziskavi so opredeljeni vzroki za tolikšno razliko in z vizualno primerjavo z ortofotom ocenjen obseg dejanskih krčitev gozdov v navedenem obdobju. Najpomembnejša vzroka sta različna natančnost razmejevanja poligonov med posameznimi rabami tal ter različna interpretacija rab tal med obema letoma, in to kljub nespremenjenem stanju na terenu. Ocena dejanskih krčitev gozdov obsega 14,2 % prvotnega podatka.

ABSTRACT

Inconsistencies in official spatial data found in different government organisations and different periods are a commonly known problem and all the attempts to solve it are slow and fortuitous. Differences between data can have an impact on decisions, plans and policies in a country, connected with calculations of land use changes. This article discusses inconsistencies between different official data on deforestation in Slovenia. The authors assess the area of deforestation in the period between 2002 and 2012, with an overlay of vector data from map of Actual Land Use Data Base for 2002 and 2012. The map is managed by the Ministry of Agriculture, Forestry and Food. The assessed area of deforestation is ten times higher than the official value in Slovenia Forest Service annual reports. The causes for such a discrepancy were identified in the survey. An assessment of actual deforestation was done by visual comparisons of orthophoto. The most important causes were: different accuracy of delineation of polygons between land uses and different interpretation of land uses between both years, although the situation in nature remained the same. Assessment of actual deforestation was 14.2% of the initial value.

KLJUČNE BESEDE

evidenca dejanske rabe tal, gozd, sprememba, krčitev, interpretacija

KEY WORDS

land use database, forest, change, deforestation, interpretation

1 INTRODUCTION

1.1 Identifying changes in land use

Every country would, without doubt, like to know how and when spatial changes occur. More commonly, however, this is information they need to know. One of the most noticeable and significant spatial changes is deforestation. Remote sensing technologies have now developed to such an extent that the opportunities for studying areas of deforestation have increased markedly, giving us the option of covering and monitoring large areas, such as an entire country, at a single moment in time.

A variety of data on land use in Slovenia has been around for many years, and the study of land use has a long history here. Numerous studies comparing land use from the 18th century onwards use, as their basic source, military maps drawn up during the reign of Jožef II (Čarni et al., 1998; Zorn, 2007; Paušič and Čarni, 2012) or the Franz I cadastral survey (Petek and Urbanc, 2004), which was compiled between 1818 and 1828. Use of the current land cadastre, administered by the Surveying and Mapping Authority of the Republic of Slovenia (SMARS), is only partly suited to the purposes of analysing land use over recent decades, since the land parcel is the smallest unit of area in which land use is recorded. The significant deviation from the situation in reality also presents a problem (Gabrovec and Kladnik, 1997; Mivšek et al., 2012). Use of the cadastre is suitable for establishing changes in land use across several decades of history. Aerial and satellite images, which form the basis for the production of various digital spatial databases, are used to provide more precise information on land use in Slovenia over the last two decades; they lag behind the actual situation to a lesser extent, with the differences between them lying in the gaps of time between the images and in their level of precision.

Satellite images of the terrain form the basis for the CORINE land cover (CLC) spatial database for 1990, 2000 and 2006 compiled by the European Environment Agency. Its advantage lies in the fact that it uses a uniform methodology for all European countries, thereby enabling comparisons to be made between them. In Slovenia, CLC enables trends in changes in land use to be monitored, although it is not subtle enough for fragmented land use, since the methodology only encompasses changes in cover of over 5 ha (Rikanovič, 2003; Petek, 2004; Skumavec and Šabić, 2005). For requirements relating to the monitoring of land at the European Union level, the European Commission established LUCAS, the Land Use/Cover Area frame statistical Survey (European Commission … 2010), which aims to monitor the situation and trends in land use and cover within the EU on the basis of field visits to selected points (1,621 points in Slovenia in the 2012 inventory) (European Commission …, 2013).

The Statistical GIS land cover database for 1993, 1997 and 2001 (Skumavec and Šabić, 2005) uses, in addition to Landsat satellite images of differing resolutions (30 x 30 m in 1993 and 1997, 15 x 15 m in 2001), the more detailed data provided by a variety of institutions. The smallest unit for mapping arable, forest and open land and bodies of water is one hectare; therefore, the division into categories for the purpose of classification is not suitable for spatial units smaller than statistical regions. An additional problem is presented by the classification of forested areas, since this category also encompasses areas covered by bushes, overgrown areas and those areas visible as forested areas in satellite images (Skumavec and Šabić, 2005). This means that they do not only cover areas defined as forests in the Forests Act (Zakon o gozdovih, 1993).

In 1997 the Ministry of Agriculture, Forestry and Food (MAFF) decided to set up a countrywide system for determining and overseeing land use. The objectives of the system for determining and overseeing land

use were: to establish a geographical information system for agriculture, provide links with the land cadastre, introduce a common administrative control system within the framework of the European Union to oversee agricultural subsidies, provide bases for the preparation and production of national and municipal spatial plans, establish a register of perennial plants, determine less-favoured areas, provide assistance to state administration at all levels of planning and management policy, and lay down the bases for and assist in the preparation of topological maps for analytical purposes. (Project for …, 2003). Vector data for the entire country has been available from the Records of Actual Arable and Forest Land Use (RABA) since 2002.

Under the Rules on the Records of Actual Arable and Forest Land Use (2008), checks are made of the quality of interpretation of between 5 and 10% of the data. The Cohen's Kappa value, with the help of which we can determine the attribute errors, was calculated for RABA 2002. For that part of RABA 2002 examined, this value was 0.959, which confirms that the precision of the land use attribute is considerably high (Project …, 2003). On 1 January 2014 RABA also became the basic source for defining the actual use of a land parcel in the land cadastre (Cadastral Income Act, 2011); this gives the quality of the data in RABA even greater significance and increases its usefulness across the relevant sectors. The above represents the basis for the use of the RABA database as the basis for preparing an analysis of deforestation in Slovenia over the last ten years.

1.2 Problem and purpose of the research

When drawing up the report for the Climate Change Convention and reports under the Kyoto Protocol, we encountered the practical problem of a discrepancy between the various sources of official data on deforestation in Slovenia. Miličić and Udovč (2012) have already drawn attention to the fact that the consequences of the differences between the databases of individual institutions and between different time periods stretch beyond bureaucratic and scientific circles; Indeed, the discrepancies between the different sets of official records have wide consequences not only for official documents and research; unfortunately, they also have practical consequences for landowners. There are reports of difficulties being encountered by the forest inspection service (Čar Seražin and Ahačič Pogačnik, 2013) and in water management circles (Marolt and Vugrin, 2012).

In the Pomurje statistical region, Lisec, Pišek and Drobne (2013) found that changes in land use had occurred across 20% of the area studied when a comparison of land use between 2002 and 2011 was conducted. Changes from the category of other arable land to the category of forests accounted for a relatively high proportion of these changes. The authors point out that, when using RABA data to analyse changes in land use, a great deal of attention has to be paid to the primary source (reference point in time of the data) and the methodology of data capture. They also find that the RABA database is not suitable for analysing the expansion of built land without checks being made of its reliability or without additional data. In analysing built land between 2008 and 2012, Lampič and Repe (2013) similarly drew attention to the lack of methodological consistency of RABA and the gap in the interpretation of the national orthophoto, since the overlapping of land use layers does not give a realistic picture of the increase in built land. They state that a precise estimate of the actual errors cannot be made. This research attempts to overcome this problem and to get as close as possible to the actual situation in order to establish the extent to which deforestation has taken place. The primary purpose of the research is to identify the various possible reasons for the occurrence of these major differences in the area of defores-

tation in the last decade between the data in RABA and the data of the Slovenian Forest Service (SFS), which is officially tasked with monitoring and recording activities affecting forests and issuing approval for such activities (Forests Act, 1993). The second purpose of the research is to assess the actual extent of deforestation over the same period.

2 METHODS

2.1 Establishing the extent of deforestation between 2002 and 2012 and the reasons for the differences between the various sets of data

We produced a deforestation map using RABA data with the help of the ESRI® ArcMap™ 10.0 ArcInfo software tool with the aim of studying the extent of deforestation over the last decade. We covered RABA data for 2002 (Ministry…, 2012a) and 2012 (Ministry…, 2012b). In our case, deforestation was represented by a change in land use from the category of forests in 2002 to any other land use category in 2012. We compared the data on deforestation from the RABA records with the data from the annual reports of the SFS (Slovenian Forest Service, 2012). By overlaying the RABA maps, we find that the surface area of deforestation over the last ten years is over ten times greater than appears in the official SFS records on deforestation.

We compared the deforestation map visually with the situation as presented on the national orthophoto from 1998 and 2009-2011 which formed the basis for the production of the RABA records in 2002 and 2012. With the help of a visual comparison, a review of the area legislation and the systems used to collect and update the data on deforestation of both institutions, we sought the reasons that had given rise to these large differences between the two sets of data on deforestation in the last decade.

The MAFF has established and maintains records on the actual use of arable and forest land in graphic form on the basis of orthophoto and other sources. The data is captured using a computer-supported orthophoto interpretation method (with a resolution of no less than one metre). Due regard is also paid to notifications from users and competent institutions (Agency of the Republic of Slovenia for Agricultural Markets and Rural Development, Inspectorate of the Republic of Slovenia for Agriculture, Forestry and Food) from field visits conducted (Rules on the Records …, 2008; Rules amending the Rules…, 2010). In its annual reports, the SFS reports on areas for which permits have been issued in a specific year for deforestation for agricultural purposes, approvals issued for deforestation for other purposes, and areas in which illegal deforestation has occurred.

2.2 Assessment of the actual deforestation situation

Owing to the large differences between the two sets of data on deforestation, we wished to acquire an assessment of the actual extent of deforestation on the basis of the RABA records. When we overlaid the RABA 2002 and 2012 databases, numerous linear polygons ('slivers') appeared; these were the result of the difference in the level of precision in the distribution of land use between the two years in question. We removed the surface area of the deforestation polygons located within a 15-metre belt of forest edge in 2012 from the deforestation map. In doing so we also relied on the Rules on the Records of Actual Arable and Forest Land Use (2008), under which data on a forest from the records of actual use may deviate from the forest edge under the forest management plan by a maximum of 15 metres if the or-

thophoto or the situation established in the field shows this. There is no point in making an estimate of deforestation that is more precise than the positional precision of the forest edge; we therefore removed the belt from the deforestation assessment. We subsequently further removed polygons of less than 25 m^2 in size. The Rules on the Records of Actual Arable and Forest Land Use (2008) determine the smallest areas of capture for individual types of use. The smallest area of capture for land use is 25 m^2 for waters, built and related land, and greenhouses.

In order to determine the extent of deforestation more precisely, we checked a certain number of deforestation polygons by individual land use type. We determined the size of the sample in accordance with the guidelines provided by Lillesand and Kiefer (1994), who proposed a minimum of 50 polygons from each land use category. We increased the size of the sample to 100 polygons for those land use categories (Ministry…, 2011) into which former forest land had passed and accounting for more than 10% of the entire extent of deforestation. We included all polygons of those land use categories containing fewer than 50 deforestation polygons.

In order to ensure that the polygons in the sample studied were as spaced as evenly as possible, we selected the polygons in relation to the proximity of the systematic network of 4 x 4 km points across the entire country (in the D48/GK system). Each of the 1,268 points in the network represents 16 km^2 of surface area of Slovenia. We searched for the nearest polygon to the points. We determined a distance of 2,828.43 m as the greatest distance from a point; this corresponds to the radius of the circumscribed circle of the square (1), where the edge of a square is equal to the distance between points within the systematic network (4 km) (Hladnik and Žižek Kulovec, 2012, 35).

$$R = \frac{d}{2} = \frac{a\sqrt{2}}{2} \quad (1)$$

R – radius of the circumscribed circle of the square

d – diagonal of the square

a – edge of the square

We selected polygons for the samples systematically from among those polygons that corresponded to the condition described using the 'every k-th' polygon principle (Cochran, 1977, 206). We examined the polygons selected for the sample with the aid of the orthophoto from 1998 and 2009-2011 which formed the basis for the production of the RABA vector bases in 2002 and 2012. For every polygon examined we checked whether the deforestation recorded had actually taken place. We reduced the entire surface area of deforestation within a specific type of land use in proportion to the calculated surface percentage of real deforestation in the sample.

3 RESULTS

By overlaying the land use maps from 2002 and 2012, we obtained a figure on deforestation in Slovenia in the 2002–2012 period of 38,592 ha, or an average of 3,859.2 ha of deforestation annually. SFS data on the approvals granted for activities affecting forests and illegal activities between 2002 and 2011 shows that deforestation occurred across an area of 3,418 ha, or an average of 341.8 ha annually. Based on the RABA records,

deforestation occurred on 1.90% of the surface area of the country over a ten-year period; according to SFS data, this figure was 0.17% over the same period. This gives a tenfold difference between the two sets of data.

3.1 Reasons for the difference between the two sets of data

Since large differences have arisen between the two sets of deforestation data, we compared the deforestation map visually with the orthophoto from both selected years, and examined the system for collecting data on deforestation or changes in land use, and the legal regulations applying to the area in question. Errors arising from differences between 2002 and 2012 were identified as the main reasons for the significant difference between the sets of data. These errors related to:

- **Quality of the data sources**

Data sources have become more precise in recent years; a forest edge can therefore be defined with greater accuracy. Black-and-white orthophotos were used for preparation of the database of actual land use in 2002. These were taken using single-colour technology with the size of the pictorial element being 50 cm. Colour orthophoto was used for preparation of the database of actual land use in 2012. Since 2006, recording has been done using a multi-spectrum digital camera (in the visible colour and infrared spectrums), with a pictorial element of 50 cm. Slovenia is entirely covered by colour orthophoto with a pictorial element of 50 cm; 30% of the country is also covered by colour orthophoto with a pictorial element of 25 cm and in false-colour infrared orthophoto with a pictorial element of 50 cm (Surveying and Mapping Authority…, 2014). RABA is also corrected on the basis of additional, more precise information: e.g. in the absence of any information to the contrary from the farmers concerned, an extensive orchard bordering a forest is recorded as forest in the older records. This means that a forest could pass into another land use category without any actual changes having taken place. The polygons produced are linear in form and of a smaller surface area.

- **Precision of the digitalisation of actual land use**

The number of nodes in the distribution of individual types of land use had increased markedly by 2012. The polygons that arose from this difference are linear in form and of a smaller surface area (Figure 1).

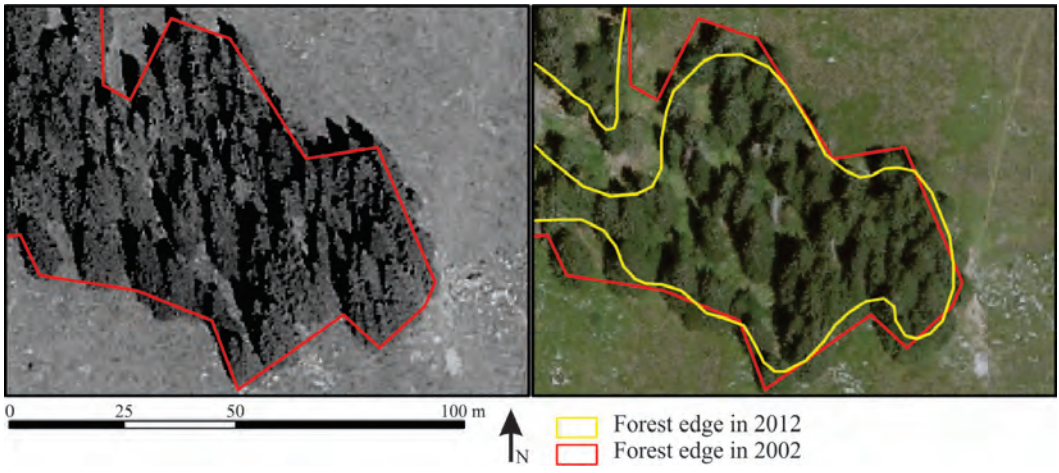

Figure 1: Change in the precision of digitalisation and the number of nodes between 2002 and 2012.
Source: National orthophoto (2002, 2012), SMARS; RABA (2002, 2012), MAFF. Figure compiled by: Mojca Nastran

- **Interpretation of categories of actual land use**

The number of categories of land use changed between 2002 and 2012, with new classes being created (1180, 1190, 1212, 1600) and one class being abolished (1130) (Ministry of Agriculture…, 2011). The key used for interpretation purposes was, throughout the entire period of data capture, updated, leading to increasingly accurate definitions of land use categories; moreover, clearings and roads came to be excluded from forested areas. In some cases the land use classification was therefore changed from forest to another category without any deforestation having occurred in nature (Figures 2 and 3).

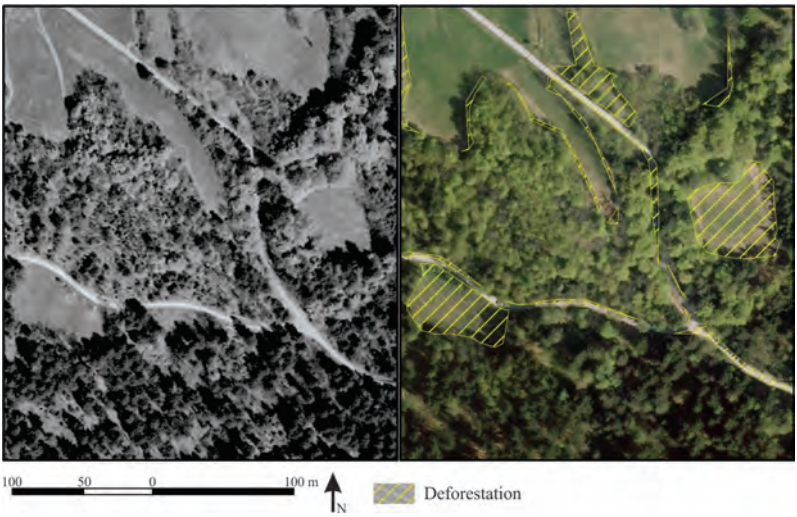

Figure 2: Comparison of the exclusion of clearings and roads from forested land between 2002 and 2012.
Source: National orthophoto (2002, 2012), SMARS; RABA (2002, 2012), MAFF. Figure compiled by: Mojca Nastran

Figure 3: Change in the classification of land use from 'forest' to 'trees and bushes' between 2002 and 2012 without any change in the actual situation in nature having occurred.
Source: National orthophoto (2002, 2012), SMARS; RABA (2002, 2012), MAFF. Figure compiled by: Mojca Nastran

3.2 Estimate of the actual extent of deforestation 2002–2012

3.2.1 Removal of linear and small deforestation polygons

The original deforestation figure of 38,592 ha was, after the removal of the polygons located within 15 metres of a forest edge in 2012, reduced to 31.5%. Deforestation polygons smaller than 25 m^2 in size account for 37.1% of the remaining deforestation polygons; however, they contribute 0.20% of the original deforestation area. Following removal of the 15-m belt and the polygons less than 25 m^2 in size, the estimate of deforestation equals 12,078 ha, which corresponds to 0.60% of the surface area of the country.

3.2.2 Removal of deforestation polygons based on a visual examination on the orthophoto

The findings of our examination of the polygons on the orthophoto show that deforestation had actually occurred on a third of the surface area of the polygons examined (33.5%). Following the visual examination, we reduced the area of deforestation by a further 17% of the original deforestation figure. We estimate the surface area of deforestation under the method described to be 5,491 ha, which is 0.27% of the surface area of Slovenia.

The highest number of errors were found in land use categories 1222 (extensive or meadow orchard), 1500 (trees and bushes), 1800 (forest trees on arable land), 4100 (marshland), 4210 (reeds) and 4220 (other marshy land), where the proportion of polygons with actual deforestation is less than 20%. We reduced the entire surface area of deforestation within an individual type of land use in proportion to the calculated surface percentage of actual deforestation in the sample.

Table 1: Results of the visual examination of deforestation polygons.

Land use code	Type of actual land use	Area of deforestation (ha)	No of polygons	No of polygons examined	Surface area of polygons examined (ha)	No of polygons with actual deforestation	Surface area of actual deforestation (ha)	Proportion of actual deforestation (%)	Assessment of actual deforestation in land use (ha)
1100	field	181.1	4,100	50	3.2	22	1.4	42.1	76.3
1160	hop garden	0.1	3	3	0.1	2	0	23.9	0
1180	perennial plants in field areas	0.6	14	14	0.6	9	0.5	76.3	0.5
1190	greenhouse	0.7	11	11	0.7	8	0.4	57.3	0.4
1211	vineyard	160.6	2,149	50	2.3	26	1.9	83.9	134.7

1212	root stock nursery	0.1	2	2	0.1	2	0.1	100	0.1
1221	intensive orchard	28.3	375	50	3.1	23	2.3	74.2	21
1222	extensive/meadow orchard	332.2	7,766	50	1.4	9	0.3	17.7	58.9
1230	olive grove	33.1	596	50	2.8	23	1.9	68.4	22.6
1240	other permanent plantations	0.3	22	22	0.3	5	0.1	34.6	0.1
1300	permanent meadows	3,158.2	69,569	100	3.3	44	1.5	46.4	1,465.5
1321	bog meadow	10	139	50	3.2	19	1.3	42.5	4.2
1410	overgrown arable land	1,854.7	20,032	100	9.3	40	5.6	59.7	1,107.5
1420	forest plantation	19.8	39	39	19.8	13	6.2	31.3	6.2
1500	trees and bushes	2,207.1	26,111	100	9.6	0	0	0	0
1600	uncultivated arable land	493.3	7,021	50	2.4	41	2.2	92.2	455
1800	forest trees on arable land	725.2	6,503	50	4.1	8	1.1	27.7	200.6
3000	built and related land	2,025.3	20,487	100	8.7	34	7.3	84.2	1,704.4
4100	marshland	20.5	17	17	20.5	0	0	0	0
4210	reeds	8.1	12	12	8.1	2	0	0.3	0
4220	other marshy land	54.7	270	50	6.9	9	1.3	18.6	10.2
5000	dry, open land with special plant cover	478.3	4,894	50	6.3	11	0.9	14.4	68.8
6000	open land without or with insignificant plant cover	166.6	1,421	50	9.7	18	5.9	61	101.6
7000	waters	118.9	1,960	50	1.9	24	0.8	44.1	52.5
Total		12,077.6	173,513	1,120	128.3	392	43		5,491.1

4 DISCUSSION

More than two thirds (68.5%) of the original deforestation figure we obtained by comparing the RABA records from 2002 and 2012 lies within a belt 15 metres from a forest edge. We therefore conclude that the linear polygons produced as a result of the more precise digitalisation of recent years account for the bulk of the error in the deforestation data.

In nearly two thirds of cases (65%) we found, when examining deforestation polygons on the orthophoto, that the polygons did not represent actual deforestation in nature. The majority of the errors arose because of a differing interpretation of a situation that had not changed in nature between 2002 and 2012. It is very unlikely that forest (land use category 2000) has changed into land use categories 1222 (extensive or meadow forest), 1500 (trees and bushes) and 1800 (forest trees on arable land) in such a short period of time (ten years). Mixed forest-arable use is often difficult to interpret on the basis of an orthophoto. A visual comparison between the deforestation map and the orthophoto yields a different definition of use, without any actual changes having occurred in nature, precisely with these types of use over the period of time in question. The attribute error for interpreting land use on the basis of an orthophoto was determined for the RABA 2002 database as part of the Capture and monitoring of ar-

able land use project. The highest number of interpretation errors occurred when determining land use categories 1500 (trees and bushes), 3000 (built and related land), 1410 (field), 1310 (intensive meadow) and 1222 (meadow orchard) in place of land use category 2000 (forest), and vice versa (Project for …, 2003). These errors demonstrate the difficulty of interpreting these categories and the greater likelihood of errors. This matches our findings following the visual comparisons between the deforestation map and the orthophoto, and the data on the incorrect interpretations obtained from an examination of the sample of deforestation polygons.

The difference between the SFS records on deforestation in the period in question and our final estimate of actual deforestation is reduced considerably and only amounts to an additional 2,073 ha, or 0.10% of the entire area of the country. This difference has arisen from the methodology used to estimate deforestation and from the differences in data capture between the two institutions (MAFF, SFS).

5 CONCLUSION

The figure on the deforestation that has taken place over the last ten years from the RABA records is over ten times higher than the figure provided by the SFS, which monitors deforestation in Slovenia as part of its official duties. Our estimate of actual deforestation, arrived at after we removed deforestation polygons from the 15-metre belt and polygons smaller than 25 m^2, and proportionately reduced the deforestation area on the basis of a visual comparison of the orthophotos, reduced the difference between the two sets of data considerably. Most of the errors caused by establishing deforestation directly from the RABA database arose because of reasons related to determining forest edges and the differing interpretations of land use in the same area without actual changes having taken place in nature. By comparing the RABA records in the period of time in question, we are only able to reach conclusions on changes in actual use, since changes can occur because of changes in legislation, higher-quality information in the field, more precise instructions on interpretation and changes to the methodology.

We advance two main areas of focus in the research and put forward two solutions for aligning or removing the differences between the databases from the different time periods. The first solution is the standardisation of the borders of polygons. This would remove the narrow linear polygons ('slivers') produced from the overlapping of two vector databases (Figure 2). The second solution proposes correction of the interpretative differences in land use in the older databases. Example: an examination of the new orthophoto leads us to conclude that with regard to actual land use category 1222 (meadow orchard), there have been no actual changes between the two periods in question; therefore, 'meadow orchard' land use (previously forest) is also ascribed to this polygon. The solutions proposed are unrealistic for the entire database, since this would entail the practical re-digitalisation of old orthophoto using the new interpretation key. They can, however, be a satisfactory aid to research work on the aforementioned number of polygons.

Owing to the legal provisions, their continuous updating, the fact that they cover the entire country, their high level of precision and the fact that they are subject to interdepartmental reporting, the records of actual use of arable and forest land are the most suitable database for use in wider analyses of land use changes. In order to establish land changes over a period of time, we have to be critical when using them, chiefly because of errors in the level of precision when drawing the dividing line between different

land use categories and their differing interpretations in individual years. This paper is an attempt to draw attention to the large difference between various sets of official spatial data and to initiate a discussion that will help to reduce major errors, thereby improving the reliability of data on land use changes.

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(NE)USKLAJENOST URADNIH PROSTORSKIH EVIDENC PRI UGOTAVLJANJU KRČITVE GOZDOV V SLOVENIJI

OSNOVNE INFORMACIJE O ČLANKU:
GLEJ STRAN 736

1 UVOD

1.1 Ugotavljanje sprememb rabe tal

Poznavanje sprememb v prostoru je zagotovo želja, še večkrat pa potreba vsake države. Ena izmed opaznejših in vplivnejših sprememb v prostoru so krčitve gozdov. Z razvojem tehnik daljinskega zaznavanja so se močno povečale možnosti za preučevanje površin krčitev gozdov, saj lahko že v trenutku zajamemo in spremljamo velike površine (na primer celotno državo).

Različni podatki o rabi tal v Sloveniji segajo daleč nazaj, saj ima spremljanje tega področja že dolgo zgodovino. V številnih študijah, v katerih so avtorji primerjali rabo tal od 18. stoletja naprej, kot osnovni vir uporabljajo jožefinske vojaške zemljevide (Čarni et al., 1998; Zorn, 2007; Paušič in Čarni, 2012) ali franciscejski kataster (Petek in Urbanc, 2004), ki je bil vzpostavljen med letoma 1818 in 1828. Za analizo sprememb rabe tal v zadnjih desetletjih je uporaba sedanjega zemljiškega katastra, ki ga vodi Geodetska uprava Republike Slovenije (GURS), le pogojno sprejemljiva, saj je najmanjša površinska enota, na kateri se beleži raba tal, parcela. Problematično je tudi veliko zaostajanje za dejanskim stanjem (Gabrovec in Kladnik, 1997; Mivšek et al., 2012). Kataster je primeren za ugotavljanje sprememb rabe tal, ki segajo več desetletij v zgodovino. Za natančnejše podatke o rabi tal v Sloveniji v zadnjih dveh desetletjih uporabljamo letalske in satelitske posnetke, ki so podlaga za različne digitalne prostorske podatkovne baze. Njihov zaostanek za dejanskim stanjem je manjši, razlike izhajajo le iz časovnega razmika med snemanji in natančnosti.

Satelitski posnetki površja so podlaga za prostorsko zbirko CORINE Land Cover (CLC) za leta 1990, 2000, 2006, ki jo je pripravila Evropska okoljska agencija. Njena prednost je enotna metodologija v vseh evropskih državah, ki omogoča medsebojno primerjavo. V Sloveniji tako zbirka CLC omogoča spremljanje trenda sprememb rabe tal, pregroba pa je za majhne, fragmentirane rabe tal, saj metodologija zajema le spremembe pokrovnosti, večje od 5 hektarov (Rikanovič, 2003; Petek, 2004; Skumavec in Šabić, 2005). Evropska komisija je za spremljanje površin na ravni Evropske unije vzpostavila sistem LUCAS – Land Use/Cover Area frame Survey (European Commission, 2010), ki temelji na spremljanju stanja ter dinamike sprememb rabe tal in pokrovnosti v Evropski uniji, na podlagi terenskih ogledov izbranih točk (v Sloveniji 1621 točk v popisu leta 2012) (European Commission, 2013).

V bazi podatkov Statistični GIS pokrovnosti tal za leta 1993, 1997 in 2001 (Skumavec in Šabić, 2005) se poleg satelitskih posnetkov Landsat različnih ločljivosti (30 x 30 m leta 1993 in 1997 ter 15 x 15 m

leta 2001) uporabljajo podrobnejši podatki različnih institucij. Najmanjša enota pri kartiranju kmetijskih, gozdnatih, odprtih površin in voda je en hektar, zato klasifikacijska delitev kategorij ni primerna za nižje prostorske enote od statističnih regij. Dodatna težava je klasifikacija gozdnatih površin, ker ta kategorija zajema tudi grmovje in površine v zaraščanju ter površine, ki so na satelitskih posnetkih vidne kot gozdnate (Skumavec in Šabić, 2005), torej ne zajame le površin, ki so z Zakonom o gozdovih (1993) opredeljene kot gozd.

Leta 1997 se je takratno ministrstvo za kmetijstvo, gozdarstvo in prehrano (sedaj ministrstvo za kmetijstvo in okolje) odločilo, da bo za celotno državo vzpostavilo sistem za določanje rabe zemljišč in nadzor nad njimi. Cilji pri tem so bili: vzpostavitev geografskega informacijskega sistema v kmetijstvu, povezovanje z zemljiškim katastrom, uvajanje skupnega administrativnega kontrolnega sistema v okviru Evropske unije za nadzor nad subvencijami v kmetijstvu, zagotovitev podlag za pripravo in izdelavo republiških in občinskih prostorskih planov, vzpostavitev registrov trajnih rastlin, določanje območij z omejenimi dejavniki, pomoč državni administraciji na vseh ravneh pri načrtovalni in upravljalni politiki, zagotovitev podlag in pomoči pri izdelavi topoloških kart, za izvajanje analiz ipd. (Projekt …, 2003). Od leta 2002 so iz Evidence dejanske rabe kmetijskih in gozdnih zemljišč (RABA) na voljo vektorski podatki za vso državo.

Po pravilniku o evidenci dejanske rabe kmetijskih in gozdnih zemljišč (2008) se kakovost interpretacije preverja za 5 do 10 % zajetih podatkov. Za evidenco RABA 2002 je bil izračunan Cohenov koeficient kappa, s katerim določimo atributne napake. Za pregledani del evidence RABA 2002 je znašal 0,959, kar potrjuje, da je atributna natančnost o rabi zemljišč precej visoka (Projekt …, 2003). S 1. januarjem 2014 je postala evidenca RABA tudi osnovni vir za opredelitev dejanske rabe parcele v zemljiškem katastru (Zakon o … 2011), zato imata kakovost podatkov v bazi RABA in njena večsektorska uporabnost še toliko večji pomen. Zaradi vsega navedenega se baza RABA lahko uporablja kot podlaga za pripravo analize krčitev slovenskih gozdov v zadnjem desetletju.

1.2 Problematika in namen raziskave

Pri pripravi poročila za Konvencijo o spremembi podnebja ter poročanje po Kjotskem protokolu smo se srečevali s težavami zaradi neskladnosti med različnimi uradnimi podatki o krčitvah gozdov v Sloveniji. Že Miličić in Udovč (2012) sta opozorila, da posledice razlik v bazah med posameznimi institucijami in obdobji presegajo birokratske in znanstvene kroge. Neusklajenost uradnih evidenc ne vpliva le na uradne dokumente in raziskave, temveč jo, žal, močno občutijo tudi lastniki v praksi. Tako poročajo o težavah pri delu gozdarske inšpekcije (Čar Seražin in Ahačič Pogačnik, 2013), posledice se občutijo tudi na področju urejanja voda (Marolt in Vugrin, 2012).

Lisec, Pišek in Drobne (2013) na primeru pomurske statistične regije ugotavljajo, da se je na podlagi primerjave podatkov o rabi zemljišč za leti 2002 in 2011 zemljiška raba spremenila na 20 % površine preučevanega območja. Razmeroma velik je delež sprememb iz razreda druga kmetijska zemljišča v razred gozd. Poudarjajo, da je pri uporabi podatkov baze RABA za analizo spreminjanja rabe zemljišč treba veliko pozornosti nameniti primarnemu viru (referenčni časovni točki podatkov) in metodologiji zajema. Ugotavljajo tudi, da baza RABA brez preverjanja zanesljivosti ali dodatnih podatkov ni primerna za analizo širitve pozidanih zemljišč.

Lampič in Repe (2013) pri analizi sprememb pozidanih površin v obdobju 2008 in 2012 podobno opozarjata na metodološko neusklajenost baze RABA in razkorak v interpretaciji državnega ortofota, saj prekrivanje slojev rab tal ne da realne slike o povečanju pozidanih površin. Navajata, da se dejanske napake ne da natančneje oceniti. V tej raziskavi poskušamo to preseči in se čim bolj približati dejanskemu stanju pri ugotavljanju obsega krčitve gozdov. Prvi namen raziskave je opredelitev vzrokov za velike razlike v površini krčitev v zadnjem desetletju med bazo RABA in podatki ZGS, ki po uradni dolžnosti spremlja in evidentira posege v gozd in zanje izdaja soglasja (Zakon o gozdovih, 1993). Drugi namen raziskave je oceniti dejanski obseg krčitev v istem obdobju.

2 METODE

2.1 Ugotavljanje krčitev gozdov v obdobju 2002–2012 in vzrokov za razliko med podatki

Karto krčitev gozdov smo izdelali iz podatkov v bazi RABA s programskim orodjem ESRI® ArcMap™ 10.0 ArcInfo. Zanimal nas je obseg krčitev v zadnjem desetletju. Prekrili smo podatke baze RABA za leti 2002 (Ministrstvo…, 2012a) in 2012 (Ministrstvo…, 2012b). Kot krčitev gozda smo obravnavali spremembo rabe tal iz razreda gozd leta 2002 v kateri koli drug razred rabe tal v letu 2012. Podatke o krčitvah iz evidence RABA smo primerjali s podatki iz letnih poročil ZGS (Zavod za gozdove Slovenije, 2012). Površina krčitev v zadnjem desetletju s prekritjem kart RABA za več kot desetkrat presega uradne evidence ZGS o krčitvah gozdov.

Karto krčitev smo primerjali s stanjem na državnem ortofotu iz let 1998 ter 2009–2011, ki je bil podlaga za nastanek evidenc RABA 2002 in 2012. Z vizualno primerjavo, pregledom področne zakonodaje ter sistemov zbiranja in dopolnjevanja podatkov o krčitvah obeh institucij smo iskali razloge, ki vplivajo na nastanek velike razlike med podatki o krčitvah gozdov v zadnjem desetletju.

MKO vzpostavi in vodi evidenco dejanske rabe kmetijskih in gozdnih zemljišč v grafični obliki na podlagi ortofota ali drugih virov. Podatki se zajemajo z metodo računalniško podprte interpretacije ortofota (z ločljivostjo najmanj en meter). Upoštevajo se tudi obvestila uporabnikov in pristojnih institucij (Agencija Republike Slovenije za kmetijske trge in razvoj podeželja, Inšpektorat Republike Slovenije za kmetijstvo, gozdarstvo in hrano) ter preverjanja na terenu (Pravilnik o evidenci…, 2008; Pravilnik o spremembah…, 2010). ZGS v letnih poročilih zajame površine, za katere so bila v posameznem letu izdana dovoljenja za krčitve gozdov v kmetijske namene in soglasja za krčitve gozdov v druge namene, ter površine nezakonitih krčitev gozdov.

2.2 Ocena dejanskega obsega krčitev

Zaradi velike razlike med podatkoma o krčitvah smo želeli dobiti oceno dejanskega obsega krčitev na podlagi evidence RABA. Ko smo prekrili bazi podatkov RABA za leti 2002 in 2012, so nastali številni linijski poligoni (sliverji), ki so posledica razlik v natančnosti razmejevanja rabe tal med obema letoma. Površino poligonov krčitev, ki je v 15-metrskem pasu gozdnega roba v letu 2012, smo odstranili s karte krčitev. Pri tem smo se oprli na Pravilnik o evidenci dejanske rabe kmetijskih in gozdnih zemljišč (2008), po katerem lahko podatki o gozdu iz evidence dejanske rabe odstopajo od gozdnega roba po gozdnogospodarskem načrtu za največ 15 metrov, če tako izhaja z ortofota ali iz ugotovljenega dejanskega stanja na terenu.

Natančnejša ocena krčitev od pozicijske natančnosti gozdnega roba ni smiselna, zato smo navedeni pas odstranili iz ocene krčitev. Naknadno smo odstranili še poligone, manjše od 25 m^2. Pravilnik o evidenci dejanske rabe kmetijskih in gozdnih zemljišč (2008) določa najmanjše površine zajema za posamezne rabe. Najmanjša površina zajema rabe tal je 25 m^2 za vode, pozidana in sorodna zemljišča ter rastlinjake.

Za natančnejšo oceno obsega krčitev smo preverili določeno število poligonov krčitev po posameznih rabah tal. Velikost vzorca smo določili skladno s smernicami Lillesanda in Kieferja (1994), ki predlagata najmanj 50 poligonov iz vsakega razreda rabe tal. Pri razredih rabe tal (Ministrstvo…, 2011), v katere preide gozd in obsegajo več kot 10 % celotnega obsega krčitev, smo velikost vzorca povečali na 100 poligonov. Pri razredih rabe tal, ki vsebujejo manj kot 50 poligonov krčitev, smo v vzorec pregleda zajeli vse poligone.

Želeli smo, da bi bili poligoni v pregledanem vzorcu čim bolj enakomerno prostorsko razporejeni, zato smo jih izbrali glede na bližino sistematične mreže točk 4 x 4 km po vsej državi (v sistemu D48/GK). Vsaka od 1.268 točk v mreži predstavlja 16 km^2 površine Slovenije. Točkam smo poiskali najbližji poligon. Kot največjo oddaljenost od točke smo določili razdaljo 2.828,43 metra, kar ustreza polmeru kvadratu očrtanega kroga (1), kjer je stranica kvadrata enaka razdalji med točkami v sistematični mreži (4 km) (Hladnik in Žižek Kulovec, 2012, 35).

$$R = \frac{d}{2} = \frac{a\sqrt{2}}{2} \quad (1)$$

R – polmer kvadratu očrtanega kroga

d – diagonala kvadrata

a – stranica kvadrata

Izmed poligonov, ki ustrezajo navedenemu pogoju, smo jih za vzorec izbirali sistematično po načelu »vsak k-ti« poligon (Cochran, 1977, 206). Poligone, ki smo jih izbrali v vzorec, smo pregledali na ortofotu iz let 1998 in 2009–2011, ki so bili podlaga za nastanek vektorskih baz RABA 2002 in 2012. Za vsak pregledani poligon smo preverili, ali se je zabeležena krčitev zares zgodila. Glede na izračunan površinski delež realnih krčitev v vzorcu smo proporcionalno zmanjšali celotno površino krčitev za posamezno rabo tal.

3 REZULTATI

S prekritjem kart rabe tal za leti 2002 in 2012 smo dobili podatek o krčitvah gozda v Sloveniji v obdobju 2002–2012, ki znaša 38.592 hektarov oziroma povprečno 3.859,2 hektara krčitev letno. Podatki ZGS o izdanih soglasjih za posege v gozd in nelegalnih posegih v letih 2002–2011 kažejo, da je bilo krčitev 3.418 hektarov oziroma povprečno 341,8 hektara letno. Krčitve na podlagi evidence RABA v desetletnem obdobju pokrivajo 1,90 % površine države, na podlagi podatkov ZGS v enakem obdobju pa 0,17 % površine države. Razlika med podatkoma je več kot desetkratna.

3.1 Vzroki za razliko med podatkoma

Zaradi velike razlike med podatkoma o krčitvah smo karto krčitev vizualno primerjali z ortofotom obeh izbranih let, pregledali sistem zbiranja podatkov o krčitvah oziroma spremembah rabe tal in področne

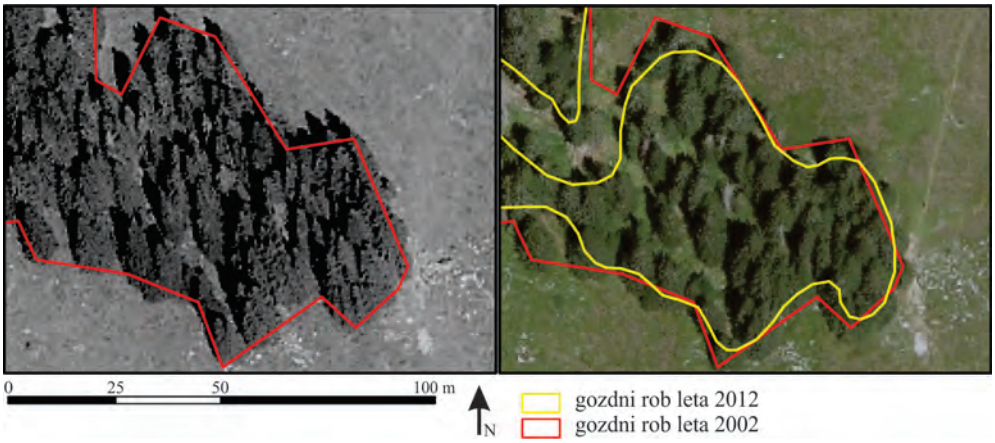
pravne predpise. Kot morebitne glavne vzroke za veliko razliko med podatki izpostavljamo napake zaradi razlik med letoma 2002 in 2012 v:

- **kakovosti podatkovnih virov:**

V zadnjih letih so viri podatkov natančnejši, zato je rob gozda lahko natančneje opredeljen. Pri pripravi baze dejanske rabe tal za leto 2002 se je uporabljal črno-beli ortofoto, posnet v enobarvni fotografski tehniki z velikostjo slikovnega elementa 50 centimetrov. Pri pripravi baze dejanske rabe tal za leto 2012 je bil uporabljen barvni ortofoto. Po letu 2006 snemanje poteka z digitalno kamero v več spektrih (vidnem barvnem in infrardečem) in s slikovnim elementom 50 centimetrov. Slovenija je v celoti pokrita z barvnimi ortofoti s slikovnim elementom 50 centimetrov, 30 % Slovenije tudi z barvnimi ortofoti s slikovnim elementom 25 centimetrov in barvnimi bližnjimi infrardečimi ortofoti s slikovnim elementom 50 centimetrov (Geodetska uprava …, 2014). RABA se popravlja tudi na podlagi dodatnih, natančnejših informacij, tako je bil na primer ekstenzivni sadovnjak, ki meji na gozd, brez dodatne informacije kmetov v starejših evidencah zabeležen kot gozd. S tem je lahko gozd prešel v drug razred rabe tal brez dejanske spremembe. Poligoni, ki nastanejo, so linijskih oblik in manjših površin;

- **natančnosti digitalizacije dejanske rabe tal:**

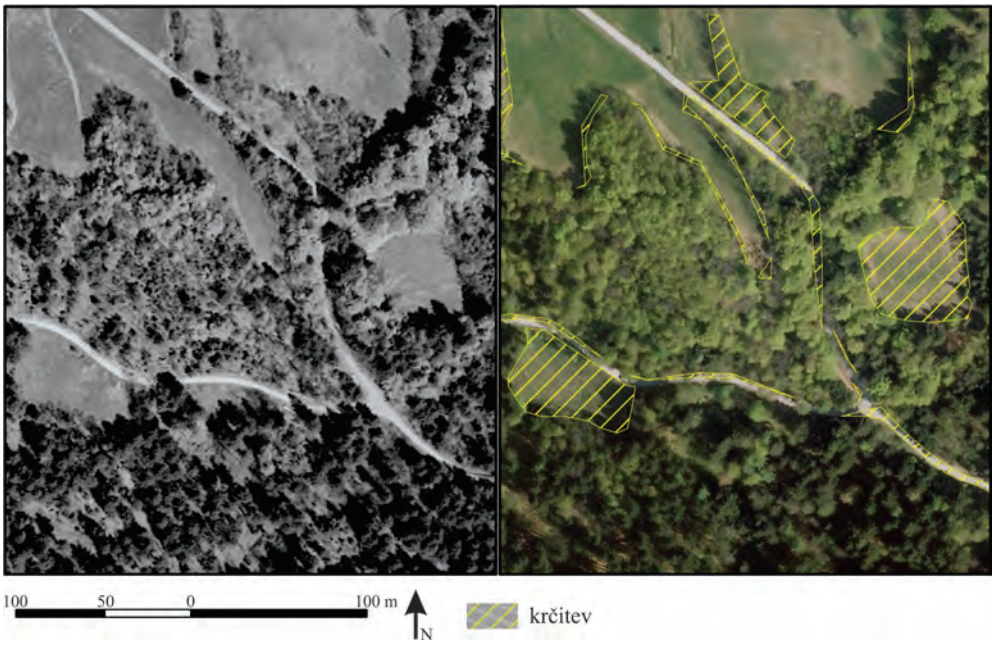
Število vozlov pri razmejevanju posameznih rab tal se je v letu 2012 močno povečalo. Poligoni, nastali zaradi te razlike, so linijskih oblik in pokrivajo manjšo površino (slika 1);



Slika 1: Sprememba natančnosti digitalizacije in števila vozlov med letoma 2002 in 2012.
Vir: Državni ortofoto (2002, 2012), GURS; RABA (2002, 2012), MKO; izdelava slike: Mojca Nastran.

- **interpretaciji razredov dejanske rabe tal:**

Med letoma 2002 in 2012 se je spremenilo število razredov rabe tal. Nastali so novi razredi (1180, 1190, 1212, 1600), en je bil ukinjen (1130) (Ministrstvo za kmetijstvo …, 2011). Interpretacijski ključ se celotno obdobje zajemanja dopolnjuje in vse bolj natančno opredeljuje razrede rabe tal. Iz gozdnega prostora so bile izključene jase in ceste. V nekaterih primerih se je zato spremenila klasificirana raba tal iz gozda v drug razred brez dejanske krčitve v naravi (sliki 2 in 3).



Slika 2: Primerjava izvzetosti cest in jas iz gozdnega prostora v letih 2002 in 2012.
Vir: Državni ortofoto (2002, 2012), GURS; RABA (2002, 2012), MKO; izdelava slike: Mojca Nastran.

Slika 3: Sprememba uvrstitve rabe tal iz rabe »gozd« v rabo »drevesa in grmičevje« med letoma 2002 in 2012 brez spremembe dejanskega stanja v naravi.
Vir: Državni ortofoto (2002, 2012), GURS; RABA (2002, 2012), MKO; izdelava slike: Mojca Nastran

3.2 Ocena dejanskega obsega krčitev gozdov v obdobju 2002–2012

3.2.1 Odstranitev linijskih in majhnih poligonov krčitev

Prvotni podatek o krčitvah gozdov (38.592 ha) se je po odstranitvi poligonov v razdalji 15 metrov od gozdnega roba v letu 2012 zmanjšal na 31,5 %. Poligoni krčitev, manjši od 25 m^2, pomenijo 37,1 % preostalih poligonov krčitev, vendar prispevajo 0,20 % deleža prvotne površine krčitev. Po odstranitvi 15-metrskega pasu in poligonov, manjših od 25 m^2, ocena krčitev obsega 12.078 hektarov, kar ustreza 0,60 % površine države.

3.2.2 Odstranitev poligonov krčitev na podlagi vizualne primerjave na ortofotu

S pregledom poligonov na ortofotu smo ugotovili, da so se dejanske krčitve zgodile na tretjini površine pregledanih poligonov (33,5 %). Po vizualnem pregledu smo površino krčitev zmanjšali še za 17 % prvotnega podatka o krčitvah. Površino krčitev gozdov po opisani metodi ocenjujemo na 5.491 hektarov, kar znaša 0,27 % površine Slovenije.

Največ napak je bilo pri razredih rabe tal 1222 (ekstenzivni oziroma travniški sadovnjak), 1500 (drevesa in grmičevje), 1800 (kmetijsko zemljišče, poraslo z gozdnim drevjem), 4100 (barje), 4210 (trstičje) in 4220 (ostalo zamočvirjeno zemljišče), kjer je delež poligonov z dejanskimi krčitvami manjši od 20 %. Glede na izračunan površinski delež dejanskih krčitev v vzorcu smo proporcionalno zmanjšali celotno površino krčitev v posamezni rabi tal.

Preglednica 1: Rezultati vizualnega pregleda poligonov krčitev.

Šifra rabe tal	Ime dejanske rabe tal	Površina krčitev (ha)	Število poligonov	Št. pregledanih poligonov	Površina pregledanih poligonov (ha)	Št. poligonov z dejanskimi krčitvami	Površina dejanskih krčitev (ha)	Delež dejanskih krčitev (%)	Ocena dejanskih krčitev v rabi (ha)
1100	njiva	181,1	4100	50	3,2	22	1,4	42,1	76,3
1160	hmeljišče	0,1	3	3	0,1	2	0,0	23,9	0,0
1180	trajne rastline na njivskih površinah	0,6	14	14	0,6	9	0,5	76,3	0,5
1190	rastlinjak	0,7	11	11	0,7	8	0,4	57,3	0,4
1211	vinograd	160,6	2149	50	2,3	26	1,9	83,9	134,7
1212	matičnjak	0,1	2	2	0,1	2	0,1	100,0	0,1
1221	intenzivni sadovnjak	28,3	375	50	3,1	23	2,3	74,2	21,0
1222	ekstenzivni oziroma travniški sadovnjak	332,2	7766	50	1,4	9	0,3	17,7	58,9

1230	oljčnik	33,1	596	50	2,8	23	1,9	68,4	22,6
1240	ostali trajni nasadi	0,3	22	22	0,3	5	0,1	34,6	0,1
1300	trajni travnik	3158,2	69569	100	3,3	44	1,5	46,4	1465,5
1321	barjanski travnik	10,0	139	50	3,2	19	1,3	42,5	4,2
1410	kmetijsko zemljišče v zaraščanju	1854,7	20032	100	9,3	40	5,6	59,7	1107,5
1420	plantaža gozdnega drevja	19,8	39	39	19,8	13	6,2	31,3	6,2
1500	drevesa in grmičevje	2207,1	26111	100	9,6	0	0,0	0,0	0,0
1600	neobdelano kmetijsko zemljišče	493,3	7021	50	2,4	41	2,2	92,2	455,0
1800	kmetijsko zemljišče, poraslo z gozdnim drevjem	725,2	6503	50	4,1	8	1,1	27,7	200,6
3000	pozidano in sorodno zemljišče	2025,3	20487	100	8,7	34	7,3	84,2	1704,4
4100	barje	20,5	17	17	20,5	0	0,0	0,0	0,0
4210	trstičje	8,1	12	12	8,1	2	0,0	0,3	0,0
4220	ostalo zamočvirjeno zemljišče	54,7	270	50	6,9	9	1,3	18,6	10,2
5000	suho, odprto zemljišče s posebnim rastlinskim pokrovom	478,3	4894	50	6,3	11	0,9	14,4	68,8
6000	odprto zemljišče brez ali z nepomembnim rastlinskim pokrovom	166,6	1421	50	9,7	18	5,9	61,0	101,6
7000	voda	118,9	1960	50	1,9	24	0,8	44,1	52,5
Skupaj		12077,6	173513	1120	128,3	392	43,0		5491,1

4 RAZPRAVA

Več kot dve tretjini površin, na katere se nanaša prvotni podatek o površini krčitev (68,5 %), ki smo ga dobili s primerjavo evidenc RABA 2002 in 2012, ležita v 15-metrskem pasu od gozdnega roba, zato sklepamo, da največjo napako pri podatkih o krčitvah pomenijo linijski poligoni, nastali zaradi natančnejše digitalizacije v zadnjih letih.

Med pregledom poligonov krčitev na ortofotu smo v dveh tretjinah primerov (65,0 %) ugotovili, da ne pomenijo dejanske krčitve gozda v naravi. Večina napak nastane zaradi drugačne interpretacije nespremenjenega stanja v naravi med letoma 2002 in 2012. Za razrede rab tal 1222 (ekstenzivni oziroma travniški sadovnjak), 1500 (drevesa in grmičevje) in 1800 (kmetijsko zemljišče, poraslo z gozdnim drevjem) je sprememba iz gozda (2000) v tako kratkem obdobju (10 let) malo verjetna. Mešane gozdno-kmetijske rabe je pogosto težko interpretirati na podlagi ortofota. Pri vizualni primerjavi karte krčitev z ortofotom se ravno pri teh rabah pojavlja v časovnem obdobju drugačna opredelitev rabe brez dejanske spremembe v naravi. Za podatkovno bazo RABA 2002 je bila v okviru projekta Zajem in spremljanje rabe kmetijskih zemljišč določena atributna napaka za interpretacijo rabe zemljišč na podlagi ortofota. Največ interpretacijskih napak se je zgodilo pri določitvi rabe 1500 (drevesa in grmičevje), 3000 (pozidano in sorodno zemljišče), 1410 (njiva), 1310 (intenzivni travnik) in 1222 (travniški sadovnjak) namesto 2000 (gozd) in nasprotno (Projekt za …, 2003). Te napake kažejo, kako težko je interpretirati te razrede in koliko večja je verjetnost napak. To se ujema z našimi ugotovitvami

po vizualnih primerjavah karte krčitev z ortofotom in s podatki o napačnih interpretacijah ob pregledu vzorca poligonov krčitev.

Razlika med evidenco ZGS o krčitvah v navedenem obdobju in našo končno oceno dejanskih krčitev se je precej zmanjša in znaša le še 2.073 hektarov oziroma 0,10 % površine države. Navedena razlika izhaja iz metodologije ocene krčitev in razlik v zajemu podatkov med institucijama (MKO, ZGS).

5 SKLEP

Podatek o površini krčitve gozdov v zadnjem desetletju iz evidence RABA za več kot desetkrat presega podatek ZGS, ki po uradni dolžnosti spremlja krčitve v Sloveniji. Glede na našo oceno o dejanskih krčitvah po odstranitvi poligonov krčitev iz 15-metrskega pasu, poligonov, manjših od 25 m^2, in proporcionalnega zmanjšanja površin krčitev glede na vizualno primerjavo ortofota se razlika med podatkoma precej zmanjša. Največ napak pri ugotavljanju krčitev neposredno iz podatkovne baze RABA nastane zaradi razlik v določitvi gozdnega roba ter različne interpretacije rabe tal na isti površini, brez dejanske spremembe v naravi. S primerjavo evidence RABA v časovnem obdobju lahko le sklepamo o spremembah dejanske rabe, saj so te lahko tudi posledica sprememb v zakonodaji, kakovostnejših informacij s terena, natančnejših navodil za interpretacijo in sprememb metodologije.

Na podlagi opravljene raziskave izpostavljamo dva glavna poudarka in predlagamo dve rešitvi pri usklajevanju oziroma odpravi razlik med bazami iz različnih časovnih obdobij. Prva rešitev je poenotenje mej poligonov, s katerim bi odstranili ozke linijske poligone (tako imenovane sliverje), ki nastanejo po prekritju dveh vektorskih baz (slika 2). Kot drugo rešitev pa predlagamo popravo interpretacijskih razlik rab tal v starejših bazah. Primer: z novim ortofotom ugotovimo, da je dejanska raba travniški sadovnjak (1222), v naravi pa med obema obdobjema ni dejanskih sprememb, zato tudi v starejši bazi temu poligonu pripišemo rabo tal travniški sadovnjak (prej gozd). Predlagani rešitvi sta za celotno bazo podatkov nerealni, saj bi bila potrebna vnovična digitalizacija starih ortofotov po novem interpretacijskem ključu. Sta pa lahko dober pripomoček pri posameznih raziskavah na omejenem številu poligonov.

Evidenca dejanske rabe kmetijskih in gozdnih zemljišč je zaradi pravnih določil, stalnega obnavljanja, pokrivanja celotne države, velike natančnosti in tudi medsektorskega poročanja najprimernejša baza podatkov za širše analize sprememb rab tal. Za ugotavljanje površinskih sprememb skozi časovna obdobja moramo biti pri njeni uporabi kritični, predvsem zaradi napak pri natančnosti razmejevanja med razredi rabe tal in njihove različne interpretacije med posameznimi leti. V članku želimo opozoriti na veliko razliko med različnimi uradnimi prostorskimi podatki in odpreti razpravo, ki bi pripomogla k zmanjšanju večjih napak, s tem pa izboljšala zanesljivost podatkov o spremembah rabe tal.

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