THE DELIMITATION OF LANDSCAPE UNITS FOR THE PLANNING OF PROTECTION – THE EXAMPLE OF THE FORESTS BY UPPER LISWARTA LANDSCAPE PARK

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Abstract: The delimitation of landscape units can be helpful in the preparation of studies related to landscape protection and landscaping. The aim of this article is to propose the modification of the method of local landscape delimitation developed for the landscape audit for the needs of protected areas. The comparison of two methods of delimitation indicates that the same area can be assigned to different landscape types and subtypes. The proposed modification of the method of landscape unit delimitation allows a more detailed reflection of the landscape and its links to the administrative boundaries of administrative communities.

Key words: landscape audit, landscape in protected area, landscape park, landscape management, landscape units

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Introduction

The implementation of landscape audits, based on the act of 24th April 2015 on changes in some acts connected with the reinforcement of landscape protection mechanisms (Act… 2015), was preceded by the development of a methodology of landscape auditing (Solon et al. 2014). This methodology includes the delimitation, typology and valuation of current landscapes, on the basis of which priority landscapes can be distinguished. According to the act, a priority landscape should be understood as a landscape that is particularly valuable for society because of its natural, cultural, historical, architectural, urban, rural or aesthetic-scenic value. For this reason, it is necessary to maintain or define the principles and conditions by which this can be determined (Solon et al. 2015). The undertaken works are connected with the implementation of the European Landscape Convention (2006), the purpose of which is *i.a.* promoting landscape protection, management and planning. Similar activities have been carried out in other European countries, such as Italy (Maximova 2016), Sweden (Dovlén 2016), the Czech Republic (Kolejka, Lipsky 2008) and Slovakia (Kozová et al. 2009).

The methodology of carrying out a landscape audit may also be helpful in the preparation of other studies related to landscape protection and landscaping, e.g. environmental plans for protected areas such as national parks or landscape parks (Gorzym-Wilkowski 2016). National parks are created in areas with natural landscapes,

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whereas landscape parks concern mainly harmonious natural-cultural landscapes (Chmielewski et al. 2015). This second form of conservation is also created to protect the landscape. The development of the draft environmental plans for a landscape park includes, *i.a.* an inventory of landscape values (Regulation … 2005). The valuation of landscapes using the landscape audit methodology must be carried out within landscape units known as local landscapes (Solon et al. 2015). These units are separated within physico-geographical mesoregions (Proposal 2018). The features of these units are: homogeneity of the landscape background while preserving spatial heterogeneity, maintaining functional links between the spatial elements of the landscape and the repeatability of the spatial structure and physiognomy in different parts of the landscape (Solon et al. 2014). Local landscapes can be treated as basic landscape management units.

Recently, many authors in Poland have paid more and more attention to issues related to landscape audits, both in terms of the methodology of separating local landscapes and their typology. The authors of the current typology of Polish landscapes (Chmielewski et al. 2015) point to the need to test it in different physico-geographical, cultural or socio-economic regions. The conclusions of these works should be used to improve the proposed typology. So far, such tests have been carried out for four communes in the Częstochowa district (Myga-Piątek et al. 2015), Kazimierski Landscape Park (Michalik-Śnieżek, Chmielewski 2017), Szczyrk commune (Badora, Jakubiec 2018) and the Popielów commune (Solecka et al. 2018).

Because a landscape audit is drawn up for the whole province, it was assumed that the scale of the study would completely different from that of a landscape park. Therefore, the authors proposed a modified method of landscape unit delimitation, taking into account the conditions resulting from the much smaller area occupied by landscape parks and the principles of preparing protection plans for landscape parks. The aim of the work is to present the author's method of local landscape delimitation, which is a modification of the audit method, and to compare the results of the landscape unit delimitation using the two methods: audit and modified.

Landscape parks in the nature conservation system

The landscape park is one of the nature conservation forms defined in the Nature Conservation Act (Act… 2004). It comprises an area which is

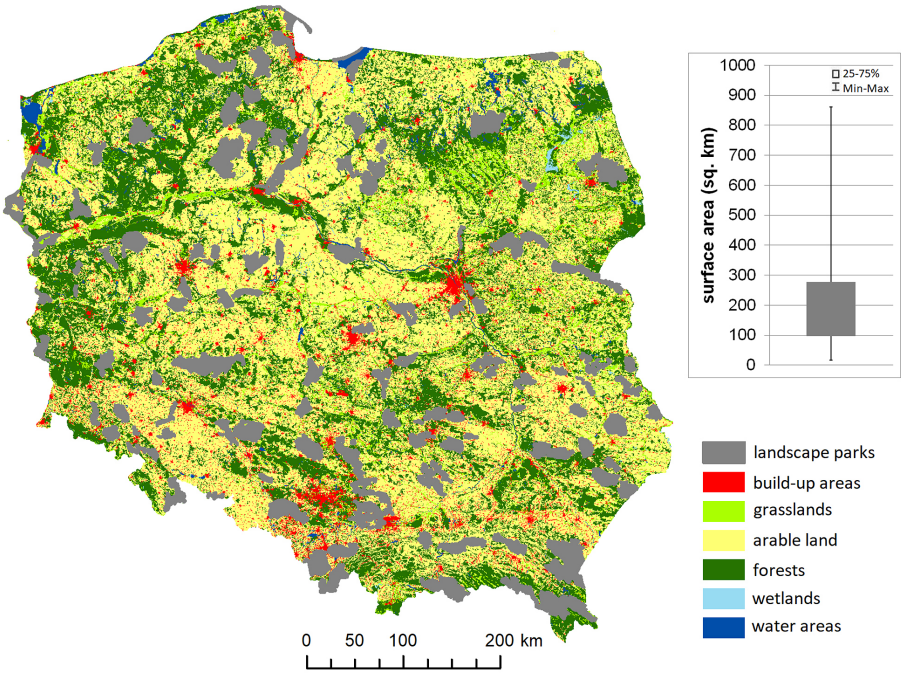

Fig. 1. The location of landscape parks on the background of Poland's land cover.

protected due to its natural, historical, cultural and landscape values, in order to preserve and promote these values in harmony with sustainable development. The concept of creating landscape parks appeared in Poland in the early 1960s (Kistowski 2004). To date, 123 landscape parks have been created in Poland, occupying a total area of about 26,000 km^2, which is 8.3% of the territory of Poland. Landscape parks in Poland are not large compared to their counterparts elsewhere in Europe (Kistowski 2004). The average size of a landscape park in Poland is 216.4 km^2 (Fig. 1). The largest landscape park in Poland, Barycz Valley Landscape Park, occupies an area of 861.2 km^2, while the smallest, Stawki Landscape Park, is only 17.3 km^2.

Study area

From all the landscape parks in Poland, to present the author's method of local landscape delimitation, the Forests by Upper Liswarta Landscape Park was selected. It was established on 21st December 1998 under Regulation No. 28/98 of the Częstochowa Province (Regulation … 1998). It is the 16th largest landscape park in Poland (387.4 km^2) and the third in the Silesian Province. It is located within 6 mesoregions, according to the division of Kondracki (2011) modified by J. Solon et al. (2018): Upper Mała Panew Depression, Upper Liswarta Depression, Krzepice Depression, Liswarta Depression, Herby Rock Step, Woźniki Rock Step. Administratively, it includes the territory of 3 districts and 12 communes (Figs 2, 3). The selection of this landscape park as a study area was determined both by its size and good recognition of the area (Kurda, Pukowiec 2013, 2015).

A characteristic feature of the park is its high level of forest cover, with the predominance of coniferous forests. The dominant species in the forests of this area is *Pinus sylvestris*. The moderately moist habitats are covered by *Leucobryo-Pinetum* and *Querco roboris-Pinetum* with *Quercus robur* and *Quercus petraea*, wetland habitats are covered by *Calamagrostio villosae-Pinetum*, and peat bogs are covered by *Vaccinio uliginosi-Pinetum sylvestris*. In moist habitats, riparian forests, especially *Carici remotae-Fraxinetum*, occupy an important place. There are also oak-hornbeam forests and *Quercetalia pubescenti-petraeae* in the park. The particularly valuable areas in the park include peat bogs, partially protected as ecological lands (Mastaj 2008). The conservation of nature is strengthened by 4 forest nature reserves: Łęg nad Młynówką, Cisy w Łebkach, Cisy nad Liswartą and Rajchowa Góra (RDOŚ 2017). One important element of the Liswarta valley landscape are its numerous fish ponds. They comprise water communes with rare plant species – *Nuphar lutea, Nymphaea alba, Salvinia natans,* as well as rush plants (Rąkowski 2004). They create favourable conditions for the existence of numerous, rare species of animals, especially birds. Another important element of the landscape park is its cultural objects, in particular grange and palace complexes.

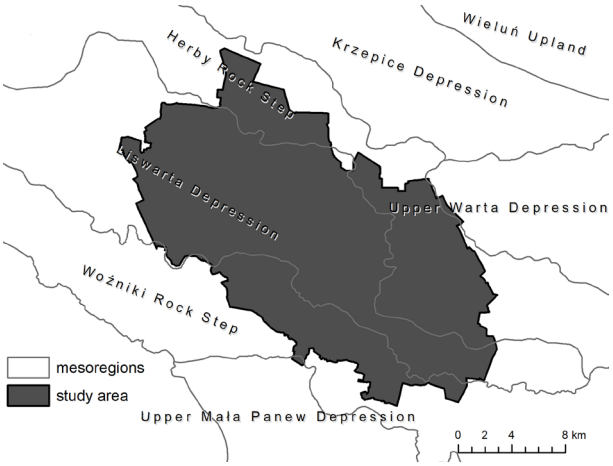

Fig. 2. Location of the Forests by Upper Liswarta Landscape Park on the background of mesoregions.

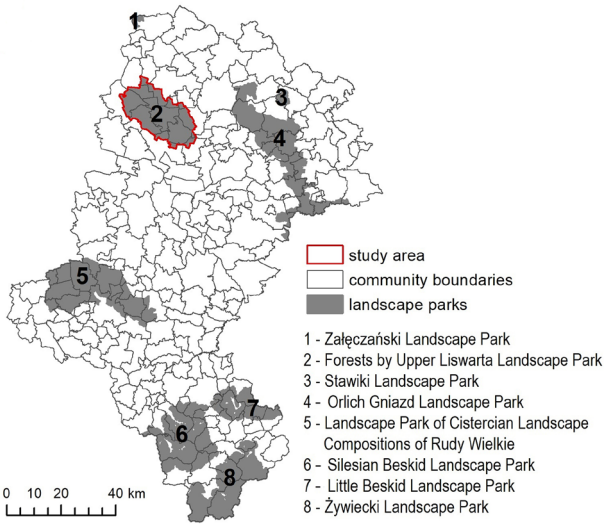

Fig. 3. Location of the Forests by Upper Liswarta Landscape Park in the background of the communes of the Silesian Voivodeship.

Materials and methods

The delimitation of landscape units was carried out using the two methods: audit and modified, on the same scale of 1:20,000. It involves the division of the analysed area into smaller spatial units, in a disconnected and exhaustive manner, according to the criterion of a uniform landscape background (Solon et al. 2014). In the case of the audit method, the units are delimitated within mesoregions. However, the authors proposed a modification of this method based on the delimitation of units within the communities' boundaries (Fig. 4). In this way, in the last stage of the work, there is no need to adjust the boundaries of the separated landscape units to fit the existing formal boundaries, which is necessary when delimiting according to the audit method.

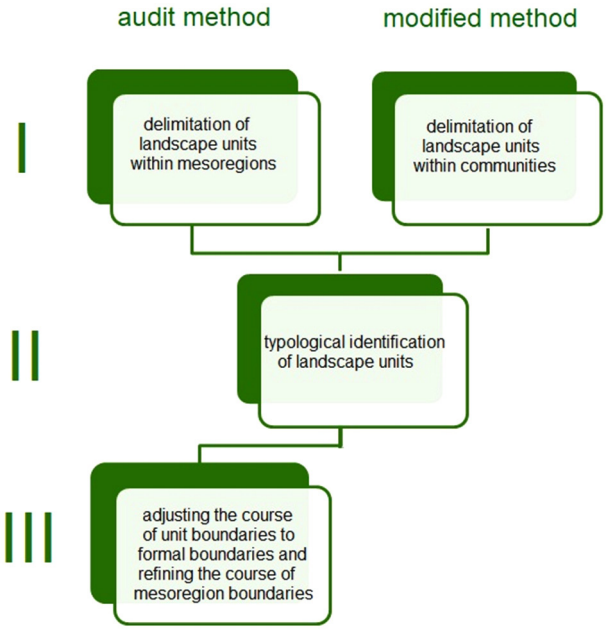

Fig. 4. Diagram showing the differences between the audit method and the modified method.

To delimitate the landscape units using both methods, an orthophotomap from 2015 with a field grid size of 0.25 m, as well as layers in .shp format, showing the administrative division of Poland into communes and mesoregions were used (Solon et al. 2018).

Results

In the Forests by Upper Liswarta Landscape Park, the number of delimitated landscape units, as well as landscape types and subtypes, depends on the method used (Table 1). Using the audit method, 53 units were distinguished, whereas in the case of the modified method as many as 64 were distinguished. The occurrence of the same groups and types of landscapes was found, while there are differences in the occurrence of

Table 1. Characteristics of landscapes subtypes.

Landscape subtype	Audit method			Modified method		
	Area (ha)	Number of units	Area (%)	Area (ha)	Number of units	Area (%)
2a – swampy meadow with extensively used wet meadows	541.1	1	1.40	542.5	3	1.40
3a – coniferous forests	23,138.3	10	59.74	20,106.7	17	51.92
3b – deciduous forests	2,749.1	10	7.10	5,770.9	9	14.90
6a – rural (agricultural) artificial water reservoirs	142.9	2	0.37	407.2	4	1.05
6b – rural (agricultural) with dominance of ribbon-like groups of small arable fields, meadows and pastures	6,223.4	13	16.07	5,774.1	9	14.91
6c – rural (agricultural) with dominance of tessellated small arable lands	5,532.2	11	14.29	4,589.4	11	11.85
6d – rural (agricultural) with dominance of tessellated medium arable lands	96.2	1	0.25	1,026.2	3	2.65
6e – rural (agricultural) with dominance of large-area fields and / or meadows and pastures	0.0	0	0.00	190.1	1	0.49
7a – mosaic with a predominance of natural elements	0.0	0	0.00	66.7	2	0.17
8c – suburban and residential areas with compact, multi-row buildings with a rural character with home gardens and without field areas	89.5	2	0.23	89.5	2	0.23
12a – large industrial complexes	46.5	2	0.12	46.5	2	0.12
14a – communication and transport nodes	102.9	1	0.27	117.0	1	0.30
Total	38,726.8	53	100.00	38,726.8	64	100.00

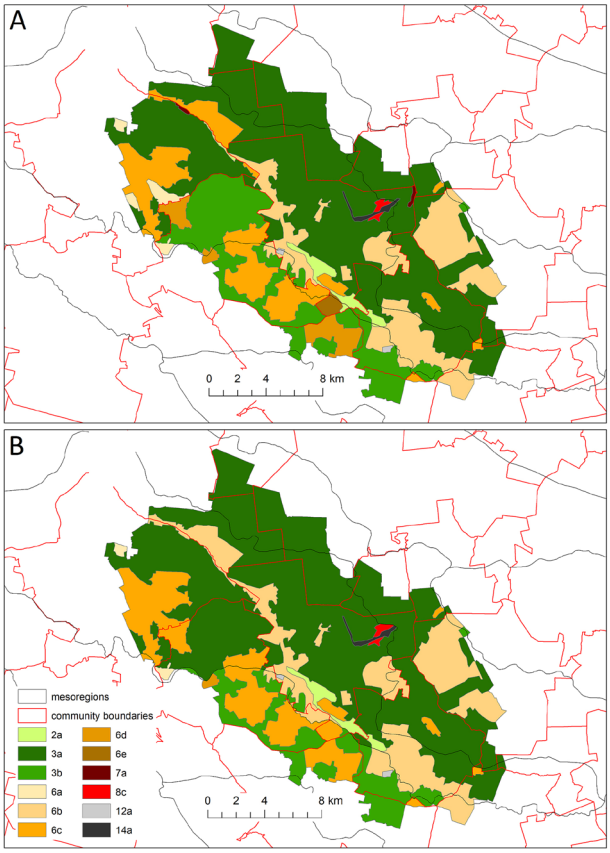

Fig. 5. Local landscapes distinguished by a modified method (A) and audit method (B). Explanation of landscape subtypes in Table 1.

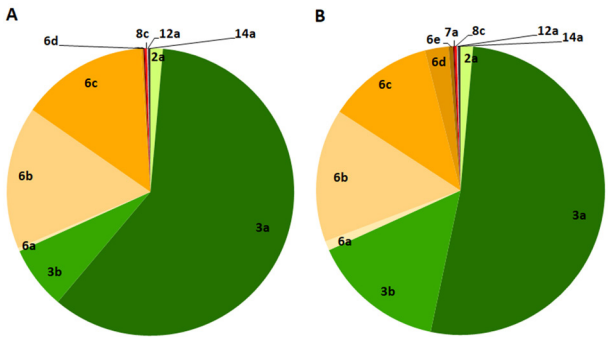

Fig. 6. Landscape subtypes structure in the study area developed by the audit method (A) and modified method (B). Explanations of landscape subtypes in Table 1.

landscape subtypes. The landscape sub-type 6e and 7a were not distinguished in the case of delimitation of local landscapes using the audit method, whereas in the case of delimitation by the modified they were (Figs 5, 6).

The spatial extent of the differences between landscape types and subtypes delimitated using the two methods is not large – 12.1% of the study area for subtype change, and only 0.6% for landscape types (Fig. 7). Due to the use of various spatial units (mesoregions and communities), the difference also applies to the area of the largest units. The largest distinguished landscape

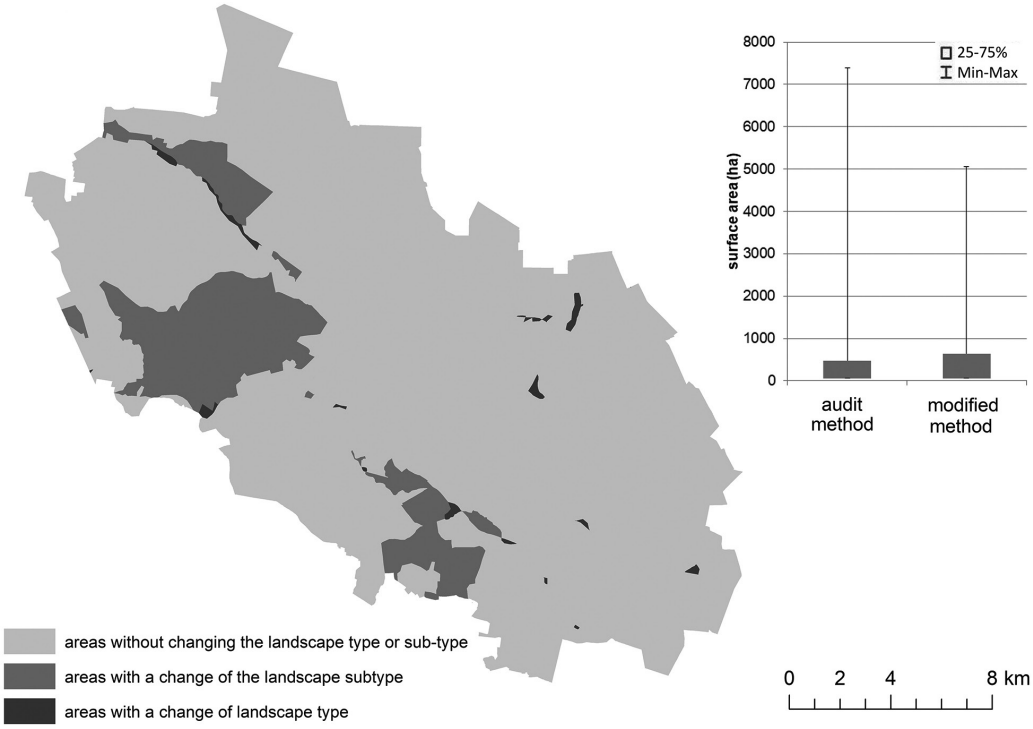

Fig. 7. Spatial range of differences in delimitated units. The graph presents the characteristic of the surface area of delimitated landscape units.

units are larger in the case of the audit method. However, the majority of units delimitated by both methods have the same surface area (Fig. 7).

Detailed analysis of the range of landscape units delimitated using the two methods allows the following types of changes to be distinguished:

1. changes in landscape types:
- as a result of crossing the border of the mesoregion, a fragment of the forest (type 3) is included as a patch of agricultural landscape (type 6), although it is a part of a larger forest complex – 6 cases;
- as a result of crossing the border of the mesoregion, a fragment of the agricultural landscape (type 6) is included as a patch of forest landscape (type 3) – 6 cases;
- as a result of crossing the border of the mesoregion, a fragment of the suburban and residential areas with compact, multi-row buildings with a rural character with home gardens and without field areas (type 8) is included as a patch of forest landscape (type 3), although it is a part of a larger meadow complex – 2 cases;
- as a result of crossing the border of the mesoregion, a fragment of the swampy meadow with extensively used wet meadows (type 2) is included as a patch of agricultural landscape (type 6), although it is a part of a larger meadow complex – 1 case;
- as a result of crossing the border of the mesoregion, a fragment of the swampy meadow with extensively used wet meadows (type 2) is included as a patch of forest landscape (type 3), although it is a part of a larger meadow complex – 1 case;
- as a result of crossing the border of the mesoregion, a fragment of the large industrial complexes (type 12) is included as a patch of agriculture landscape (type 6), although it is a part of a industrial complex – 1 case;
- as a result of crossing the border of the mesoregion, a fragment of communication and transport nodes (type 14) is included as a patch of forest landscape (type 3), although it is a part of a communication complex – 1 case;
- as a result of eliminating the administrative boundaries between communities, a fragment of mosaic with a predominance of natural elements (type 7) is included as a patch of forest landscape (type 3) – 1 case;
- as a result of crossing the boundary of the communities, a fragment of agricultural landscape (type 6) is included as a patch of the mosaic with a predominance of natural elements (type 7) – 1 case;
- as a result of crossing the boundary of the communities, a fragment of agricultural landscape (type 6) is included as a patch of the swampy meadow with extensively used wet meadows (type 2) – 1 case;

2. changes of the landscape subtype:
- as a result of the border of the communes crossing the forest landscape (subtype 3a), it is divided into two parts characterised by different subtype of landscape (3a and 3b) – 9 cases;
- as a result of the border of the communes crossing the agricultural landscape (6c), it is divided into two parts characterised by different subtype of landscape (6b and 6e) – 1 case;
- as a result of the border of the mesoregion crossing the forest landscape (3a and 3b), it is divided into two parts assigned to neighbouring units – 2 cases;
- as a result of the border of the mesoregion crossing the agricultural landscape (6b), it is divided into two parts assigned to neighbouring units – 1 case.

Discussion

The modified method of the delimitation of landscape units for preparing landscape park conservation plans is connected with linking the boundaries of local landscapes to the boundaries of communities. This form separation has several justifications. Firstly, the boundaries of mesoregions, which are natural boundaries, often do not have the character of sharp border lines, but create broader or narrower transition zones. Determination of the area that will be the subject of specific activities related to landscaping requires the determination of distinct boundaries; therefore, only administrative boundaries can be fully useful. Although the boundaries of mesoregions presented on the maps are distinct, they are in fact a simplified representation of fuzzy borders (Armand 1980, Solon et al. 2018). In addition, the borderline of mesoregions has a smaller impact on the cultural landscape, especially within the highlands and lowlands (Chmielewski,

Chmielewski 2018). The relationship between mesoregions and the landscape are visible only in the mountains, because the boundaries of the mesoregions are clear (Balon, Jodłowski 2018). Secondly, the aim of landscape parks is to protect natural-cultural landscapes. The occurrence of this type of landscape is often shaped by artificial boundaries demarcated by humans. All manifestations of human activity, and thus elements of the landscape associated with them, require boundaries demarcated by humans (Andrejczuk 2013). Borders are often demarcated arbitrarily and without taking environmental features into account, which leads to a gradual diversification of the landscape, due to the different treatment of areas on either side of the border line (Rykiel 1990, Wojciechowski 2006, Sobala 2012). Administrative borders also often overlap with cultural boundaries. In the discussed area, the boundary between the Russian and Prussian Partition is reflected in the diversity of the landscape (Plit 2016). Today, the administrative border of the Częstochowa and Lubliniec districts runs along this border. In addition, consultations with the local government are part of the procedure for establishing conservation plans. Hence, all activities in the field of landscape conservation and landscaping in landscape parks must be agreed with local government. Thus, the landscape units delimitation within communes has a very practical importance, because it can facilitate the management of individual landscape units and counteract the difficulties connected with the unification of landscape conservation principles within one landscape unit.

The other scale of the study, in comparison with the landscape audit, also supports the delimitation of landscape units within communities. As a result of this kind of delimitation, the landscape units are smaller, so landscaping can be more adapted to conservation needs. Additionally, the spatial extent of the study is also defined by the formal boundaries of the landscape park, which reflects a different regime of landscape management on either side of the border (Sobala 2012).

The modified method of local landscape delimitation has a practical dimension, e.g. in the development of strategic, planning or conservation documents for protected areas or for municipalities. Table 2 synthetically presents the differences between the audit method and the modified method, taking into account the stages of proceedings and the justification for the changes.

Conclusions

The delimitation of landscape units within communes could have practical importance for landscape management within landscape parks (Kistowski 2012). Modification of the audit method complies with the assumption that the choice of method should be treated in the functional basis, in order to accurately reflection the aims of the work (Pietrzak 1993). This dictates the need to look for a method that best reflects the actual state of the landscape. Testing the modified methods in the study area contributed to the detection of the following differences:

1. Separation of a larger number of units in the case of the modified method.
2. A more detailed reflection of subtypes of rural landscapes in the case of the modified method:

– a difference in the number of separated subtypes,
– a difference in their percentage share.

Table 2. Stages of methodological proceedings in the audit method and modified method.

Stage of procedure	Audit method	Modified method	Justification
Border delimitation	Province (administrative border) and mesoregions (nature border)	Landscape park and communes (administrative border)	Development of planning and conservation documents for the landscape park
Unit coding	The code contains information about the location in the mesoregion and the order of the landscape within it	The code contains information about the location within the communes and the order of the landscape within it	Change made for the practical use of document entries within the boundaries of communes
Defining landscape unit boundaries	Defining the boundaries of administrative borders	There is no need to define landscape units elaborating	

The use of a modified method enables a more detailed reflection of the landscape. Dominant forms of land use, as well as the intensity of land utilisation and present features of the spatial structure, are the criteria of the current landscape type and subtype delimitation. (Chmielewski et al. 2015). The above-mentioned criteria refer primarily to the location of administrative units. Various types of documents are prepared for landscape parks: planning, strategic and protective. Some of them, e.g. conservation plans, have to be agreed with local governments. Hence, it seems necessary for the implementation of their provisions to take into account administrative boundaries during the delimitation of landscape units. Therefore, in case of developing conservation plans, the modified method has a practical dimension.

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Authors' contribution

Michał Sobala – 40%, Katarzyna Pukowiec-Kurda – 40%, Anna Żemła-Siesicka – 20%.

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