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Evaluation of yield and fruit quality in new tomato hybrids with the *rin* gene

JANINA GAJC-WOLSKA^{1*}, ALEKSANDRA KORZENIEWSKA²,
KATARZYNA NIEMIROWICZ-SZCZYTT², JADWIGA RADZANOWSKA¹

¹Department of Vegetable and Medicinal Plants

²Department of Plant Genetics, Breeding and Biotechnology, Warsaw University of Life Sciences – SGGW

Abstract: *Evaluation of yield and fruit quality in new tomato hybrids with the rin gene.* The tomato is an important crop in the fresh vegetable and food processing industry. The *rin* mutation is noteworthy because hybrids (*rin/Rin*) form the base for most present-day cultivar production of slow-ripening, long shelf-life, fresh-market tomatoes. The purpose of the field experiments carried out in 2009–2010 was to assess the yield of new tomato hybrids and the evaluation of fruit quality as to their sensory traits (aroma, texture and taste). The new tomato hybrids 325, 330, 334, 336 and 348, as well as two standard cultivars, ‘Adam F₁’ and ‘Faustine F₁’, were used in these experiments. The new tomato hybrids with the *rin* gene yielded at a similar level as standard cultivars. They also received similar values of such traits as fruit weight, pericarp thickness and the number of locular cavities in the fruit as compared to fruits of standard cultivars. The assessment of the sensory quality of the tomato fruit hybrids was at a comparable level with the assessment of the standard cultivar fruits. These fruits received high marks for fruit fleshiness, flesh juiciness and overall quality, but lower marks for tomato smell, taste and sweetness.

Key words: *Solanum lycopersicum* Mill., sensory analysis, field culture

INTRODUCTION

The development and maintenance of the high quality of vegetables, includ-

ing tomatoes, has proven to be a difficult and complicated task. The changing conditions at the time of vegetation (light, frosts, drought, excessive rainfall) and the impact of post-harvest factors (transport, packaging, storage) significantly affect the quality [Shewfeld and Henderson, 2003]. The quality of products is evaluated by sensory analysis, which has proved to be one of the most reliable methods for testing organoleptic traits, particularly the aroma and texture of fruit [Booth, 1990; Baryłko-Pikielna et al., 1996]. Obtaining tomato hybrids with good quality fruits for prolonged storage is achieved by breeding work using the improved lines with the *rin* (ripening inhibitor) gene [Giovannoni, 2004; Tanksley, 2004; Barry and Giovannoni, 2006]. Lines with the *rin* gene cannot be directly used in the breeding of cultivars because during their maturation process their fruit turns yellow or yellow-orange and is unpalatable [Sing et al., 1974; Giovannoni, 2007]. Hybrids with the *rin* gene have a reduced level of the polygalacturonase enzyme [Buescher et al., 1976; Tigchelaar et al., 1978] and only fruits which ripen on the plant obtain a uniform red colour [Buescher et al., 1981; Nguyen,

*tel. +4822 593 22 49, e-mail: janina_gajc_wolska@sggw.pl

1991]. The taste of hybrid fruit obtained based on the line with the *rin* gene is not always satisfactory [Kopeliovitch et al., 1982; Jones, 1986]. Before the fruits of new tomato varieties can be introduced into the market, they are assessed for the quality of many traits, but it is the consumers' opinion, especially that on the fruit's taste, that determines the price and demand.

The present work was aimed at assessing the yield of new tomato hybrids and at evaluating fruit quality with regard to sensory traits (aroma, texture and taste).

MATERIAL AND METHODS

In 2007–2008 the sensory quality of tomato fruits (the methods are described below) was evaluated. The investigation began by using five lines with the *rin* gene tomato and three lines of red fruits to obtain tomato hybrids (Table 1). As a result of the breeding, five new tomato hybrids were obtained. The experiments with the new tomato hybrids (325, 330, 334, 336, 348) and with two standard cultivars, 'Adam F₁' and 'Faustine F₁', were arranged in a one-factor split-plot design with three replications over two years (2009, 2010) in the experimental field at the Department of Plant Genetics, Breeding and Biotechnology at Wolica. The plants were planted in the field on 26 May and 28 May respectively with a spacing of 50×70 cm and with 16 plants per plot. The cultivated plants were stacked up, grown in two shoots and decapitated after 31 July. The plants were grown in grey-brown podsolic soil of valuation class IV and, after using

green manure in the first year, they were additionally foliar fertilized twice with Florovit®. Protective treatments were performed in accordance with the recommendation of the Plant Protection Calendar. During the period of water shortage the plants were T-Tape irrigated. The N, P, K, and Mg content of the soil was kept at an optimum level with fertilizers applied to equal the average to 150 kg N per ha (60 kg N side dressing), 60 kg P per ha and 200 kg K per ha. The fruit harvest lasted from the middle of July in 2009 and in 2010 until the middle of September. The fruit was picked as it ripened and was sorted and weighed to determine the total and market yield (kg·m⁻²) as well as the fruit weight (g), number of locular cavities and the thickness of the pericarp (mm).

Sensory analysis was conducted using the scaling method. A trained ten-person panel evaluated the tomato fruit samples according to toughness of skin, flesh texture, core size, flesh juiciness, tomato smell, strange smell, taste (sweet, sour, typical tomato, strange) and overall quality.

A statistical analysis was performed using one-way analysis of variance. A detailed comparison of means was performed using Tukey's test at the significance level $\alpha = 0.05$.

RESULTS AND DISCUSSION

In 2007 and 2008 the development of new hybrids of tomato was initiated, which began with the sensory analysis of five new lines with the *rin* gene and three lines with red fruits, which were parental forms for the new hybrids (Table 1).

TABLE 1. Evaluation of the taste, smell and texture attributes in fruit from improved parental lines with the *rin* (ripening inhibitor) gene and red-fruit line (2007–2008)

Line/cultivar	Colour intensity	Tomato smell	Strange smell	Core size	Toughness of skin	Flesh hardness	Flesh texture	Flesh juiciness	Tomato taste	Sour taste	Sweet taste	Strange taste	Overall quality
264 <i>rin</i>	1.43 d*	2.97 c	0.47 ab	4.38 a	6.08 ab	5.40 bc	5.43 abc	3.43 cd	2.52 c	1.93 ab	2.52 ab	0.80 a	2.90 b
265 <i>rin</i>	1.07 d	2.75 c	0.61 a	3.67 ab	6.92 a	5.58 abc	4.33 c	2.97 cd	2.03 c	1.71 ab	2.60 ab	0.37 a	2.30 b
267 <i>rin</i>	0.96 d	2.79 c	0.27 ab	4.31 a	6.62 a	6.66 a	5.22 bc	3.40 cd	1.82 c	1.62 b	1.53 b	0.80 a	2.21 b
269 <i>rin</i>	1.12 d	2.46 c	0.19 ab	3.50 ab	6.21 a	5.78 abc	5.37 abc	2.62 d	2.04 c	1.57 b	2.68 a	0.00 a	2.79 b
271 <i>rin</i>	2.83 c	2.59 c	0.28 ab	3.75 a	6.42 a	6.61 ab	5.08 bc	4.04 bc	2.20 c	2.08 ab	1.86 ab	0.31 a	2.56 b
305	8.39 a	4.63 b	0.00 b	1.27 c	4.02 c	5.41 abc	6.61 a	4.98 ab	5.73 a	2.14 ab	2.53 ab	0.00 a	6.65 a
328	7.14 b	6.06 a	0.00 b	2.25 bc	4.88 bc	5.29 bc	5.00 bc	5.46 a	4.78 b	2.40 ab	2.06 ab	0.28 a	5.50 a
331	6.96 b	5.63 ab	0.00 b	1.29 c	4.77 c	6.65 ab	6.01 ab	4.93 ab	5.97 a	2.46 ab	2.47 ab	0.33 a	6.03 a
'Faustine F ₁ '	6.33 b	5.64 ab	0.10 b	1.34 c	4.10 c	5.21 c	5.75 ab	5.20 a	5.45 ab	2.65 a	1.87 ab	0.06 a	6.00 a

*Means followed by the same letters are not significantly different at $\alpha = 0.05$.

Sensory analysis showed that fruits of the lines 264, 265, 267, 269 and 271, in which the *rin* gene developed a yellow colour, obtained low values for colour intensity, tomato smell, flesh juiciness, tomato taste, sweetness and sourness, and high values for the fruit core and skin hardness – negative traits in the assessment of fruit quality. On the other hand, the fruits of lines 305, 328 and 331, which developed a red colour, received high marks for traits such as colour, tomato taste and smell when compared to the values of those factors obtained for the yellow-coloured fruit line. Small differentiations of the factor values in all of the investigated lines were observed for hardness and fruit texture. The sensory evaluation of the fruits' parental lines provided important information for further breeding to obtain hybrids with a high yield and good quality fruit. Five new hybrids (325, 330, 334, 336, 348) were obtained by breeding which, over the next two years of research with two standard cultivars, 'Adam F₁' and 'Faustine F₁', were evaluated for yield and fruit quality.

The results obtained indicate differences in the yield of new hybrids in the following years of research (Table 2). The highest fruit marketable yield in the first year of the experiment was obtained for hybrid 336. A slightly lower yield was produced by hybrids 334 and 330, while the lowest yield was obtained for hybrid 348. In the second year of the experiment the highest marketable yield was obtained for hybrid 348 and the two standard cultivars, 'Adam F₁' and 'Faustine F₁', while the lowest fruit-marketable yield was obtained for hybrid 336. Despite the differences in the marketable

yield of hybrids, there was a high yield in subsequent years of research that was comparable with the results obtained by Gajc-Wolska et al. [2010] with greenhouse tomato cultivars grown in the field.

The fruits of the hybrids assessed also differed with regard to weight, the number of locular cavities and the thickness of the pericarp (Table 2). The biggest fruit was obtained from hybrid 334 in 2009, from hybrid 348 in 2010 and from hybrid 336 in both years of this experiment. The fruit of 'Adam F₁' and 'Faustine F₁' had a smaller fruit size in 2009 and a similar fruit size in 2010 compared with the fruit of the best tomato hybrids (334 and 336 in 2009; 336 and 348 in 2010). The smallest fruits were obtained from the 330 hybrid.

The smallest number of locular cavities, together with the biggest thickness of the pericarp, was noted in hybrid 330 (Table 2). The greatest pericarp thickness was found for the cultivar 'Faustine F₁' and for hybrid 325. The results obtained indicate that the fruit harvested from the evaluated hybrids can be classified into two size classes: Class B (fruit weight 93–144 g) and Class BB (fruit weight 144–245 g). This fruit is classified as medium-sized fruit of the type that is commercial and that enjoys the highest customer demand.

The results of the profile assessment of tomato fruits are shown in Figure 1 in the form of a "quality map" in the space created by the first two main components, PC 1 and PC 2, which shows 61.37% of the variability in the sensory quality of the analysed hybrids and cultivars. The location of the fruit samples analysed in the chart proves their vari-

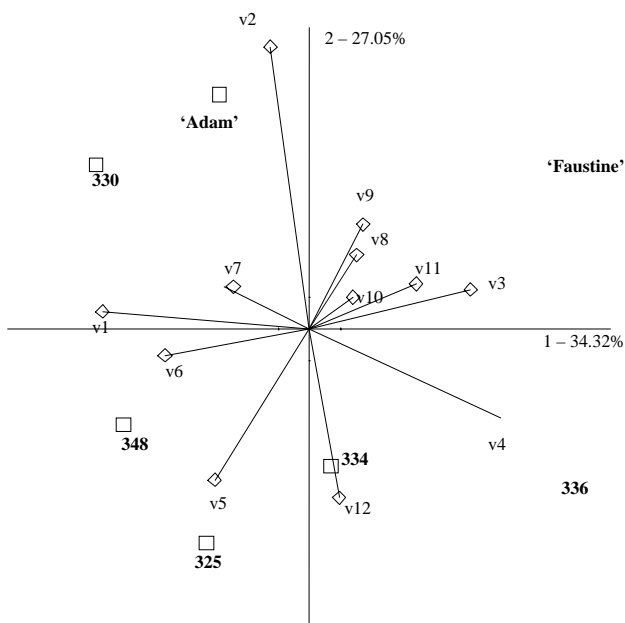
TABLE 2. Characteristic of new hybrid tomato fruit in field production (2009–2010)

Hybrid/ Cultivar	Origin	Yield (kg·m ⁻²)		Fruit features		
		Total	Marketable	Fruit weight (g)	Number of locular cavities	Thickness of the pericarp (mm)
Year of cultivation 2009						
325 F ₁	L328 x L264 <i>rin</i>	12.92 b*	10.47 bc	144 b	4.2 b	8.3 a
330 F ₁	L328 x L269 <i>rin</i>	12.07 c	10.67 b	107 c	2.8 c	8.3 a
334 F ₁	L305 x L265 <i>rin</i>	15.21 a	10.92 ab	154 a	3.3 c	7.5 a
336 F ₁	L305 x L267 <i>rin</i>	11.91 c	11.20 a	159 a	4.5 b	6.8 b
348 F ₁	L321 x L271 <i>rin</i>	12.87 b	9.44 d	147 b	5.0 a	6.2 bc
'Adam F ₁ ' (standard)	SGGW	11.74 c	9.75 cd	137 b	2.8 c	7.9 a
'Faustine F ₁ ' (standard)	Syngenta Seeds	13.02 b	10.04 c	139 b	4.0 bc	8.6 a
Year of cultivation 2010						
325 F ₁	L328 x L264 <i>rin</i>	11.04 d	7.63 bc	141 b	4.6 b	8.1 ab
330 F ₁	L328 x L269 <i>rin</i>	12.42 c	8.69 b	119 c	2.5 c	7.5 bc
334 F ₁	L305 x L265 <i>rin</i>	12.69 c	10.17 a	148 ab	4.4 b	7.2 bc
336 F ₁	L305 x L267 <i>rin</i>	11.90 cd	6.70 c	157 a	3.8 c	7.9 ab
348 F ₁	L321 x L271 <i>rin</i>	13.85 b	10.42 a	153 ab	4.0 bc	7.2 bc
'Adam F ₁ ' (standard)	SGGW	13.13 bc	10.21 a	144 ab	3.1 c	7.9 ab
'Faustine F ₁ ' (standard)	Syngenta Seeds	15.32 a	10.89 a	149 ab	3.4 c	8.3 ab

*See Table 1.

ability with regard to the taste, smell and texture attributes analysed. The highest marks for overall quality were obtained in the fruit of hybrids 334 and 325. The fruit samples of hybrids 348 and 325 received the highest marks for flesh texture and hardness, while the highest marks for flesh juiciness were obtained

for fruit of the hybrid 330 and the 'Adam F₁' cv. The fruits of the 'Faustine F₁' cv. received the highest marks for sweetness and tomato taste. However, the fruit of 'Faustine F₁' cv. also received the highest marks for strange taste, sour taste and core size. High marks for skin firmness were obtained in the fruit of hybrid



The hybrids and cultivars of tomato: 325, 330, 334, 336, 348, 'Adam F_1 ' and 'Faustine F_1 '. Attributes evaluated (vectors): v1 – tomato smell, v2 – strange smell, v3 – core size, v4 – toughness of skin, v5 – flesh texture, v6 – flesh hardness, v7 – juiciness of flesh, v8 – tomato taste, v9 – sour taste, v10 – sweet taste, v11 – strange taste, v12 – overall quality.

FIGURE 1. PCA projection of similarities, differences and sensory quality of tomato fruit (2009–2010)

336. This chart shows that the positive and negative attributes depended on the genetic potential of the cultivars, which is consistent with the findings of Krumbain et al. [2004] and Gajc-Wolska et al. [2009].

CONCLUSIONS

1. The fruit of the parental forms with the *rin* gene received low marks for colour intensity, smell, flesh juiciness and taste and high marks for core size and skin hardness. The latter two traits are regarded as negative in the assessment of fruit quality compared to the values obtained for the lines of red-coloured fruits.

2. The new tomato hybrids with the *rin* gene yielded at a similar level as standard cultivars. They also received similar marks for traits such as fruit weight, pericarp thickness and the number of locular cavities when compared with the fruit of standard cultivars.
3. The assessment of the sensory quality of the fruit of the new tomato hybrids was comparable with the assessment of the standard cultivar fruits. These fruits received high marks for fruit fleshiness, flesh juiciness and overall quality, but lower marks for tomato smell, taste and sweetness.

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Streszczenie: Ocena nowych mieszańców pomidora z genem *rin* pod względem plonowania i jakości sensorycznej owoców. Pomidor jest jedną z najważniejszych roślin uprawnych zarówno jako warzywo świeże, jak i dla przetwórstwa. Mutacja *rin* jest godna uwagi, ponieważ mieszańce (*rin/Rin*) stanowią materiał wyjściowy do

hodowli większości odmian o owocach pomidora do opóźnionego dojrzewania oraz długiego okresu przydatności do spożycia. Celem doświadczeń polowych przeprowadzonych w latach 2009–2010 była ocena plonowania nowych mieszańców pomidora i ocena jakości sensorycznej owoców (zapach, konsystencja i smak). Nowe mieszańce pomidora 325, 330, 334, 336, 348 i dwie odmiany wzorcowe 'Adam F₁' i 'Faustyna F₁' wykorzystano w tych doświadczeniach. Mieszańce pomidora z genem *rin* plonowały na zbliżonym

poziomie jak odmiany wzorcowe, nie różniły się znacząco również w takich wskaźnikach, jak: masa owocu, grubość perykarpu i liczba komórek w owocu. Ocena jakości sensorycznej owoców nowych mieszańców pomidora była zbliżona do oceny owoców odmian wzorcowych. Owoce te uzyskały wysokie noty wyróżników miążsistości i soczystości miąższu oraz oceny ogólnej, niższe noty wyróżników zapachu i smaku pomidorowego oraz smaku słodkiego.

The influence of different subclones of the M.9 rootstock on the growth and bearing of ‘Elise’ apple trees in a V-planting system

DARIUSZ WRONA*, WOJCIECH KOWALCZYK,
CEZARY PIESTRZENIEWICZ
Department of Pomology, Warsaw University of Life Sciences – SGGW

Abstract: *The influence of different subclones of the M.9 rootstock on the growth and bearing of ‘Elise’ apple trees in a V-planting system. The usefulness of seven subclones of M.9 rootstock (EMLA, Burgmer 984, Burgmer 751, T339, Pajam1, Pajam2, RN29) for the growing of ‘Elise’ apple trees in the conditions of central Poland were investigated in the period 2000–2010. Eleven years after planting, the smallest trunk cross-sectional area (TCSA) was observed within trees on M.9 RN29 and M.9 T339, and the largest on M.9 Pajam2. As for the increase of TCSA over the eleven years, the different subclones of M.9 rootstock did not exert any significant effect on the growth of the trees. The same applied to the increase of TCSA within the successive biennial periods 2000–2002, 2004–2006 and 2006–2008. Differences in increase of trunk cross-sectional area were noted within the biennial periods 2002–2004 and 2008–2010. The smallest increase of TCSA in 2002–2004 was observed on M.9 T339 and M.9 RN29 and the largest on M.9 EMLA. The biennial increments of TCSA in 2008–2010 were the smallest on M.9 T339, M.9 RN29 and M.9 Pajam1, while the largest were on M.9 Pajam2. In 2001–2010, yield per tree was not significantly different, except for the years 2004 and 2009. In 2004 the yield per tree was the lowest on M.9 T339, M.9 RN29 and M.9 Pajam2, and the highest on M.9 EMLA. The lowest yield per tree in 2009 was obtained on M.9 RN29 and the highest on M.9 751, M.9 Pajam2 and M.9 EMLA. No significant differences between different subclones of M.9 rootstock were noted in cumulative yield per tree for ten years of bearing. The mean fruit mass and the cropping efficiency coefficient*

(CEC) did not depend on subclones of M.9 rootstock.

Key words: cropping efficiency coefficient, cumulative yield, fruit size, apple orchard, tree vigour

INTRODUCTION

When investigating the popularity of plants cultivated in orchards, it would seem that apple trees are the most popular kind planted both in Poland and throughout the world. The developments in research and methods of planting, favourable soil, weather and climate conditions, as well as the significant increase in the number of available cultivars and rootstocks, have caused the popularity of apple trees to increase. The intensification of apple production has seen a growing number of commercial orchards, greater competition and constant changes in production. This has led to an increase in the number of trees planted per surface area unit, which contributes to vigour, high precocity of bearing, the productivity of the trees grown and to the high quality of the fruit [Wertheim, 1989; Webster, 1992].

When searching for planting systems aimed at the intensification of apple production, the V-Güttingen system (Swit-

*tel. +4822 593 21 05, e-mail: dariusz_wrona@sggw.pl

zerland) should be taken into account. It has the following strong points: the appropriate amount of daylight reaches the trees' crowns, early and regular bearing and high fruit quality and quantity. On the other hand, the weak points are the high costs of building and running the system [Szczygieł et al., 1999; Hampson et al. 2002; Rutkowski et al., 2009].

In intensive orchard design, the choice of rootstock is a key element as it affects the apple tree in different ways. This is the reason for releasing numerous rootstocks best adapted to local soil and climatic conditions [Riesen and Monney, 1996; Sadowski et al., 2004; Czynczyk and Jakubowski, 2007; Hrotkó, 2007]. Of the numerous rootstocks available worldwide, M.9 is the most common in western Europe among dwarfing rootstocks [Czynczyk et al., 2001; Hrotkó, 2007; Stehr, 2007]. However, growing trees on this rootstock in Poland can sometimes be risky, because the root system can be damaged by low temperatures during winters without snow [Webster, 1999; Bielicki et al., 2002]. M.9 has approximately 150 selected subclones of English, Belgian, French, Dutch and German selection. The following are the most common: M.9 EMLA, M.9 T337, M.9 T339, M.9 Pajam1, M.9 Pajam2, M.9 RN29, Burgmer 984 and Burgmer 751.

The aim of the experiment was to compare the usefulness of seven subclones of M.9 rootstock for growing 'Elise' apple trees in a V-planting system.

MATERIALS AND METHODS

The experiment was conducted at the Warsaw-Wilanów Experimental Station, Central Poland, on a fertile, silty, loam

alluvial soil in the years 2000–2010. The soil assured favourable physical and chemical conditions and was permeable to air and water. The 'Elise' apple trees on seven subclones of M.9 rootstock of different origin (EMLA, Burgmer 984, Burgmer 751, T339, Pajam1, Pajam2, RN29) were planted in the spring of 2000 and trained in the V-planting system. The experiment was carried out in a randomised block design. Trees were spaced at a distance of 3.5×0.7 m (4,082 trees per hectare). Each subclone of M.9 rootstock was represented by ten trees per plot, in four replications. The alleyways were under sward and herbicide strips maintained along the tree rows. Routine orchard practices were carried out according to the recommendations for commercial apple orchards in Poland. In the first year after planting, at the beginning of bloom, all flowers were removed by hand. In subsequent years, chemical and hand thinning of fruitlets was regularly used.

The vigour of the trees was assessed based on TCSA after eleven years (spring 2011), as well as on its increase over eleven years (spring 2000 to spring 2011). In addition, the increase in TCSA was determined for the successive biennial periods: spring 2000–2002, 2002–2004, 2004–2006, 2006–2008 and 2008–2010. TCSA was derived from diameter measurements at 30 cm above the ground. The yield was assessed each year based on yield per tree and the cumulative yield was calculated for the entire period of harvesting (2001–2010). The CEC was determined as the ratio of cumulative yield (2001–2010) to the final TCSA (spring 2011). Fruit size was estimated as the mean weight of 100 fruits per plot.

The results were subjected to an analysis of variance. The Newman-Keuls test was used at $\alpha = 0.05$ for the evaluation of the significance of the differences between the treatment means.

RESULTS

The initial size of the trees (spring 2000) did not depend on subclones of M.9 rootstock (Table 1). After eleven years in the orchard (spring 2011), the different subclones of M.9 rootstock had no significant effect on TCSA in comparison with the standard M.9 EMLA. The relative tree size of all subclones of M.9 rootstock varied from 79% for trees on M.9 RN29 to 102% for trees on M.9 Pajam2. Significant differences in the vigour of trees were reported only between subclones M.9 RN 29, M.9 T339 and M.9 Pajam 2. The smallest TCSA was recorded for trees on M.9 RN29 and M.9 T339, and the largest on M.9 Pajam2. As for the increase of TCSA over the eleven years of the study (spring 2000–2011), the different subclones of M.9 rootstock

did not exert any significant effect on the growth of the trees (Table 2). The same applied to the increase of TCSA within the successive biennial periods: spring 2000–2002, 2004–2006 and 2006–2008. On the other hand, differences in the increase of TCSA were noted within the biennial periods spring 2002–2004 and 2008–2010. The smallest increase of TCSA within 2002–2004 was observed on M.9 T339 and M.9 RN29, whereas the largest was observed on M.9 EMLA. The biennial increments in TCSA 2008–2010 were the smallest on M.9 T339, M.9 RN29 and M.9 Pajam1, but the largest on M.9 Pajam2 (Table 2).

The first yield was harvested in the second year after planting (2001). In the period 2001–2010, yield per tree was not significantly different, except for the years 2004 and 2009 (Table 3). In 2004 yield per tree was the lowest on M.9 T339, M.9 RN29 and M.9 Pajam2, and the highest on M.9 EMLA. The lowest yield per tree in 2009 was obtained on M.9 RN29 and the highest on M.9 751, M.9 Pajam2 and M.9 EMLA. No signifi-

TABLE 1. Size of 'Elise' apple trees on the subclones of M.9 rootstocks: initial and eleven years after planting

Subclones of M.9 rootstocks	Trunk cross-sectional area (TCSA) [cm ²]		Relative size* [%]
	spring 2000	spring 2011	
M.9 EMLA	1.62 a**	30.8 ab	100
M.9 984	1.50 a	28.7 ab	93
M.9 751	1.40 a	29.6 ab	96
M.9 T339	1.32 a	24.7 a	80
M.9 Pajam1	1.46 a	25.2 ab	82
M.9 Pajam2	1.50 a	31.3 b	102
M.9 RN29	1.40 a	24.3 a	79

*Tree size on M.9 EMLA assumed as 100%.

**Means followed by the same letter in columns are not significantly different at $\alpha = 0.05$.

TABLE 2. Growth of 'Elise' apple trees on the subclones of M.9 rootstocks in successive biennial periods and within eleven years of the study

Subclones of M.9 rootstocks	Increment of TCSA [cm ²]					
	spring 2000–2002	spring 2002–2004	spring 2004–2006	spring 2006–2008	spring 2008–2010	spring 2000–2010
M.9 EMLA	3.0 a*	7.3 b	6.9 a	6.1 a	5.8 ab	29.8 a
M.9 984	2.2 a	6.8 ab	6.4 a	5.9 a	5.8 ab	28.2 a
M.9 751	2.2 a	6.7 ab	6.4 a	6.5 a	6.4 ab	29.1 a
M.9 T339	1.7 a	5.9 a	5.8 a	5.1 a	4.8 a	23.3 a
M.9 Pajam1	1.7 a	6.1 ab	5.5 a	5.4 a	5.0 a	23.7 a
M.9 Pajam2	2.3 a	7.1 ab	6.8 a	6.5 a	7.1 b	27.2 a
M.9 RN29	1.8 a	6.0 a	5.5 a	5.2 a	4.5 a	22.9 a

*Means followed by the same letter in columns are not significantly different at $\alpha = 0.05$.

TABLE 3. Yield of 'Elise' apple trees on the subclones of M.9 rootstocks in successive years

Subclones of M.9 rootstocks	Yield per tree [kg]									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
M.9 EMLA	2.7 a	8.0 a	18.0 a	19.2 b	8.4 a	16.0 a	8.1 a	19.0 a	25.2 bc	10.6 a
M.9 984	2.9 a	7.5 a	19.2 a	16.3 ab	9.3 a	15.1 a	8.4 a	15.4 a	23.9 abc	9.5 a
M.9 751	2.5 a	7.0 a	20.4 a	15.6 ab	13.6 a	14.9 a	13.1 a	17.0 a	26.5 c	13.0 a
M.9 T339	2.5 a	6.3 a	18.9 a	14.7 a	9.4 a	14.5 a	8.0 a	20.9 a	20.6 ab	10.8 a
M.9 Pajam1	2.4 a	6.3 a	19.2 a	16.2 ab	10.8 a	13.9 a	10.4 a	17.6 a	22.4 abc	10.9 a
M.9 Pajam2	3.3 a	6.6 a	18.2 a	14.3 a	10.6 a	14.2 a	11.1 a	16.4 a	26.1 c	11.2 a
M.9 RN29	2.7 a	6.0 a	16.2 a	13.9 a	8.0 a	13.1 a	6.4 a	17.3 a	19.7 a	9.8 a

*Means followed by the same letter in columns are not significantly different at $\alpha = 0.05$.

TABLE 4. The cumulative yield and mean fruit mass of 'Elise' apple trees on the subclones of M.9 rootstocks

Subclones of M.9 rootstocks	Cumulative yield in 2001–2010 per tree [kg]	Mean fruit mass average for 2001–2010 [g]
M.9 EMLA	135 a*	212 a
M.9 984	128 a	212 a
M.9 751	144 a	221 a
M.9 T339	127 a	211 a
M.9 Pajam1	130 a	215 a
M.9 Pajam2	132 a	220 a
M.9 RN29	113 a	212 a

*Means followed by the same letter in columns are not significantly different at $\alpha = 0.05$.

cant differences in cumulative yield per tree for ten years (2001–2010) between the different subclones of M.9 rootstock were noted (Table 4).

The mean fruit mass did not depend on subclones of M.9 rootstock and varied between 211 g from trees on M.9 T339 and 221 g from trees on M.9 751 (Table 4).

The cropping efficiency coefficient (CEC) did not depend on subclones of the M.9 rootstock, however the most vigorous trees exhibited the lowest values (Fig. 1).

growth of ‘Elise’ apple trees, while the studies conducted over several years in the orchard by Mantinger and Stainer [1996], Czynczyk and Bartosiewicz [2003] and Czynczyk and Jakubowski [2007], as well as the investigations in the nursery carried out by Słowiński and Sadowski [2001], all led to the same conclusion. Hirst [2001] and Privé [2004] on the other hand, observed stronger growth in trees on subclones M.9 Pajam1, M.9 Pajam2 and M.9 RN29 when compared with M.9 EMLA and M.9 T337. The authors concluded that this correlation was

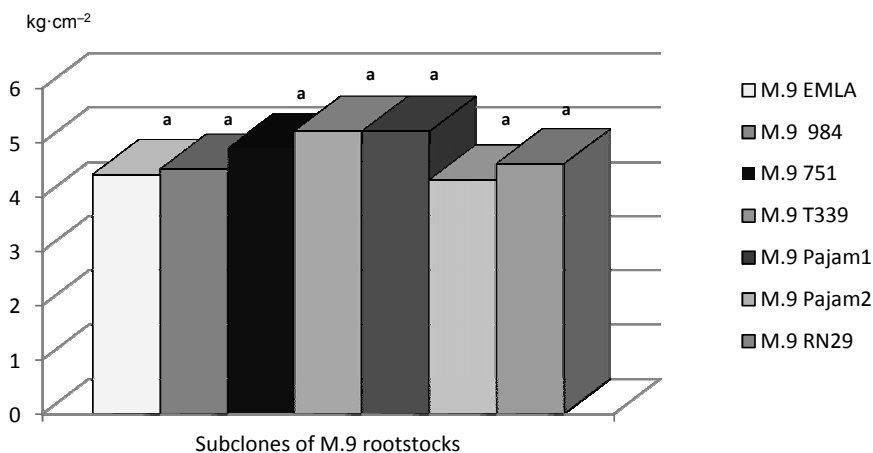


FIGURE 1. Cropping efficiency coefficient (CEC) of ‘Elise’ apple trees on the subclones of M.9 rootstocks

DISCUSSION

After eleven years, the relationship between the sizes of the trees on the subclones of M.9 rootstock was almost the same as that previously noted by Wrona and Sadowski [2006] and by Wrona et al. [2007]. The results of the experiments conducted by other researchers on this subject are contradictory. Jadczyk et al. [2004] noticed that subclones of M.9 rootstock had a slight influence on the

not constant and was determined by the location of the experiment.

The yields per tree in our experiment in the case of some subclones of M.9 rootstocks were proportional to tree size, but this was not always true. In most years no significant differences in the yield of apple trees were noticed, however in 2004 and 2009 the smallest yield was observed in trees on M.9 RN29. Similar observations were made earlier by Jadczyk et al. [2004] and Wrona et al.

[2007]. Different results were recorded by Webster and Tobutt [1994] as well as by Hirst [2001]. The authors noted that the highest yield was obtained on M.9 RN29, M.9 EMLA and M.9 Pajam2.

Zagaja et al. [1989] pointed out that rootstock may influence the fruit size of a grafted scion, but in our study this effect was weakly pronounced. The mean fruit mass was not influenced by subclones of M.9 rootstock, which was also noticed by Andziak and Tomala [2000], Czynczyk and Jakubowski [2007] and Wrona et al. [2007].

In the research we conducted CEC did not depend on subclones of M.9 rootstock. The same conclusion was drawn by Sadowski et al. [1999], Jadczyk et al. [2004] and by Wrona et al. [2007]. By way of contrast the study undertaken by Privé [2004] showed that the most productive trees grew on M.9 RN29. The author explained the higher yield efficiency on this rootstock by lower tree vigour.

CONCLUSIONS

1. In the conditions of central Poland the trees grafted on different subclones of M.9 rootstock presented similar vigour to the trees growing on standard M.9 EMLA. Significant differences in the vigour of trees were reported only between subclones M.9 RN29, M.9 T339 and M.9 Pajam2. The growth of trees on M.9 RN29 and M.9 T339 was the weakest, while it was the strongest on M.9 Pajam2.
2. All subclones on M.9 rootstock provided early bearing and high productivity, but they did not significantly

influence the yield, fruit size or cropping efficiency coefficient of the 'Elise' apple trees.

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Streszczenie: Wpływ różnych podklonów podkładki M.9 na wzrost i plonowanie jabłoni ‘Elise’ prowadzonej w systemie V. W latach 2000–2010 oceniano przydatność siedmiu podklonów podkładki M.9 (EMLA, Burgmer 984, Burgmer 751, T339, Pajam1, Pajam2, RN29) dla uprawy jabłoni ‘Elise’ w warunkach centralnej Polski. W jedenastym roku po posadzeniu najmniejsze pole powierzchni przekroju pnia miały drzewa rosnące na podklonach M.9 RN29 i M.9 T339, a największe na M.9 Pajam2. Na podstawie analizy przyrostu pola powierzchni przekroju pnia za okres jedenastu lat badań stwierdzono, że zastosowane podklony podkładki M.9 nie wywarły znaczącego wpływu na wzrost drzew. Podobne zależności odnotowano w odniesieniu do przyrostu pola powierzchni przekroju pnia w okresach dwuletnich: 2000–2002, 2004–2006 oraz 2006–2008. Z kolei różnice w przyroście pola powierzchni przekroju pnia stwierdzono w okresach: 2002–2004 oraz 2008–2010. Najmniejszy przyrost pola powierzchni przekroju pnia za okres 2002–2004 miały drzewa na podklonie M.9 T339 i M.9 RN29, największy na M.9 EMLA. Za okres 2008–2010 najsłabiej rosły drzewa na M.9 T339, M.9 RN29 oraz M.9 Pajam1, najsilniej na M.9 Pajam2. W latach 2001–2010 plon z drzewa nie

zależał od podklonu podkładki M.9 z wyjątkiem 2004 i 2009 roku. W 2004 roku najniższy plon uzyskano z drzew na M.9 T339, M.9 RN29 i M.9 Pajam2, najwyższy M.9 EMLA, z kolei w 2009 roku najniższy na M.9 RN29, zaś najwyższy na M.9 751, M.9 Pajam2 oraz M.9 EMLA. Suma-

ryczny plon z drzewa z dziesięciu lat owocowania nie zależał od podklonu podkładki M.9. Nie stwierdzono również wpływu podklonu podkładki M.9 na średnią masę owocu oraz wskaźnik intensywności owocowania drzew.

The physiological and biochemical reactions of selected grass species cultivated with the hydrogel amendment under salt stress (preliminary studies)

ANNA HADAM^{1*}, MARIOLA WROCHNA²

¹Department of Environmental Protection

²Laboratory of Basic Research in Horticulture, Faculty of Horticulture and Landscape Architecture, Warsaw University of Life Sciences – SGGW

Abstract: *The physiological and biochemical reactions of selected grass species cultivated with the hydrogel amendment under salt stress (preliminary studies).* The aim of the study was to assess the influence of hydrogel on the free proline accumulation, relative chlorophyll *a* content and relative water content (RWC) of red fescue (cv. 'Raisa'), smooth-meadow grass (cv. 'Jarotka') and perennial ryegrass (cv. 'Stadion') exposed to simulated salt stress. The experiment was conducted for four months in pots under greenhouse conditions. The hydrogel was used in the amount of 2 g per 1 dm³ of the medium. Salt stress in pots with and without hydrogel amendment was simulated on one-month-old plants by adding three different concentrations of water and road-de-icing salt solutions. The salinity increased proline accumulation and reduced relative chlorophyll *a* content in all of the tested species. Salt stress did not influence RWC in smooth-meadow grass and red fescue, but decreased RWC in perennial ryegrass. Under saline conditions hydrogel had no effect on the proline accumulation and RWC of all of the tested species. The relative chlorophyll *a* content was increased by sorbent only in perennial ryegrass under medium salt stress. The results obtained supported the conclusion that whereas the level of soil salinity was the main factor that had influenced the parameters tested; the efficacy of hydrogel under saline conditions was poorly indicated. The results should, however, be confirmed in field studies and experiments using other physiological and biochemical indicators of salt stress and taking into consideration other cultivars and species of turf.

Key words: hydrogel, drought, soil salinity, lawns, *Festuca rubra*, *Poa pratensis*, *Lolium perenne*

INTRODUCTION

Hydrogels are substances that ensure water-storage and thus allow plants to mitigate drought [Trippei et al., 1991]. Soil super sorbents support the growth and development of many agricultural (cotton), horticultural (tomato, tobacco) or forestry (pine seedlings) species [Wallace and Wallace, 1986; Al-Humaid, 2005; Sarvas et al., 2007]. The results of a pilot study conducted by the authors showed that, under simulated drought stress, gel sorbent enhances the germination, growth and dry matter of several grass species [Hadam, 2010]. In spite of the high water requirements of lawns, the water sorbent meant the frequency of watering could fall from three times a week to once a week, which reduced irrigation costs by three and a half times.

Grasses are the most common greenery alongside traffic lanes, where they shape landscape and microclimate conditions [Wysocki and Stawicka, 2005]. Unfortunately, due to the high costs of

*tel. 608 072 333, e-mail: ann.hadam@gmail.com

irrigation these plants are neglected and therefore some innovative cultivation, such as the application of gels, is needed.

Despite the above, hydrogels can also absorb cations. Akhter et al. [2004] observed that this ability decreases the resistance of gel sorbents to drought. On the other hand, numerous authors have shown that the application of hydrogel under saline conditions gives some benefits to crops. It has been observed that it increases the tolerance of wheat [Saleh and Hussein, 1987], maize [El-Sayed and Kirkwood, 1992] and bean [Aydin et al., 2011] to salt stress.

In Poland the problem of soil salinity relates mainly to plants, including grasses, on green belts near to roads. There, the use of salts, especially sodium chloride, for de-icing is frequent and high [Borowski, 2008]. Nevertheless, the effect of hydrogel on turf species growing under such conditions remains relatively unexplored.

Perennial ryegrass and red fescue are the most common grass species found alongside Polish traffic lanes [Wysocki, 1994; Harkot et al., 1998; Harkot et al., 1999]. Borowski [2008] observed that *Lolium perenne* is the most tolerant species to NaCl salinity whereas *Festuca rubra* is less tolerant. It was found that smooth-meadow grass (*Poa pratensis*), which is present near the roadside grass in the lowest amount, is the most sensitive species to salt stress. Hanslin and Eggen [2005] have indicated, however, that such differences in the tolerance of grass also concerns species and cultivars.

In studies conducted by the authors on perennial ryegrass (cv. 'Stadion', 'Naki', 'Accent'), red fescue (cv. 'Are-

ta', 'Raisa') and smooth-meadow grass (cv. 'Jarotka', 'Limousine') cultivated with hydrogel under simulated salinity, the presence of road-de-icing salt (97% NaCl) was the main factor that influenced the growth and fresh matter of all of the plants. Nevertheless, under low and medium salinity, the gel was beneficial to the condition of all the cultivars of red fescue and smooth-meadow grass, as well as to the cv. 'Stadion' perennial ryegrass. No influence was observed on the cv. 'Naki' and 'Accent' perennial ryegrass [Hadam et al., 2011a and 2011b; unpublished studies]. Studies of the influence of hydrogels on selected biochemical and physiological processes in grasses exposed to simulated salt stress are needed to find a better explanation of the results obtained.

One of the most commonly used biochemical indicators of plant tolerance to salinity is the accumulation of proline [Chen et al. 2001; Turan and Aydin, 2005]. An increased amount of this amino acid has also been observed in the leaves of several grass species cultivated under saline conditions [Huimin et al., 2001; Borowski, 2008]. As salt stress causes osmotic stress in plants, the water capability in their cells decreases, which is evidenced by turgor loss and a reduction in relative water content [Morant-Manceau et al., 2004]. Under saline conditions the intensity of photosynthesis may also decrease. A simple and quick indicator of such a reaction is the assessment of relative chlorophyll *a* content by means of a chlorophyll content meter [Jaleel et al., 2008].

The purpose of the present study was therefore to establish whether hydrogel influences proline accumula-

tion, relative water content and relative chlorophyll *a* content in the leaves of perennial ryegrass, smooth-meadow grass and red fescue exposed to simulated salt stress.

MATERIAL AND METHODS

Experimental design

The study was conducted over four months in the greenhouse of the Faculty of Horticulture and Landscape Architecture at Warsaw University of Life Sciences – SGGW.

An experimental growth medium, which consisted of sand, peat and horticultural soil (1 : 1 : 1), was mixed with hydrogel in the amount recommended by the manufacturer (2 g·dm⁻³ of the medium). The substrates prepared in this way were put into 0.8-dm⁻³ plastic pots (12 cm). Pots with and without hydrogel amendment were sown with (1) perennial ryegrass (*Lolium perenne*) ‘Stadion’ (0.123 g of seeds per pot; equivalent to ca. 10.8 g/m²), (2) smooth meadow-grass (*Poa pratensis*) ‘Jarotka’ (0.074 g of seed per pot; equivalent to ca. 6.5 g·m⁻²) and (3) red fescue (*Festuca rubra*) ‘Raisa’ (0.086 g of seeds per pot; equivalent to ca. 7.6 g·m⁻²). The number of seeds planted per pot was estimated based on seedling emergence, seedling purity and the sowing standard for each tested species [Rutkowska and Pawluśkiewicz, 1996].

Simulation of salinity stress

After a month of sowing, the plants were treated with a water solution of Kłodawska road-de-icing salt (contain-

ing 97% NaCl) in the amount of 80 ml per pot and in a dose of: 0, 5 or 10 g·dm⁻³. Based on the salinity curve for the experimental substrate used, the electricity conductance obtained was low (1.30 mS·cm⁻¹), medium (5.45 mS·cm⁻¹) or high (9.91 mS·cm⁻¹) [Kreeb, 1979].

The experiment was conducted in four replications, where one replication was a single pot with one of each species cultivated (with or without hydrogel amendments) at each salinity level.

Three months after the salt treatment, the grasses cultivated with and without the hydrogel additive were evaluated for several biochemical and physiological parameters used commonly in the assessment of salinity effects on plants [Pountariga et al., 2000; Khan et al., 2007; Dhanapackiam and Muhammad Ilyas, 2010]: free proline accumulation – by the Bates method [1973], the relative chlorophyll *a* content measured with a CCM-200 (chlorophyll content meter; Opti-Science, USA) and relative water content.

During the whole experiment the plants were irrigated to the optimal level of the capillary water capacity of the tested medium and measurements were conducted by soil moisture meter (ECHO-EC5) every day. The grasses were also mown once a week to a height of 5 cm. The temperature and air humidity in the greenhouse, which fluctuated from 22.9 to 35.0°C and from 32.5 to 42.2% respectively, were measured daily by thermo-hygrometer EPI 8703.

Statistical analysis

The data were analysed using a two-factor analysis of variance (ANOVA) from the Statgraphics 4.1 Plus software. The

significance of the differences between the combinations was examined with Duncan's test at $\alpha = 0.05$. The results show the mean values.

RESULTS

The effect on free proline accumulation

Salt additive resulted in an increase in the proline accumulation in the leaves of the perennial ryegrass (Fig. 1a). The higher concentration of salt was in the pots in which significantly higher proline content was determined. Such a reaction was independent of the hydrogel amendment.

It was also observed that in both media (with and without the sorbent) the smooth-meadow grass accumulated significantly greater amount of proline, when it was treated with the medium salt concentration by comparison with the pots, where plants were cultivated at a low salinity level (Fig. 1b). Proline accumulation under high salt stress was significantly greater than that observed under low and medium salt concentration in the pots with the hydrogel amendment. In the pots without the sorbent the amount of accumulated amino acid showed no significant difference compared to that determined in the pots with and without gel amendment under medium saline conditions and compared to the pots with gel under highly saline conditions.

The free proline content in red fescue increased significantly under medium salt stress (Fig. 1c) independently of the hydrogel amendment. Under high salt concentration the amount of proline in

pots with and without gel amendment decreased significantly, however plants cultivated with the hydrogel accumulated significantly more amino acid than those without the gel.

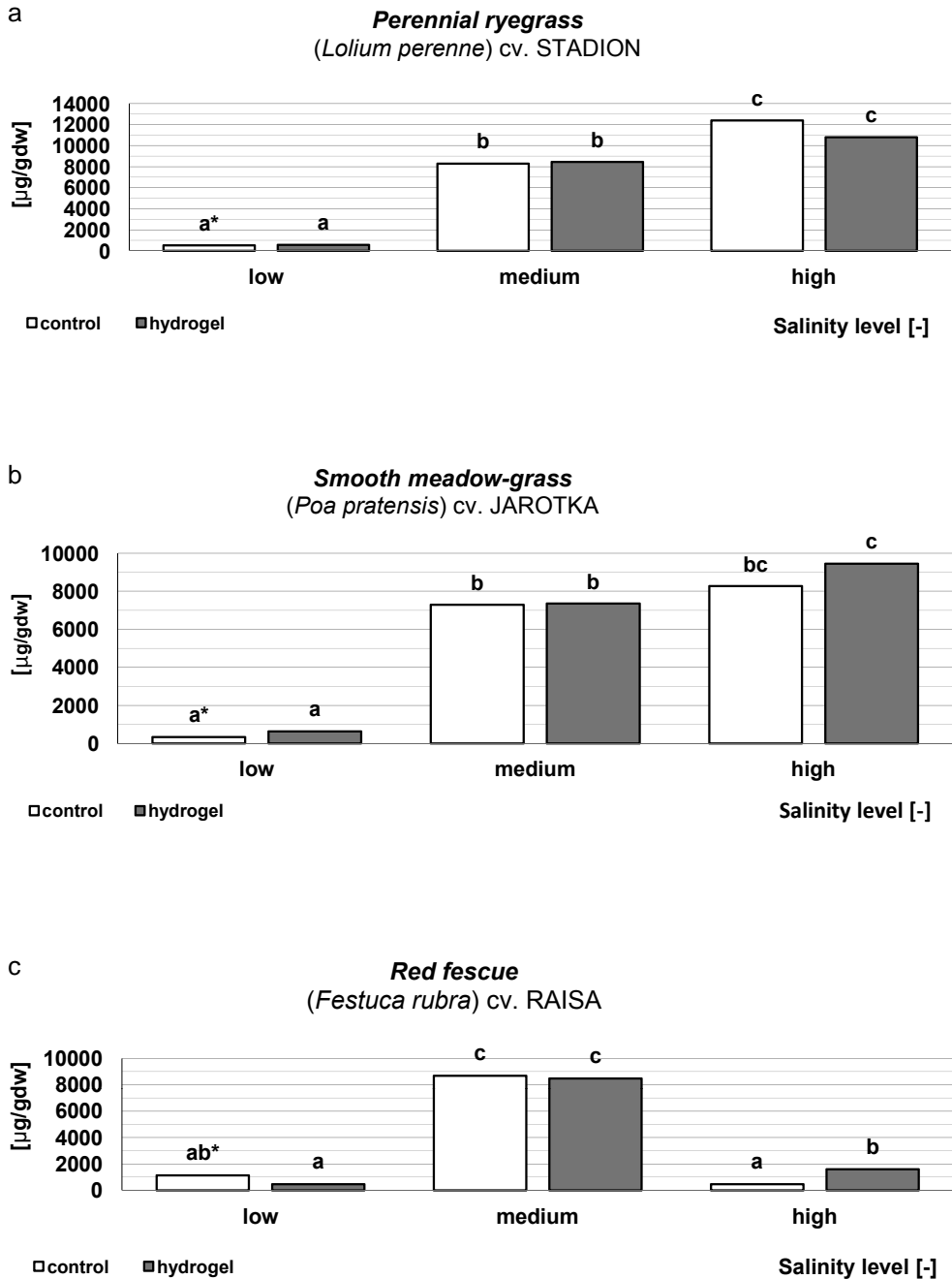
The effect on the relative chlorophyll *a* content

Under low salinity the relative chlorophyll *a* content in leaves of perennial ryegrass was not dependent on the hydrogel amendment: the values determined in pots with and without gel additive showed no significant difference (Fig. 2a). The influence of sorbent was observed, however under medium salt stress, where the amount of the dye in plants cultivated with gel was significantly higher than in the pots without it. In addition, the relative chlorophyll *a* content in plants cultivated with hydrogel under medium salinity was comparable to that observed at a low salinity level.

The hydrogel did not affect the relative chlorophyll *a* content in leaves of smooth-meadow grass (Fig. 2b). Under low salinity it was even significantly lower than in the control pots (those without gel). It was observed that in both sets of pots (with and without hydrogel amendment) the amount of dew decreased significantly as salinity increased.

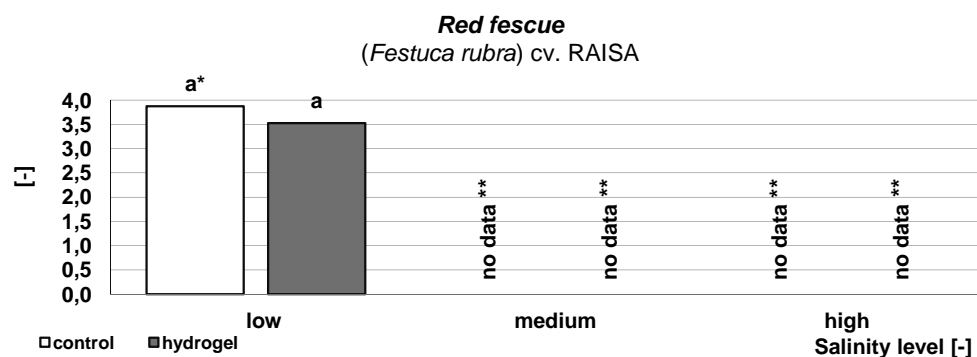
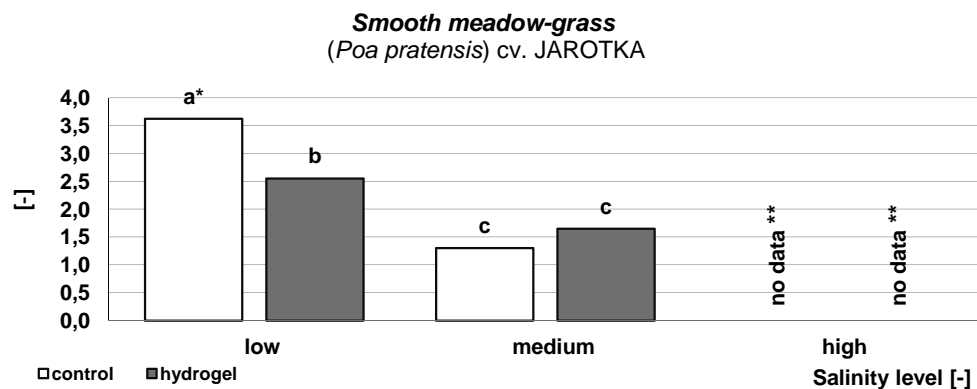
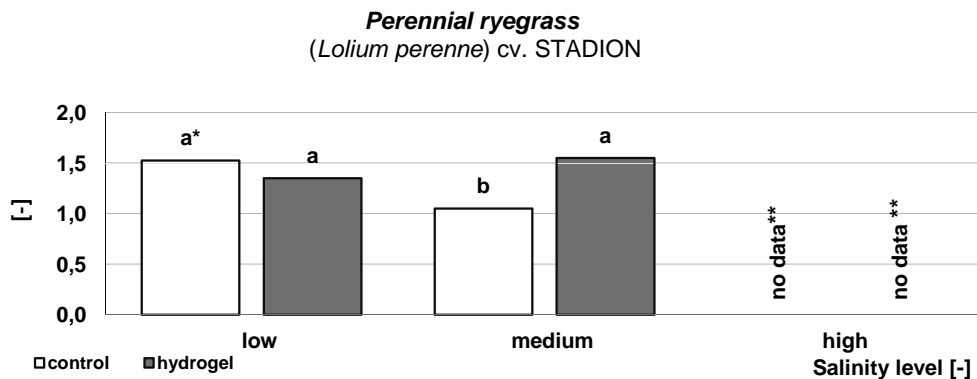
There was no significant difference in red fescue under low salt stress between pots with and without hydrogel (Fig. 2c).

The medium and high salinity measurements of relative chlorophyll *a* content for red fescue could not be conducted as the leaf width was insufficient. Under high salinity the smooth-meadow grass and perennial ryegrass were completely dried, meaning that, in this case too, measurements could not be made.



*Where the letters are different there is a significant difference between means.

FIGURE 1. Free proline accumulation in the leaves of the plants (a) perennial ryegrass (*Lolium perenne*) 'Stadion', (b) smooth-meadow grass (*Poa pratensis*) 'Jarotka' and (c) red fescue (*Festuca rubra*) 'Raisa' cultivated under saline conditions with and without hydrogel amendment



*Where the letters are different there is a significant difference between means.

**Measurements could not be conducted due to the weak condition of the plants.

FIGURE 2. Relative chlorophyll *a* content of the plants (a) perennial ryegrass (*Lolium perenne*) ‘Stadion’, (b) smooth-meadow grass (*Poa pratensis*) ‘Jarotka’ and (c) red fescue (*Festuca rubra*) ‘Raisa’ cultivated under saline conditions with and without hydrogel amendment

The effect on relative water content

The relative water content in leaves of perennial ryegrass cultivated under medium saline conditions was significantly smaller than in plants growing in low saline soil. This reaction was independent of the hydrogel amendments (Fig. 3a).

Salinity and hydrogel had no significant effect on relative water content in the leaves of smooth-meadow grass (Fig. 3b) and of red fescue (Fig. 3c).

The measurements for relative water content were not conducted under high salinity due to the weak condition of all of the plants.

DISCUSSION

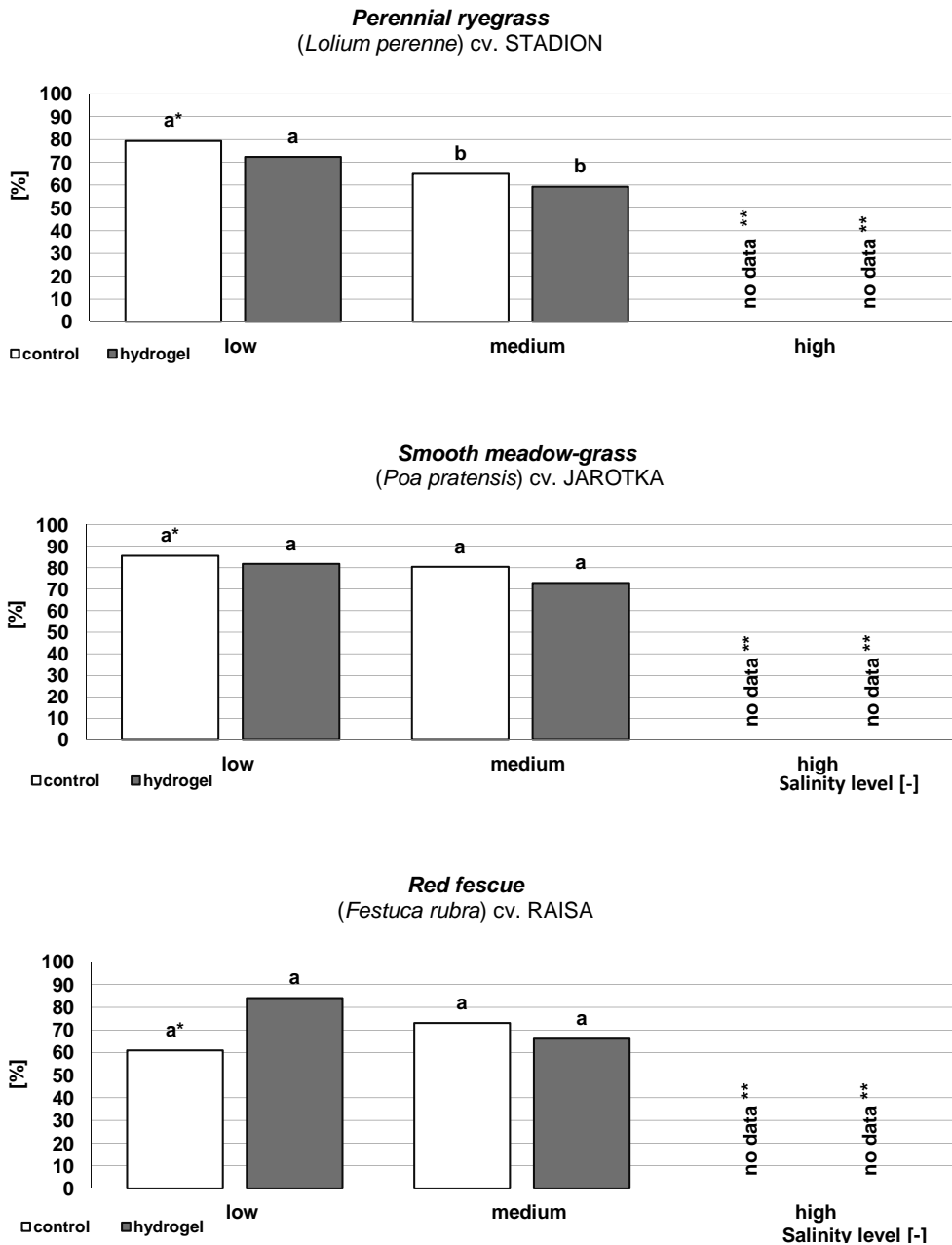
Proline accumulation is a protective mechanism observed in plants subjected to stress factors [Phang et al., 2008]. Under unfavourable conditions, such as salinity, their amount in plants grows [Mattioli et al., 2009], which was also observed in this study. The salt additive resulted in an increased proline accumulation in the leaves of perennial ryegrass and smooth-meadow grass. Similar results have been observed in other studies that investigated the impact of salinity on turfs [Huimin et al. 2001; Borowski, 2008] and different plant species [Mansour et al., 2005; Turan and Aydin, 2005].

The proline content in red fescue also increased under medium salt stress. Under high salinity this species was probably unable to defend itself against the stress, which meant that the proline accumulation under these conditions was significantly lower and comparable to that observed at a low level of salinity.

It was observed that hydrogel had no effect on proline accumulation in the saline conditions in all of the tested species. At all levels of salinity, the amount of amino acid in perennial ryegrass and smooth-meadow grass cultivated with the sorbent was comparable to the amount of amino acid in the plants grown in the substrate without hydrogel. The gel sorbent influenced red fescue only at high salinity. In these conditions the proline content with the hydrogel amendment was significantly greater than in the control group. The sorbent had no impact, though, under low and medium saline conditions.

The data on proline accumulation do not explain the results from the previous studies, which indicated that hydrogel enhanced the fresh matter of perennial ryegrass, red fescue and smooth-meadow grass in conditions of low and medium salinity [Hadam et al., 2011a and 2011b; unpublished studies]. It can therefore be suggested that proline accumulation is not affected by the hydrogel in the grasses. Biomass accumulation is, however, strongly associated with the intensity of photosynthesis, which, in turn, is dependent, among other factors, on the amount of chlorophyll [Santos, 2004]. On the other hand, exposure of plants to salt stress may reduce the content of this dye [Stepień and Kłobuś, 2006].

The results presented demonstrate that the influence of hydrogel on relative chlorophyll *a* content under saline conditions depends on the species tested. In the leaves of smooth-meadow grass the amount of photosynthetic dye decreased as salinity increased in all pots – with or without the gel amendment (Fig. 2b).



*Where the letters are different there is a significant difference between means.

** Measurements could not be conducted due to the weak condition of the plants.

FIGURE 3. The relative water content of the plants (a) perennial ryegrass (*Lolium perenne*) ‘Stadion’, (b) smooth-meadow grass (*Poa pratensis*) ‘Jarotka’ and (c) red fescue (*Festuca rubra*) ‘Raisa’ cultivated under saline conditions with and without hydrogel amendment

In contrast, while in the subsoil without the hydrogel the amount of relative chlorophyll *a* content in the leaves of perennial ryegrass decreased as salinity increased, the amount of the dye in this species cultivated with the gel amendment was stable up to medium salinity (Fig. 2a). This may suggest that under medium salt stress hydrogel increased the fresh matter production of perennial ryegrass by creating the appropriate conditions for photosynthesis.

The photosynthetic activity of perennial ryegrass enhanced by the gel amendment may also explain the decreasing relative water content observed in this species (Fig. 3a). The stomatal apparatus is opened during photosynthesis, which results in the assimilation of CO₂ and increased transpiration [Stepień and Kłobuś, 2006]. On the other hand, the decreasing RWC in the leaves of perennial ryegrass cultivated without sorbent under medium saline conditions could be the effect of another mechanism. The water available to *Lolium perenne* could have been reduced due to a high concentration of salt in the medium. A phenomenon such as this is often expressed in turgor loss and a decreased relative water content [Cicęk and Cakırlar, 2002]. The results presented are also consistent with other studies that have observed that changes in relative water content under saline conditions depend on the species [Abt-el Baki et al., 2000; Morant-Manceau et al., 2004]. Whereas salinity had an impact on relative water content in the leaves of perennial ryegrass, it did not affect this parameter in the smooth-meadow grass (Fig. 3b). As hydrogel had no influence on the RWC of this species it is possible that *Poa pratensis* had ac-

tivated a protective mechanism against the stress prompted by stomatal closure [Brugnoli and Lauteri, 1990].

The result obtained above was consistent with studies of the powerful effects of salinity on plants [Neelam and Ajah, 2005]. Salt stress was the main factor affecting the physiological and biochemical processes found in the grass species tested. Under conditions of low and medium salinity it was the perennial ryegrass and smooth-meadow grass especially that responded to stress with a number of protection mechanisms.

Under saline conditions support for the influence of hydrogel on the biochemical and physiological reactions presented was, however, weak. The sorbent only enhanced relative chlorophyll *a* content in the leaves of perennial ryegrass under medium salt stress. This reaction was not found in the case of the other species tested. The proline accumulation and relative water content were not affected by the sorbent. It may therefore be concluded that an assessment of other biochemical and physiological indicators for the evaluation of hydrogel impact on turfs under saline conditions, with consideration given to larger amounts of perennial ryegrass, smooth-meadow grass and red fescue cultivars, is very necessary. The studies should also be confirmed by field trials.

CONCLUSIONS

1. Salt stress influenced all of the selected physiological and biochemical processes in the grass species tested – independently of the hydrogel amendment.

2. As salinity rose in the case of perennial ryegrass and smooth-meadow grass, so a higher amount of protective protein/proline was accumulated.
3. Proline accumulation in red fescue increased only under medium salinity. High salinity was already too great a stress for this species and it reduced osmoprotectant production.
4. The relative water content in the leaves of smooth-meadow grass and red fescue was stable under low and medium salinity.
5. A high salinity level had a particularly negative effect on all of the species tested, which meant that their relative water content and relative chlorophyll *a* content could not be measured.
6. Hydrogel had almost no effect on the proline accumulation of the grass species tested and cultivated under saline conditions. It did increase the relative chlorophyll *a* content of perennial ryegrass under medium salt stress, but had no influence on the amount of the dye in the leaves of smooth-meadow grass and red fescue. The sorbent did not affect the relative water content of any of the species tested.
7. The results did not confirm that hydrogel is an effective soil conditioner on lawn grass areas, that will improve their tolerance to saline conditions. The data presented should be tested in studies of other biochemical and physiological indices with consideration given to additional cultivars of perennial ryegrass, smooth-meadow grass and red fescue. The results should also be confirmed by field trials.

Acknowledgments

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Streszczenie: *Fizjologiczne oraz biochemiczne reakcje na zasolenie u wybranych gatunków traw uprawianych z dodatkiem hydrożelu (badania wstępne).* Celem badań była ocena wpływu hydrożelu na akumulację wolnej proliny, zawartość chlorofilu *a* i względną zawartość wody w liściach (RWC – ang. relative water content) traw narażonych na działanie stresu solnego. Doświadczenie wazonowe prowadzono przez cztery miesiące w warunkach szklarniowych. Wazony z hydrożelem oraz wazony kontrolne (bez dodatku sorbentu) obsiewano w siewach czystych jednym z trzech gatunków testowych życią trwałą, wiechliną łąkową i kostrzewą czerwoną. Stres solny symulowano po miesiącu od wysiewu, traktując rośliny trzema różnymi stężeniami soli do odladzania ulic. Zasolenie wpłynęło na wzrost akumulacji proliny i spadek względnej zawartości chlorofilu *a* u wszystkich testowanych gatunków. Stres solny nie spowodował obniżenia RWC w liściach wiechliny łąkowej i kostrzewy czerwonej, u życicy trwałej zaobserwowano jednak znaczący spadek RWC. Hydrożel nie wpłynął na większość oznaczanych parametrów, z wyjątkiem względnej zawartości chlorofilu *a* u życicy trwałej utrzymywanej podłożu o silnym zasoleniu. Uzyskane wyniki pozwoliły stwierdzić, że zasolenie było głównym czynnikiem determinującym oznaczane parametry. Wpływ hydrożelu na fizjologiczno-biochemiczne reakcje traw był natomiast nieznaczny. Uzyskane wyniki należy potwierdzić w badaniach terenowych, a także w doświadczeniach z wykorzystaniem innych parametrów fizjologiczno-biochemicznych z uwzględnieniem większej liczby odmian badanych gatunków.

The effect of biopreparations on the rooting of stem cuttings in *Cotinus coggygia* ‘Young Lady’

ANDRZEJ PACHOLCZAK*, WIESŁAW SZYDŁO, KRYSZYNA ZAGÓRSKA,
PAWEŁ PETELEWICZ

Department of Ornamental Plants, Warsaw University of Life Sciences – SGGW

Abstract: *The effect of biopreparations on the rooting of stem cuttings in Cotinus coggygia ‘Young Lady’.* The EU-imposed restrictions on the use of plant protection chemicals require the nurseryman to screen for new substances that are environmentally friendly and yet effective in the production of plant material. Biopreparations may constitute such a group, as they contain substances that have little environmental impact. The aim of this study was to evaluate the effect of AlgamiPlant (0.2%), HumiPlant (0.2%) and Route (0.1%) on rhizogenesis in stem cuttings of smoke bush. Cuttings harvested from stock plants were treated with the preparations mentioned above. After ten weeks their root system was compared to that of the control, untreated cuttings and to those treated with synthetic auxin IBA applied either by spraying in an aqueous solution ($200 \text{ mg} \cdot \text{dm}^{-3}$) or as the commercial rooting powder Rhizopon AA (2%). All three biopreparations positively affected rooting in smoke bush cuttings. The effects of treatments with biopreparations on contents of chlorophyll a+b, free amino acids and reducing sugars in the leaves of cuttings were not unequivocal and no relationship could be established between their changes and rhizogenesis. The treatment with Route which resulted in an elevated polyphenolic acid content in cuttings positively affected their rhizogenesis. Spraying cuttings of smoke bush with solutions of the preparations tested can replace treatments with synthetic auxin and may therefore be recommended for commercial practice.

Key words: smoke bush, rhizogenesis, AlgamiPlant, HumiPlant, Route, chlorophyll, reducing sugars, polyphenolic acids

INTRODUCTION

The increasing demand for ornamental plant material and the strong competition among nurseries compels growers to deliver the best material in the shortest possible time and in large quantities. As a consequence, new methods to intensify nursery production are constantly being tested. Until now synthetic auxins have served as active substances of commercial rooting powders widely used in nurseries to stimulate rhizogenesis in cuttings. The EU-imposed restrictions on the use of plant protection chemicals, including auxins, require nurserymen to screen for new substances that are environmentally friendly and yet effective in the production of plant material. Biopreparations may constitute such a group as they contain substances that have little effect on the environment. These are either single or multi-compound preparations that contain extracts from sea algae (*Eclonia maxima*, *Laminaria digitata*, *Fucus vesiculosus* or *Durvillea potatorum*) [Dobrzański et al., 2008]. They induce, or are said to induce, plant resistance to different stresses and they can also positively affect rhizogenesis and root-system development by inducing

*tel. +4822 593 22 70, 607 344 814, e-mail: pacholczak@poczta.onet.pl

anatomical and morphological changes in plants [Cambri et al., 2008, Khan et al., 2009]. Our previous studies have shown that certain biopreparations not only enhance rhizogenesis in cuttings of ornamental shrubs, but can even replace the rooting powders [Jacygrad and Pacholczak, 2010, Pacholczak et al., 2010].

AlgamiPlant is a liquid preparation produced on the base of a seaweed extract from *Sargassum*, *Laminaria*, *Asco-phyllum* and *Fucus*. It contains three groups of plant hormones: gibberellins, cytokinins and auxins [Bai et al., 2007]. It is supplemented by potassium salts of amino acids at 10%. The preparation enhances the uptake of macroelements and microelements and their translocation within plants, increases the respiration rate and root growth, and participates in photosynthesis and other metabolic processes. It positively affects plant resistance to stresses, and accelerates flowering and fruit set [Bai et al., 2007]. HumiPlant is a colloid suspension produced from leonardites – intermediates between peat and brown coal. It contains a mixture of humic (12%) and fulvic (6%) acids and such elements as nitrogen, phosphorus, potassium, zinc and boron. Humic substances improve soil structure promoting the development of soil microflora and fauna, which in turn activate the soil compounds required by plants. They improve the soil's water-holding capacity and maintain optimal soil pH [Matysiak et al., 2010]. They enhance photosynthesis and respiration in plants. As HumiPlant also enhances root development it was included in the trials. Ammonium zinc acetate (AAC), an active ingredient of Route, has been recently used to stimulate the root growth of numerous

agricultural crops such as corn or rape. Plants with enhanced root growth are less prone to drought and hence produce better yields. The mechanism of AAC is different from that of typical auxin co-factors. When AAC is applied to plants it stimulates the biosynthesis of endogenous auxins thus resulting in a change in the endogenous auxin/cytokinin activity ratio, which in turn can enhance root formation [Pacholczak and Szydło, 2008]. The purpose of this study was to compare the three preparations AlgamiPlant, HumiPlant and Route with a commercial rooting powder containing synthetic auxin that is commonly used in nurseries. The tests were performed on the popular ornamental shrub *Cotinus coggygia* 'Young Lady'. An attempt was also made to detect relationships between several different biochemical parameters of cuttings, as influenced by treatments, and the subsequent rhizogenesis.

MATERIALS AND METHODS

The experiment was carried out in 2010 in the commercial nursery of M.M. Krypt in Wola Prażmowska on smoke bush *Cotinus coggygia* 'Young Lady'. The stem cuttings originated from three-year-old stock plants. The following preparations were used: Route (0.1%) mixture of AlgamiPlant (0.2%) and HumiPlant (0.2%). The cuttings were sprayed with one of the solutions once, twice or three times during the rooting period. To compare their effects with a commercial rooting powder, a synthetic auxin routinely used in nursery production – β -indolylebutyric acid (IBA) – was included. It was applied either directly to the bases of

cuttings in the form of the commercially available rooting powder Rhizopon AA (2% IBA) used routinely in the nursery, or by spraying cuttings with an aqueous solution of 200 mg·dm⁻³ IBA. While being sprayed each cutting was covered with 1 ml of a solution. The control cuttings were sprayed with distilled water. The experiment began on 29 June 2010. Semi-lignified two-nodal stem cuttings were prepared from the middle parts of shoots harvested from stock plants free from pathogens and diseases. Cuttings were rooted in Styrofoam™ boxes. They were inserted to a depth of 2 cm into a mixture of peat, perlite and sand (2 : 1 : 1), pH 5.0. The mixture was thoroughly wetted and pressed and covered with a 0.5 cm layer of coarse sand.

Water and the solutions tested were applied with a hand pressure sprayer (volume 1 dm³) on three dates: date I – beginning of the experiment (29 June), date II – a week later (6 July), date III – two weeks after the beginning of the experiment (13 July). The rooting took place in plastic tunnels equipped with automatic watering and mist systems as well as with shading devices. During the

first two weeks the cuttings were protected against the sun with an opaque foil and a shading cloth. Every two weeks, cuttings were sprayed against *Botrytis* with 0.2% Rovral or Teldor.

The experiment consisted of nine treatments (Table 1), each in three replications, each replication containing twenty cuttings. The percentages of rooted cuttings and the degree of rooting were determined ten weeks after the start of the experiment on 7 September 2010. The degree of rooting was evaluated on a five-point scale rating the development of the root ball (Table 2). The scores for the degree of rooting represent the means of three independent observations by trained personnel.

For biochemical analyses batches of an extra twenty cuttings were included. There were therefore eighty cuttings in each of the three chosen treatments 1, 6 and 9 (there were three replications of twenty cuttings for measurements and twenty for analyses). The leaves from twenty cuttings per treatment were collected three weeks after the beginning of the experiment from control, untreated cuttings and those sprayed three times

TABLE 1. A list of treatments in the experiment

No. of treatment	Treatments
1	Control (H ₂ O)
2	Rhizopon AA (2% IBA), powder
3	IBA 200 mg·dm ⁻³ , spraying
4	single treatment, AlgamiPlant 0.2% + HumiPlant 0.2%
5	two treatments, AlgamiPlant 0.2% + HumiPlant 0.2%
6	three treatments, AlgamiPlant 0.2% + HumiPlant 0.2%
7	single treatment, Route 0.1%
8	two treatments, Route 0.1%
9	three treatments, Route 0.1%

TABLE 2. The evaluation scale of the root development

Root characteristics	Score
No visible roots on cuttings	1
A few (1–3) short roots	2
4–5 roots, some of them branched, no root ball formed	3
Medium sized root system composed of 6–10 branched roots forming a root ball	4
Well formed, branched root system forming a root ball (over 10 roots)	5

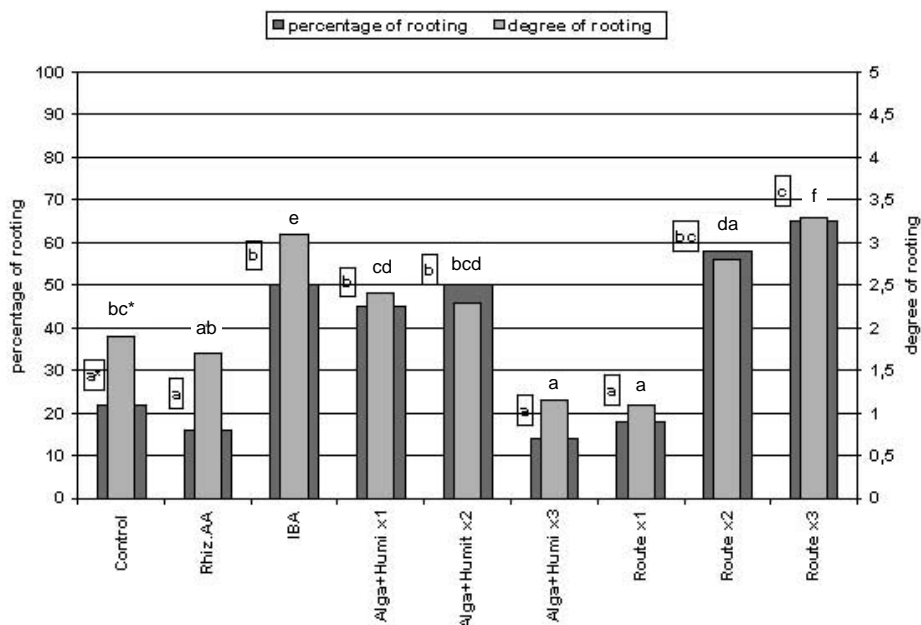
(treatments 1, 6 and 9). They were rinsed with water, dried on soft paper, finely chopped, mixed and 0.5–1 g samples were taken for the measurements of dry matter and the contents of chlorophyll a+b, reducing sugars, free amino acids and polyphenolic acids. Triplicate extracts were prepared for each analysis and three measurements were made for each extract, which produced nine readings for each data point.

For the dry matter content, 1 g samples were dried at 105°C to constant weight [Strzelecka et al., 1982]. Chlorophyll content (chlorophyll a+b) was analysed according to Lichtenthaler and Wellburn [1983]. Reducing sugars were determined by the colorimetric method of Somogyi in the Nelson modification [Nelson, 1944]. Free amino acids were measured according to Rosen [1957] and polyphenolic acids by the colorimetric method with Arnov's reagent according to Polish Norm PN-91/R-87019.

To compare the means, rooting percentages were transformed according to Bliss [Wójcik and Laudański, 1989], while the degree of rooting by root transformation by $y = x^2 + (x + 1)^2$. The above data were subjected to ANOVA 1 and checked with Duncan's test at $\alpha = 0.05$. The results of the biochemical analyses were subjected to a two-way factorial ANOVA and the means were compared using Duncan's test at $\alpha = 0.05$.

RESULTS

The analysis of variance showed the treatments had significant effect on the degree and the percentage of rooting in stem cuttings of *C. coggygia* 'Young Lady', determined ten weeks after the start of the experiment. Untreated cuttings rooted in 22% produced a few short roots (Fig. 1). The application of a commercial rooting powder, Rhizopon AA, did not enhance rhizogenesis, however its active ingredient, auxin IBA, applied as a spray on the leaves of cuttings doubled the percentage of rooted cuttings and improved the quality of their root system, as they contained 2–3 short roots on average. A comparable percentage of rooting was obtained in cuttings sprayed twice with Route and those treated once or twice with the mixture of AlgaminoPlant and HumiPlant. However, the degree of rooting was significantly lower in the latter two treatments. The best results were obtained with cuttings sprayed three times with Route, where two thirds of cuttings rooted and their root system was scored at nearly 3.5, as the cuttings had produced 5–6 roots of 3–5 cm in length. The single application of Route and the triple spraying with the mixture of AlgaminoPlant and HumiPlant produced no effect.



* Means for a given compound followed by the same letter do not differ significantly at the probability level $\alpha = 0.05$.

FIGURE 1. The effect of treatments on the degree and percentage of rooting in stem cuttings of *C. coggyria* 'Young Lady' determined ten weeks after the start of the experiment

Biochemical analyses

Both treatments, that is, triple spraying with either Route or the mixture of Algaminoplant and HumiPlant, significantly increased – by 25% on average – the chlorophyll content in the leaves of cuttings (Table 3). Also, the free amino acid levels were increased after both treatments by 84–98%. The content of the reducing sugars rose only after spraying cuttings with the mixture of the two biopreparations, while Route was ineffective. In the case of the polyphenolic acids it was Route that increased their content in the leaves of cuttings, while this did not change following the application of Algaminoplant + HumiPlant.

DISCUSSION

Our previous study showed that certain biopreparations not only enhance rhizogenesis in the cuttings of ornamental shrubs, but can even replace the rooting powders [Jacygrad and Pacholczak, 2010; Pacholczak et al., 2010], which was further confirmed in this paper on *C. coggyria* 'Young Lady'. Smoke bush is not an easy-to-root plant as its untreated control cuttings rooted only in 20%. It was surprising that a widely-used commercial rooting powder, Rhizopon AA, did not enhance rhizogenesis though its active ingredient, auxin IBA, did. It is probable that the 2% concentration of IBA was too high for this cultivar as the bases of the cuttings showed signs of

TABLE 3. The effect of Route and the mixture of AlgaminoPlant and HumiPlant on the contents of several organic compounds in leaves of cuttings of *C. coggygia* ‘Young Lady’ determined three weeks after inserting cuttings into the rooting medium

Compound	Control	AlgaminoPlant + + HumiPlant	Route
Chlorophyll a+b (mg·g ⁻¹ of d.m.)	2.76 a*	3.51 b	3.44 b
Reducing sugars (mg·g ⁻¹ of d.m.)	114.28 a	131.25 b	115.73 a
Free amino acids (μmol·g ⁻¹ of d.m.)	121.17 a	239.51 b	223.15 b
Polyphenolic acids (mol·g ⁻¹ of d.m.)	12.30 a	12.36 a	14.10 b

* Means for a given compound followed by the same letter do not differ significantly at the probability level $\alpha = 0.05$.

browning and drying. The best results were obtained with a triple spraying with Route, which contains zinc. This has been reported as having been used to enhance root system development [Blazich, 1988; Broadley et al., 2007]. Our earlier work also confirmed Route’s positive action on the rooting of the cuttings of several ornamental shrubs – probably as an auxin co-factor [Szydło et al., 2007; Pacholczak and Szydło, 2008].

The chlorophyll content was chosen as one of the indicators of the cuttings’ response to the treatments. The pigment amount contributes to the overall condition of the plants and is also a good indicator of plant response to stresses [Woodward and Bennett, 2005]. There are studies that have found that biopreparations obtained from algae increase chlorophyll content in crops [Sivasankari et al., 2006]. In the leaves of the smoke bush cuttings the chlorophyll level increased after triple spraying both with Route and with the mixture of biostimulators. However, rhizogenesis was enhanced only due to Route application, while spraying with AlgaminoPlant + HumiPlant had a negative effect on rooting. There did not therefore appear to be a relationship between the chloro-

phyll content and rhizogenesis in smoke bush.

The rooting process depends on carbohydrate concentrations in plant tissue [Costa et al., 2007]. Reducing sugars as respiratory substrates are directly involved in the production of energy, which is needed – among other things – for morphogenesis [Kopcewicz and Lewak, 2007]. There are little data on the effects of biopreparations on reducing sugar levels in treated plants and even less on the carbohydrate balance in cuttings after treatments with biopreparations. The spray application of AlgaminoPlant + HumiPlant increased the reducing sugar content in cuttings of *C. coggygia* ‘Young Lady’, but limited rhizogenesis. However, no such increase in sugar level occurred in the cuttings sprayed with Route, which in turn enhanced rooting. The relationship between levels of reducing sugars and rhizogenesis following the application of biopreparations requires further study.

Amino acids play different roles in plant organisms, serving mainly as building material for the synthesis of peptides and proteins. Some of them are storage forms of amine nitrogen; others serve as transportation forms between differ-

ent plant parts [Kopcewicz and Lewak, 2007]. Lessufleur et al. [2007] have shown that an elevated concentration of free amino acids in the rhizosphere positively affects rhizogenesis. The application of AlgaminoPlant on two nine-bark cultivars enhanced the rooting of cuttings and increased the content of free amino acids in their leaves [Jacygrad and Pacholczak, 2010]. There appeared not to be a similar relationship in smoke bush, where both treatments increased the free amino acid contents, but only Route stimulated root development.

Phenolic compounds used together with auxins improve the rooting of cuttings [Moore, 1984]. They act as auxin co-factors and are active in low concentrations [Jankiewicz, 1997]. Their mode of action is not entirely clear, but they may protect auxins against oxidation [Hartmann et al., 2002]. Their effects on cuttings are recognized: they increase the percentage of rooted cuttings and improve root development. An increase in their content following biopreparation treatments may be directly related to improved rhizogenesis. This may be true for smoke bush, as the level of polyphenolic acids was elevated only after the Route application (the treatment which enhanced rooting).

In nursery production synthetic auxins such as IBA are generally recommended as more effective and cheaper than biostimulators. The efficiency of the solution of IBA has been confirmed in this work, however, if the pressure to withdraw synthetic auxins mounts, there is a chance that certain biopreparations will be capable of replacing them. In this sense, the results of this study are encouraging. However, more detailed

studies are needed to determine the best application regimes and to provide some understanding of their mode of action before any practical recommendations can be formulated. A comparison of the economic aspects of the two application methods (spraying vs. a rooting powder) has already been made and finds in favour of the first [Pacholczak et al., 2005].

CONCLUSIONS

1. Route as well as AlgaminoPlant applied jointly with HumiPlant positively affected rhizogenesis in smoke bush cuttings; the range of their effects depended on the number of sprayings.
2. Spraying smoke bush cuttings with biopreparations may be as effective for rhizogenesis as the application of the synthetic auxin IBA.
3. The effects of treatments with biopreparations on the contents of chlorophyll a+b, free amino acids and reducing sugars in the leaves of cuttings were not unequivocal and did not permit a relationship to be established between their changes and rhizogenesis.
4. The treatment with Route, which resulted in an elevated content of polyphenolic acids in cuttings, positively affected their rhizogenesis.

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- Streszczenie:** Wpływ substancji pochodzenia naturalnego na ukorzenianie sadzonek pędowych *Cotinus coggygria* 'Young Lady'. Celowość badań nad wpływem substancji pochodzenia naturalnego na ukorzenianie sadzonek podykotowane jest w dużej mierze względami ekologicznymi oraz przepisami prawa unijnego, które ograniczają stosowanie syntetycznych substancji w produkcji roślinnej. Założeniem niniejszej pracy było zbadanie wpływu biostymulatorów AlgaminoPlant i HumiPlant oraz preparatu Route na proces rizogenezy sadzonek pędowych *Cotinus coggygria* 'Young Lady'. Ww. biostymulatory to środki stosowane w nowoczesnym ogrodnictwie i rolnictwie, bezpieczne dla ludzi i środowiska. Sadzonki do doświadczeń zostały pobrane z roślin matecznych i traktowane Rhizoponem AA (2%), auksyną IBA (200 mg·dm⁻³), preparatami: Route (0.1%) oraz AlgaminoPlant (0.2%) w połączeniu z HumiPlantem (0.2%). Biostymulator AlgaminoPlant wraz z HumiPlantem oraz preparat Route pozytywnie wpłynęły na proces ukorzeniania sadzonek. Wpływ biopreparatów na zawartość chlorofilu, wolnych aminokwasów i cukrów redukujących był niejednoznaczny i nie pozwolił na ustalenie zależności między zmianą ich zawartości a rizogenezą. Zastosowanie preparatu Route spowodowało podwyższenie zawartości polifenolokwasów, co pozytywnie wpłynęło na ukorzenienie sadzonek. Opryskiwanie sadzonek AlgaminoPlantem łącznie z HumiPlantem oraz Route w celu poprawy ukorzenienia sadzonek może być równie skuteczne jak stosowanie preparatów pudrowych zawierających auksyny.

Selected methodological approaches to the hypothetical application of the valuation of cultural heritage to historical monuments

MAŁGORZATA SOŁTAN*

Department of Environmental Protection, Warsaw University of Life Sciences – SGGW

Abstract: *Selected methodological approaches to the hypothetical application of the valuation of cultural heritage to historical monuments.* Cultural heritage has significant meaning for society and represents different values for each person. This is the reason why valuing it causes so many difficulties. There are not many publications on the subject, which is probably because of the many methodological problems. These include a lack of data and the limited nature, in the sense that they concentrate on specific national policies, of existing case studies. However, the similarity between environmental and cultural goods gives researchers an opportunity to transfer some of the valuation methods applied to the environment to cultural heritage. This paper presents selected valuation techniques and the hypothetical problems associated with applying them using the example of Polish heritage in the form of historical monuments. Though further studies are required, the results delivered by the economic approach may be of merit in the valuation of cultural heritage.

Key words: valuation, cultural heritage, environmental, non-market approaches, historical monuments

INTRODUCTION

Cultural heritage is a key element in the identification of society. It is one of the elements which makes visiting a place unique. Visitors spending their free time expect to see an aspect of history in well-maintained scenery with a cultural pro-

gramme and, if possible, to do so free of charge. The recent financial crisis has changed the economic situation in all EU countries and has forced all sectors to look for alternative ways to achieve sustainable growth [Europe 2020, 2011]. There is a need to see an opportunity in local and traditional investments and to recognise that cultural heritage has been attracting the attention of both visitors and investors for a very long time. Valuing cultural resources can help set priorities and improve the decision-making process in terms of their preservation, restoration and use. Some of the problems related to cultural heritage are also easy to find in the area of environmental amenities. Cultural and environmental goods are both public goods. Holcombe [1997] defined a public good in this way: ‘a public good, as defined by economic theory, is a good that, once produced, can be consumed by an additional consumer at no additional cost. A second characteristic is sometimes added, specifying that consumers cannot be excluded from consuming the public good once it is produced’. This means that environmental sites, such as national parks, have a lot in common with cultural ones, such as the historic monuments visited by tour-

*tel. +4822 593 202 68, e-mail: gosia.soltan@gmail.com

ists. The same set of recreational or educational benefits for visitors is derived from environmental and cultural goods. The visitor receives the value of enjoying a cultural heritage good, which in fact means the largest amount of money that visitor would be willing to pay (WTP) to have that opportunity. The definition of the use value that a person visiting a cultural heritage site receives would be the largest amount of money over and above any existing entry fee that the visitor would be willing to pay to gain access to the site. The sum of all the individual visitors' WTPs gives us the total use value. The maximum WTP to gain access to the site is the definition of the use value [Navrud and Ready, 2002]. The value can be estimated from direct use (e.g. visiting a site), indirect use (e.g. viewing pictures of a site) and passive use (e.g. knowing that the place is a part of history and will be preserved) [Morey and Rossmann, 2002]. Sometimes these values are described as non-use or passive-use values in opposition to active-use ones, where, for example, tourists enjoy the assets of a site by direct consumption [Throsby and Rizzo, 2006].

The environmental issues can be measured in two ways using market based approaches: when we have available data and with non-market based instruments. However, when we study the preferences of visitors to museums [Mazanti, 2001], monuments [Morey et al., 2003] and cultural heritage sites [Tuan and Navrud, 2006], where there are no prices available for non-market cultural goods, it is possible to use prices derived from hypothetical markets. The main aim of this paper is to investigate non-market valuation approaches, including hedonic

pricing, the travel cost, contingent valuation (CV) and the choice experiment (CE) methods in terms of the challenges raised by Polish cultural heritage.

MATERIAL AND METHODS

For the purposes of this paper, the author simplified and stripped down each of the economic approaches mentioned above so that they could be applied successfully (in the author's view) to historical monuments. Knowledge gleaned from the literature on valuation, which is mostly associated with the environment, was compared with the present state of the monuments. Though the research was based on site visits, a parallel effort was nevertheless made to collect data, including archives. The first theoretical or empirical obstacle reached was deemed the reason to reject the chosen method. The questions which were asked and the number of respondents were relative to the chosen method and site capacity (see details in Table 1).

Hedonic pricing

It is well known that some environmental attributes influence house prices. This common rule is used unrestrainedly, for example in hotels, where a nice view is included in the price. We can observe the same tendency with rooms with a view of the historic part of a town rather than of other, workaday buildings. This method makes it possible to see how cultural heritage affects the price of real estate. The drawback is that this method can be applied only when we have relatively extensive market data [Thorsby, 2010].

TABLE 1. Summary of methods with regard to the selected examples of historical monuments

Method	Data-collection method (literature/interview)		(in the pilot research the aim for each monument was to ask 20 random people)			Respondents	Obstacle/problem	Possibility of the application failing while researching the historical monument
Hedonic pricing	Literature/ /maps	Comparison of data, continuous timeline is essential	Grunwald	No need to ask respondents			Lack of data/interrupted timeline	Westerplatte
			Raclawice					
			Westerplatte					
TCM	Direct interviews	Question to visitors: <i>What is the main purpose of your trip?</i>	Grunwald	18 ppl – visiting Grunwald 2 ppl – Grunwald was on their route			Big and attractive city as a main pur- pose of the trip; absence of visitors	Westerplatte (Raclawice causes a problem, which is the absence of visitors)
			Raclawice	No respondents on the site				
			Westerplatte	4 ppl – visiting Westerplatte 14 ppl – visiting Gdańsk and, by the way, Westerplatte (in close vicinity)				
				2 ppl – taking a boat trip (the place was not important)				
CVM	Direct interviews	A hypothetical scenario with the presence or absence of the cultural programme (CP)	Grunwald	17 ppl – presence of the CP 3 ppl – absence of the CP (main activity was taking a walk)			Absence of visitors	Raclawice
			Raclawice	No respondents on the site				
			Westerplatte	14 ppl – presence of the CP 6 ppl – absence of the CP (having historical knowledge of the place)				
				Under research				
CE	Direct or indirect interviews	Indirect interviews (via e-mail), chosen group of respon- dents received a questionnaire with visualizations	Grunwald				Not identified	Not recognized, still under research
			Raclawice					
			Westerplatte					

The travel cost method (TCM)

The travel cost method was developed to compare the value of market activities with the value of outdoor recreation. A participant who chooses to visit a site must incur the cost of travel. Choice of site is based on the idea that on a particular occasion a forward thinking visitor will consider all aspects of the candidate sites, including the total cost of reaching each of them and the entry fee. The visitor will then choose the one which has the best attributes and price. There now follow examples of the challenges faced in applied studies using TCM. Often we are observing many possible destinations, none of which will be visited by the potential visitors in a given year. A frequent solution to simplify the interviewing is to group visitors geographically according to their home address and to rate visits from a region or zone of origin (the zonal travel cost model). Further challenges arise when we try to measure the proper costs of trips. A round trip should include the direct costs of the journey as well as the cost of the time spent travelling. This is because the visitor could use the time for an income-generating activity. Travel to and from the site is costly both because of the direct costs of the journey and also because the time spent travelling could be used for another utility-generating or income-generating activity [Navrud and Ready, 2002]. On each occasion, the individual potential visitor calculates the utility from each site and chooses the one site that promises the highest utility on that occasion.

The contingent valuation method (CVM)

The CVM uses a survey to determine individuals' willingness to pay (WTP) for hypothetical changes to a good or service. The respondents are asked to imagine a situation and not the real decisions to be made in relation to it. In the random application the respondent must choose between two unreal situations, one of which will provide them with higher monetary wealth but a lower level of cultural goods. The role of the interviewer is to discover how the respondent would value the good bearing in mind their hypothetical behaviour. It is important to fully describe the cultural good to the respondent before asking them to decide between the two presented actions. There is a balance to be struck here between overloading the interview with details and giving only scant information. The quality of cultural heritage includes its visual aspects. For this reason it is useful to show the respondent photographs simulating the hypothetical situation. Giving respondents a choice of two answers (dichotomous method) is a fruitful approach as it is easier for them to choose between two prices than suggest their own. Unfortunately, the answers provide limited information about the respondent's WTP for the good in question.

Choice experiment

The typical CE survey provides a hypothetical situation in which people express their preferences by choosing the most suitable of the non-existent variants. The respondents are shown alternative options for one object, place or

good described by a set of selected attributes. The levels taken by two or more of the attributes differ from the versions shown [Longo, 2007]. The design of the questionnaire can be based on quantitative attributes, such as visitors per day or entrance fee, nevertheless most researchers use qualitative attributes such as the availability of incentives, services or cultural features. An example would be the presence or absence of guided tours [Longo, 2007] or a mixture of these features [Apostolakis and Jaffry, 2005]. The levels of the attributes should be reasonable and first of all realistic. Otherwise, the questionnaire would be rejected or the answers provided would not show true choices. When valuing cultural heritage we are dealing with aesthetic values which are best “described” by visualizations, which is the form that is most easily interpreted and understood by respondents.

Results and discussion

An example of cultural heritage is a historical monument, which is defined as an immovable monument of special importance to the culture of our country. The rank of historical monument is established by special regulation of the President of Poland¹. In this paper the author has attempted to make a hypothetical choice of techniques applied to the environment to identify the possibilities for their use in evaluating a particular kind of cultural heritage: the historical monument.

Hedonic pricing is used when data is available. A good example is the research

done by Moorehouse and Smith [1994], who studied the influence of changes in architectural styles on the prices of a row of houses from the nineteenth century. It is unrealistic to collect data on real estate in Poland due to its historical and political situation over the last twenty years. The problem is especially visible with places and objects which continue to remind people of sensitive issues so that each anniversary reawakens latent regrets or dissatisfactions. This mostly happens where the rancour is still fresh, such as with regard to WW II during the research conducted on Westerplatte. Though a long time has now passed, most of the information is hidden in archives, lost or unpublished.

TCM is realistic for places which attract a lot of visitors. It is easy to question them about why they have chosen one cultural attraction over another, about the distance they have travelled and about the cost of their trip. In these cases people have made a special effort to get to a cultural site and have devoted their free time and money to making the round trip. Researchers should choose historical monuments that are outside the city, such as the site of the battle of Grunwald² (Fig. 1) or Westerplatte³

²Grunwald: battlefield monument of history by the Regulation of the President of the Republic of Poland of 17.09.2010. This is where, on 10 July 1410, a combined army of Poles, Lithuanians, Russians and Tatars defeated the Teutonic Order, thus beginning its decline.

³Westerplatte: the battlefield on the Westerplatte, which is a historical monument by the Regulation of the President of the Republic of Poland of 22.08.2003. It is close to Gdańsk. On 1 September 1939 at 04.47 in the direction of the Military Transit Depot (at Westerplatte) the first volley was fired by the German battleship Schleswig-

¹National Heritage Board of Poland website: www.nid.gov.pl.



FIGURE 1. Panoramic view of Grunwald (photo by M. Soltan, 2011)



FIGURE 2. Panoramic view of Westerplatte (photo by M. Soltan, 2011)

(Fig. 2), as it is easier to visit tourist attractions within walking distance or that can be reached easily on public transport. At first glance this method would appear applicable at least to the site of the battle of Grunwald, but a problem arises concerning the question of the purpose of visitors' trips. Most visitors (nine out of ten of those asked during the author's site visit) had decided to visit Westerplatte

because it was in the vicinity of Gdańsk, which was their main destination.

Taking CVM into consideration we are able to design a scenario in which, for example, we ask visitors to estimate their willingness to pay for new hypothetical amenities. For Westerplatte this method will give hypothetical results. The researcher can choose the additional amenities, such as an interactive museum or a cultural programme, devise a visualisation for the chosen scenario and ask visitors about their preferences dur-

-Holstein. This was the act which began World War II. This historical monument commemorates the heroic defence put up by the Polish soldiers.



FIGURE 3. Raclawice: a panoramic view of the battlefield (photo by M. Soltan, 2011)

ing site visits. During the author's out-of-season, January visit to Westerplatte the author found a variety of respondents (families, school trips, weekend visitors), while in summer the historical site attracts more people (based on an interview with a man from the marina, who normally works on the Gdańsk Długie Pobrzeże to Westerplatte boat). Visitors can choose between the scenarios shown. At this stage of the research no obstacle was identified. The author then chose Raclawice⁴ (Fig. 3). In this case there was a problem at the site because there was no one there and therefore no opportunity to distribute and complete questionnaires. We are not able to obtain complete information from behaviour on how public goods are consumed as it is

always based on the observation of behaviour linked with public asset services and goods [Herriges and Kling, 1999].

The third of the methods presented, choice experiment (CE), may offer a way to measure the value of historical monuments. Society values cultural resources for a variety of aesthetic, cultural and historical reasons. If they look at realistic visualizations with different attributes, it is possible for the chosen respondents to reveal their real preferences without site visits. If we apply this method we can obtain information about the preferred development options for the site and its vicinity. Economic analyses are not sufficient when valuing cultural heritage, which means that the researcher must combine economic values with cultural ones. However, cultural benefits are very difficult to measure. One of the suggestions made by Throsby [2010] is to include elements such as the aesthetic (beauty, harmony), spiritual (understanding, enlightenment, insight), social (connection with others, a sense of identity), historical (connection with the past), symbolic (objects or sites as repositories or conveyors of meaning) and the quality of authenticity (integrity, uniqueness)

⁴Raclawice: the battlefield of Raclawice (a historical monument by the Regulation of the President of the Republic of Poland of 14.04.2004). Here, a Polish army under the command of Tadeusz Kościuszko defeated a Russian army under the command of Major General Alexander Tormasow. The battle took place on 4 April 1794 in the village of Raclawice, which is now in the province of Małopolska. The victory of the Polish army, despite the very great importance of the military, raised the morale of the insurgents.

in methods for assessing cultural value. We can see from this cultural approach how extensive the range of analytical perspectives on valuing cultural heritage can be. Nevertheless, economic analyses can still offer insights into cultural heritage even if they do not capture all of its very diverse elements [Throsby and Rizzo, 2006].

CONCLUSIONS

Far fewer cultural heritage valuation studies than those concerning environmental research have so far been conducted. This is largely because cultural services are harder to analyse and describe. Studying historical monuments may also reawaken sensitive issues, which then raises questions about the data's credibility, including those concerning the quantity of materials and interruptions in the data's timeline. Nevertheless, a number of studies have been made and they have clearly shown that non-market valuation methods might be successfully applied to cultural heritage attractions of local, national and global significance – even when there are different functions and multiple functions (the Augustowski Canal, for example, has two functions: tourism and sailing). Further studies should also focus on neighbouring areas, as relatively little is yet known about how the value of cultural resources may be affected by changes in the immediate vicinity. Even though it requires further work and refinements to existing methodology, the economic approach to valuing cultural heritage remains a potentially useful and valuable one.

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Streszczenie: *Waloryzacja dziedzictwa kulturowego: poszukując możliwości zastosowania hipotetycznego w odniesieniu do pomników historii – wybrane podejścia metodologiczne.* Dziedzictwo kulturowe ma istotne znaczenie dla społeczeństwa, a także przedstawia różną wartość dla każdego człowieka z osobna. To jeden z powodów, dla których wycena dziedzictwa kulturowego przysparza tak wiele trudności. Publikacje z tego zakresu nie są liczne, prawdopodobnie z powodu trudności metodologicznych: niewielu opracowań, braku danych, ograniczeń case study wynikających ze specyfiki polityki krajowej. Jednak podobieństwo dóbr środowiskowych i kulturowych stwarza możliwość przeniesienia wybranych metod wyceny środowiska naturalnego na grunt dziedzictwa kulturowego. W publikacji przedstawiono wybrane techniki wyceny i związane z ich hipotetycznym zastosowaniem obszary problemowe, na przykładzie pomników historii. Nasuwa się wniosek, że konieczne jest prowadzenie dalszych badań w tym zakresie, niemniej jednak podejście ekonomiczne może mieć wartość dodaną dla procesu wyceny dziedzictwa kulturowego.

Landscape thinking: the identification and preservation of landscape character in rural spatial planning

ELŻBIETA RASZEJA*

Department of Landscape Architecture, Poznań University of Life Sciences

Abstract: *Landscape thinking: the identification and preservation of landscape character in rural spatial planning.* Landscape thinking means a new approach to research and practice based on the assumption that landscape should be recognized as an asset that integrates the contemporary development of rural areas. Most recently, a significant change has come into landscape research methodology and into the planning concept of preservation policy. What is proposed is the abandonment of simple preservation based on sectors in favour of systematic landscape management, which involves managing both resources and processes of change in spatial planning and management. The previously dominant preservation activities, which were a response to unfavourable spatial and landscape phenomena, are now being replaced by plans and strategies for managing rural areas based on the recognition of landscape character. The role of landscape is changing. Where once it was simply a subject of preservation it is now the locus of interdisciplinary spatial planning integration and combines a variety of research perspectives. In practice, this means applying coherent and transparent methods of landscape identification and assessment – especially in the context of their connection with spatial planning and its usefulness for rural area development. This article presents selected methods for landscape identification and assessment that are currently applied in European countries and the methods devised and promoted by the European Council for the Village and Small Town (ECOVAST). The aim of the paper is also to show the meaning of landscape thinking at various levels of the planning and management of rural space. The author presents the results of her own projects carried out in the Wielkopolska region and shares her experience of

cooperation with institutions, local government and local communities in research and design work.

Key words: spatial planning, landscape management, rural areas, landscape character, Wielkopolska

INTRODUCTION

The rural landscape is now undergoing profound transformations, which are characterised first of all by the disappearance of regional and local diversity, increased homogeneity of spatial structures, the disruption of cultural continuity and the disturbance of ecological stability. The character of rural areas is changing. From being a space for agricultural production they are being transformed into a multifunctional space of consumption, in which an increasingly important role is being played by recreation, tourism, housing and the non-productive use of natural resources. Meanwhile, agriculture is in decline, both in its functional and land-use aspects [Cloke et al., 2006; Mather et al., 2006]. This has significant impact on the structure, form and content of the contemporary rural landscape. In recent years the historical structures of the landscape, which in rural areas had exhibited exhibited high persistence and

*tel. +4861 848 79 61, e-mail: ktzera@up.poznan.pl

stability, have been deformed, and the symbolism of the landscape, which has for ages influenced the meaning of life for the rural population, is becoming completely incomprehensible to its contemporary users and consumers.

The threats to the cultural landscape from contemporary development processes mean that a reassessment of the preservation methods and instruments is needed. For this reason the identification and interpretation of landscape is a particularly important task for landscape architects. It is connected with specific requirements concerning professional expertise as well as with the need to conduct intellectual and methodological investigations. A reference point for this is provided by the common European landscape policy, as presented in the European Landscape Convention, as well as by the new ideas about landscape generated by contemporary research [Olwig, 2007]. The following tendencies may be distinguished in this respect:

- Focus on the identification of the character and uniqueness of the landscape and on its regional and local diversification;
- Multifaceted, holistic and interdisciplinary approaches;
- The incorporation of non-academic entities, including local communities, into research programmes;
- Application of research in landscape planning and management.

Landscape thinking refers to a novel approach to research and practice based on the assumption that landscape should be considered as an asset that integrates the contemporary development of rural areas. Such an approach leads to changes in the methodology of landscape studies,

in planning concepts and in preservation policy [Antrop 2005a; Tress et al., 2007]. What is proposed is the abandonment of simple preservation based on sectors in favour of systematic landscape management, which involves managing both resources and processes of change in spatial planning and management [Klijn, 2004; Selman, 2006]. From the point of view of planning practice, it is essential to assess the character, dynamics, persistence and resistance to change of the landscape. The focus here is on the identification of the specific character of areas and their distinguishing characteristics, as well as on determining the integrity and cohesion of the landscape, including its consistency with its ecological structure and cultural content.

It was in this context that Robert Melnick [1985] used the term “landscape thinking”, stressing that landscape is dynamic in character and that the analysis of the processes occurring in it makes it possible not only to understand it better, but also to establish more effective methods and tools to preserve and protect it. A major problem in landscape architecture connected with the management of rural areas is to preserve the sense of cultural identity and the specific character of a landscape. The protection, planning and management of landscape should be based on an in-depth identification of its nature and specific character. This requires not only the identification of landscape forms and types, but also an understanding of the processes that have led to its present structure, an appreciation of current changes and an idea of prospects for the future [Muir, 2000; Claval, 2005; Palang et al., 2005].

It is essential in landscape management to establish a manner and mode of making spatial decisions that is responsive to changes in social conditions, needs and objectives. Decision making is a continuous and conscious process – determined by the level of management and the time perspective – that involves choosing the means to be employed from a number of alternatives. The basic types of decisions in the landscape management process include: immediate reactions (control and supervision, administrative measures), functional decisions (regulations, local planning), integrating decisions (regional plans and strategies, protection plans) and proactive decisions that are oriented to long-term effects and to reaching higher goals that combine a number of values into a development policy [Klijn, 2004].

Landscape thinking does not only refer to individuals engaged in research, planning procedures or the decision-making process. It should also include inhabitants and users of landscapes [Jones, 2007]. The protection of landscape, as well as the planning and management of its resources, needs to incorporate its social perception. There is a great diversity of opinion on landscape among different groups of users. This is connected with a variety of evaluations and expectations concerning landscape. When comparing the results of studies conducted among different social groups, it may be stated that the predominant opinions they express depend on their lifestyles and manner of landscape use [Buijs et al., 2006; Lowenthal, 2007].

All activities in space will have specific consequences for a landscape. They therefore have to be constantly control-

led to eliminate or temper increasing conflicts and threats. Spatial planning, which aims to achieve spatial order and the harmonisation of actions in all areas of life, can be a way to do this. The major tool now used in Poland to modify space is the spatial management plan (also referred to as a local plan), which is the basis for land management. This instrument is augmented by the issuing of general permitted development orders and of variation notices to these development orders. Apart from coordinating and regulating activity, the primary function of spatial planning is to predict its consequences and, first of all, to set priorities and supply inspiration in space modification. In practice, spatial planning frequently becomes an arena for a fight over a landscape.

Poland ratified the European Landscape Convention in 2004 and has therefore declared a commitment to implementing its resolutions. The issue of cultural heritage protection in rural areas is the subject of ever more frequent discussion in Poland. There remains, however, a marked discrepancy between the level of knowledge, professional skills and political declarations and the actual state of the space that surrounds us. Its major cause is the ineffectiveness of the Polish spatial planning system and its tools for landscape protection [Böhm, 2008; Raszeja, 2002 and 2008]. Moreover, the lack of harmony between landscape identification and evaluation methods and planning is evident in that there is no transfer of the results of landscape studies to space management. We also need to focus on the low level of landscape awareness on the part of the general public and the still limited par-

ticipation of inhabitants in landscape protection.

The aim of this paper is to investigate the meaning of landscape thinking based on studies of landscape and to assess the degree to which current planning practice and space management in rural areas should incorporate its assumptions. While it refers to the Polish case in the first instance and is based on examples from Wielkopolska, the paper also accords with current world research trends and European landscape policy. The subject discussed in the paper is highly complex and multifaceted. Due to its limited size the study is presented in a synthetic form. The author analyses the question of landscape thinking in relation to different scales, time frames and levels of activity. This encompasses the establishment of spatial policy and long-term development strategies at the regional level, local rural development planning and the protection and management of individual sites. Some aspects are discussed in detail while others are indicated as issues requiring in-depth studies.

SCOPE AND METHODS

These investigations were based on contemporary research trends and landscape protection policy in accordance with the assumptions of the European Landscape Convention and consistent with the concept of landscape thinking. The paper first presents selected European methods of landscape identification and assessment. The criterion adopted to select them was their suitability for rural spatial planning and landscape management, for the incorporation of social per-

ceptions of landscape and for application in the preservation process. These methods were used in the studies conducted by the author that are presented here.

The paper then proceeds to analyse three research projects conducted in Wielkopolska by a team from the Department of Landscape Architecture at the Poznań University of Life Sciences led by the author. Based on these projects diverse methods of landscape identification were tested (structuring, stratification, process analysis, visual analyses and SWOT). The first of these, Rural Landscape and Cultural Heritage in the Poznań Agglomeration, is part of an interdisciplinary research programme known as Operation and Development Directions for the Poznań Agglomeration which was conducted in 2009–2010. The aim of the studies was to identify development problems and potential in the Poznań agglomeration and to develop a strategy to increase cohesion and competitiveness. The analyses were conducted in twenty community council areas in Poznań's suburban zone. The other research project, Assessment of Landscape Resources and Cultural Heritage in Terms of their Potential Use in the Rogalin Development Strategy, was carried out in 2010. The studies aimed to identify types and historical forms of landscape structure, as well as to determine the degree of transformation or preservation of the characteristics typical of a given area. Apart from the purely scholarly objectives, application objectives were formulated for the purpose of spatial planning. This involved specifying the elements and characteristics that make up the spatial identity, cultural identity and image of the countryside,

identifying the components and forms to be preserved or reconstructed and creating a strategy for landscape protection and planning. The development plan for the village of Rogalin was formulated based on the results of the studies. The final example presents spatial management as practiced in villages using the available legal instruments and planning tools and with the participation of the local community. It sets out the practical methods of operation that formed part of the response to the threat to landscape values in the village of Tomice in the Wielkopolski National Park.

These three research projects were selected so that they could be used to identify the elements significant for various spatial scales, time frames and planning levels (regional strategic planning, local development planning, site planning). These include:

- Selection of landscape identification and evaluation methods;
- Application of diverse landscape protection measures and spatial planning instruments;
- The scope and forms of social participation.

The identification and assessment of landscape as the basis for spatial planning

One of the major problems investigated in contemporary landscape studies is connected with the adaptation of its methods to the requirements of spatial planning practice. In this context a particularly important role is played by the identification and legible recording of landscape characteristics, the appropriate selection of assessment criteria and

the applicability of research results in space management. There are a number of questions that arise in the wake of devising these methods. They include the delimitation of landscape units, obtaining an explicit and clear record of a landscape's character, the selection of landscape assessment criteria and the applicability of research results to the field of spatial management.

Various methods are applied in the identification and assessment of landscape in European countries. They stem from different research traditions and diverse concepts of landscape. In some of these methods ecological aspects predominate, while in others the focus is on the visual or historical and cultural elements [Scazzosi, 2002]. Studies based on semiotic theories assuming that landscape may be compared with text, which locate the primary research problem in the understanding of the landscape's contents and the meaning-making relationships between its specific features [Claval, 2005], should also be mentioned here. The skill of reading the cultural landscape based on appropriate interpretation is conducive to understanding its content and genesis [Antrop, 2005b; Lewis, 1979; Spirn, 1998; Muir, 2000].

In some countries methods of identification and assessment of landscape have been developed and established that are strongly integrated with spatial planning. Here, the British method of Landscape Character Assessment (LCA), which is a continuation and modification of a programme of studies covering the entire country that has been in constant development and improvement since the 1970s [Jensen, 2005], should be mentioned. The character of

a landscape is defined as the distinct and identifiable pattern of elements found in its individual types. Assessments formulated based on characteristics influence the decision-making process for spatial decisions, such as land use and management, afforestation or housing development [Countryside Agency, Scottish Natural Heritage, 2002]. Methods of landscape identification and evaluation based on the isolation of homogenous spatial units using specified criteria are also applied in other European countries, such as France, Germany, Italy, Norway, the Netherlands and Sweden [Wascher, 2004; Brunetta and Voghera, 2008].

The spatial planning of rural areas may apply the Polish JARK (Jednostki Architektoniczno-Krajobrazowe; Architectural and Landscape Units) method devised by Janusz Bogdanowski [1976]. A landscape unit is an area of specific identity and a specific set of features, which unambiguously distinguish it from its surroundings. The distinguishing features include relief, vegetation cover and land use forms, as well as the history of the location. A description, valuation and guidelines for the modification and protection of a landscape are prepared for individual units and their complexes.

The pre-condition for sustainable landscape management is to understand the landscape's past. Such a role is played by the English Heritage studies of Historic Landscape Character (HLC). The objective of HLC studies is to characterise and interpret the historical dimension of landscape over a given area. These are first of all explanatory studies: their essence lies in interpreting the landscape not in surveying its historical resources, and in embracing the entire landscape

rather than individual locations. The results are used in spatial planning, landscape management, the protection of cultural heritage and agricultural policy. Thus the result has to be clear, comprehensible, applicable and integrated with other methods [Clark et al., 2004].

A particularly useful method in assessing the dynamics of rural landscape may be the CQC (Countryside Quality Counts) method. It was created to identify, describe and understand the direction, intensity and spatial distribution of changes. The results of the studies are presented as a bi-axial matrix. The vertical axis records the dynamics (intensity, degree) of changes and serves to specify the areas to be defined as stable or changeable. The horizontal axis indicates the direction of changes, which facilitates classification in terms of whether they are consistent with the features identified as distinguishing specific areas. Four categories of areas are distinguished: maintained, enhancing, neglected and diverging [Haines-Young, 2007].

Most methods of landscape identification and assessment require specialist knowledge and professional expertise. A distinctly different approach in this sense is the method developed and popularised by ECOVAST (European Council for the Village and Small Town). Its distinguishing feature is that it may be applied by non-professionals. It is based on an assumption that the perception of landscape is common and unlimited. In this way each user of the landscape may identify it and apply their sensitivity through "looking, thinking and feeling". The diagnostic device is a simple matrix for landscape identification – whose

rows describe individual components, such as layers of landscape, and whose columns describe the clarity and power of impact of the components. The landscape observations, which are preceded by studies of the literature, are conducted on site by inhabitants, while the conclusions from their studies are presented to local authorities as potential guidelines for action to be taken to benefit the landscape [ECOVAST, 2004].

RESULTS AND DISCUSSION

Landscape thinking in strategic planning

An integrated approach was applied to the research conducted for the Rural Landscape and Cultural Heritage in the Poznań Agglomeration project. The preservation of valuable landscape forms and resources is essential for the development of the Poznań agglomeration – both in terms of its cohesion and com-

petitiveness. For inhabitants, identifying with the spatial dimensions may bolster their cultural identity and so constitute a solid foundation for their social and economic integration. The specific and exceptional character of the rural historical and cultural space should be considered part of the agglomeration's development potential.

The Poznań agglomeration is a diverse area both in terms of landscape forms and in terms of the rate and directions of changes occurring in the landscape (Fig. 1). There have been disadvantageous transformations in most of the rural areas of the agglomeration, although their scale and intensity vary. Urban pressure on rural areas and the related suburbanization and counter urbanization pose a threat to spatial and landscape structures. This leads to the destruction of historical settlement systems and to deformation of the historical layout of villages (Fig. 2). The inclusion of the following research tasks was considered essential



FIGURE 1. The preserved character of the rural landscape in the Poznań agglomeration (photo by A. Kijowski)



FIGURE 2. Deformation of the historical structures of a rural landscape by contemporary housing development in the suburban zone of Poznań (photo by A. Kijowski)

to the creation of the landscape policy for the Poznań agglomeration: identification of the landscape's character in different areas, describing the spatial landscape phenomena and processes and zoning the agglomeration according to the degree of landscape transformation. The analyses were conducted using methods based on LCA and CQC. Important conclusions were also drawn from the study of the existing system of landscape planning and management in the community councils of the Poznań agglomeration, as well as from an analysis of the landscape awareness of local government officials (a questionnaire survey was conducted as part of this study). A SWOT analysis was a further significant element in the study. It indicated opportunities and threats for rural landscapes, as well as their strong and weak points in terms of spatial planning and management. The landscapes were analysed in view of perceived phenomena and current directions in the development of the Poznań

agglomeration and, in a broader sense, in terms of general development trends (political, economic, social). A list of strategic tasks for landscape protection and management was formulated based on multifaceted studies [Raszeja et al., 2010]. Local government bodies were consulted on the development strategy for the agglomeration and the landscape policy, which were discussed within the framework of extensive social consultations, including on an Internet forum. The project also involved offering training to employees of community council offices (the Agglomeration Academy) and the publication of educational literature, which also served to disseminate information.

The project presented here is an example of landscape-oriented thinking at the strategic level. On the one hand, the incorporation of landscape problems into the interdisciplinary project made it possible to present these issues within a broad research context, while on the

other, a real opportunity was offered to implement a landscape policy developed as an integral part of the comprehensive programme of strategic development for the agglomeration.

Landscape thinking in rural development planning

The protection and management of landscape at the level of local development planning should be based on a thorough recognition of its character and uniqueness. This requires not only the identification of landscape forms and types, but also an understanding of the processes that have led to the establishment of its present structure. Apart from the identification of spatial units (structuration) it is also necessary to analyse the historical transformations and layers of landscape (stratigraphy). A method of landscape analysis was developed within the framework of the studies conducted in

Rogalin that took into consideration the two aspects mentioned above: the spatial and the temporal [Raszeja and Gałecka, 2011a].

The spatial structure of the landscape in Rogalin is composed of many elements, whose interrelations are responsible for its unique character. Attention was focused on the arrangement of the green forms, including the avenue systems, roadside tree plantings, the landscaping of the parks, the domestic gardens and the natural greenery (such as the riparian complexes along the Warta River), the forest complexes and the in-field green enclaves (Fig. 3). The manner of spatial organisation of the agricultural production areas was also analysed, that is, the size and division of the fields. The studies of settlement and architectural forms focused on the housing development layouts, the types of homesteads, the proportions and shapes of structures,



FIGURE 3. Mid-field tree lane in Rogalin – a characteristic element of the agricultural landscape on the former landed estate (photo by E. Raszeja)

the materials and the architectural details. A method was developed for the analysis of landscape as part of the studies conducted in Rogalin, which involved determining and describing landscape units to illustrate the variation in spatial forms. The starting points for this were the JARK landscape units method [Bogdanowski, 1976] and the British LCA method. Each unit was elaborated on a separate landscape chart with a fixed configuration. This arrangement makes it possible to compare the specific character of individual units by listing the elements that make up a given spatial form and to determine its landscape value and sensitivity in view of planned investments. The second aspect of the studies concerned the interpretation of existing landscape forms through an explanation of their origins and of their transformations over the years. The key study for the understanding of the genesis of a landscape is to conduct a semiological interpretation,

which makes it possible to explain the origins and roles of its individual elements and forms [Spirn, 1998; Muir, 2000]. A properly defined specific character facilitates the development of landscape guidelines and proposed actions aimed at improving, protecting, maintaining or changing a landscape's character. It is very important to preserve the specific character of landscape in individual units and to emphasize the signs and symbols of the historical and cultural space so that they are easily recognizable and useful as an important element in the promotion of the village. One of the key challenges was to locate the contemporary functional content for historical objects by adaptation, renovation or renewal (Fig. 4). An important aspect of the project was to enlist the engagement of the local community and to involve it in the research (data collection) and in the design process (questionnaires, consultations, discussions). The rural inhabitants were in-



FIGURE 4. A derelict sheepfold on the former manor estate – a characteristic element of the historical landscape of Rogalin. There is a proposal to convert this building into a tourist facility (photo by M. Jaroszevska)

involved in landscape studies, participated in field studies and provided their own archive materials (see the ECOVAST method). Social participation in the next stage of the project took the form of consultations, discussions and negotiations. During meetings inhabitants formulated their proposals and wishes concerning the directions of village development, as well as conclusions and remarks on design solutions proposed by the team of authors [Raszeja and Gałęcka, 2011b].

Landscape thinking and intervention

Spatial planning frequently becomes a site for struggle and conflict over a landscape. This was the case in Tomice, which is in the Stęszew community council and is also in the area of the Wielkopolski National Park. An investor expressed interest in village land situated at Lake Tomickie with the aim of obtaining a development permit for residential development in a zone with special landscape value. The planned investment would, apart from leading to the visual degradation of open landscape and the destruction of the historical spatial structure, threaten the stability of the area's ecological and hydrological systems. This would also have negative social consequences in the form of reducing residents' access to areas traditionally used for recreation. At the request of a group of villagers the local government prepared a spatial management plan prohibiting the development due to the threats mentioned above. Unfortunately, the plan was not approved at the provincial level due to alleged legal flaws (the remarks were only formal in character, and not connected with the specific issue). This convinced the resi-

dents interested in the protection of the local landscape to seek the support of experts. For the needs of the local spatial development plan and in order to justify the decision on the building development plan, multifaceted landscape studies were conducted, which included site analyses (scenic value, functional analysis, analysis of availability and social needs, analysis of natural and social conditions) and an evaluation of the way the area functions in broader natural, landscape, cultural and social contexts. The commitment and persistence of village residents, the landscape awareness of the local authorities and the support of professionals (the author prepared an expert opinion on the landscape) meant that the development ban was maintained. It is not an easy matter to prevent or respond to landscape degradation, but there are a range of different methods and tools available to assist in doing so.

CONCLUSIONS

As is indicated by the examples presented in this paper landscape thinking has its own specific dimension and character at various levels of planning and management. The research objective was to compare three different aspects: methods of landscape identification and evaluation, landscape protection tools and spatial planning instruments, and the scope and forms of social participation. The following conclusions may be formulated based on the investigations:

1. The selection of methods for landscape identification and evaluation depends on the spatial scale and planning level. At the strategic level

on a regional scale it is important to indicate the character and diversification of landscape in different areas, as well as the present extent of, and potential future directions for, its transformation. With regard to local development planning at the village (community council) level, landscape studies focus on identifying its specific character, recreating the historical process by which the landscape was established and determining the degree of transformation or preservation of its typical features. It is essential to indicate the elements and forms that create the spatial identity, cultural identity and image of the village as these may be helpful in its development. At the level of protection (intervention) the actions to be taken are determined by the specific character of the site and the character of the planned transformations. These usually concentrate on indications of potential threats to the character and identity of the landscape, to the cohesion of the spatial composition and to the visual dimension. The analyses may therefore be summarised as investigating the scenic, functional, natural, cultural and social aspects.

2. The level, scale and time frame of planning and management also determine the application of specific planning tools and landscape protection measures. At the regional level (metropolitan area, conurbation, agglomeration) long-term strategic planning predominates and the landscape policy is shaped in tandem with other facets of a region's development policy. The actions taken are designed to secure long-term effects and more

ambitious goals in the form of sustainable development, spatial order, ecological stability, rural renewal, and the reconstruction of cultural and landscape identity. Programmes and plans for village development, as well as local spatial development plans, are put into effect within a shorter time perspective at the local level. Landscape management is carried on by decisions of a more functional and prosaic nature that regulate the manner and form of land use. The role of the local plans is to protect the specific character of the landscape, to determine a way of management consistent with the character (form and content) of the landscape and to use its resources appropriately. Intervention at specific sites typically involves immediate reactions meant to have a direct effect, such as preventing a particular threat to a landscape. This may involve institutional supervision or social control using measures such as administrative action and legal instruments.

3. Social participation takes different forms and varies in scope at specific levels of landscape planning and management, which was seen in the examples analysed. The most intense and direct social involvement was clearly seen in the interventions, though this did not involve or engage all residents. At the local planning level social participation took the form of consulting, formulating expectations, reaching conclusions and presenting opinions regarding proposals. Again, this did not engage or involve all of the village's residents. For its part, the strategic planning involved more ex-

tensive forms of social consultation, such as questionnaires, an Internet forum and meetings. Experience suggested that social participation would be weak at this level. This proved to be true because the actions and interactions of local government bodies were predominant at this level.

Landscape thinking is a proposal for a new approach to the planning and management of rural areas. Landscape is dynamic and changeable. To manage it effectively means forecasting, monitoring and controlling these changes in a manner that will not disturb significant features of landscape, that will take account of justified social needs and that will have recourse to a wide range of methods and tools.

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Streszczenie: „*Myślenie krajobrazowe*” – identyfikacja i zachowanie cech krajobrazu w planowaniu przestrzennym obszarów wiejskich. „*Myślenie krajobrazowe*” oznacza nowe podejście badawcze i praktyczne, oparte na założeniu, że krajobraz powinien zostać uznany za wartość integrującą współczesny rozwój obszarów wiejskich. W ostatnich latach nastąpiła wyraźna zmiana zarówno w zakresie metodologii badań krajobrazu, jak też koncepcji planistycznych i polityki ochronnej. Postulowane jest odejście od prostego protekcjonizmu, opartego na ujęciu sektorowym na rzecz systemowego zarządzania krajobrazem, przy czym oznacza to nie tylko zarządzanie zasobami, ale też procesami zmian w ramach planowania i gospodarki przestrzennej. Działania konserwatorskie oraz działania interwencyjne, mające charakter reakcji na niekorzystne zjawiska przestrzenno-krajobrazowe, są zastępowane przez plany i strategie zarządzania przestrzenią wiejską, oparte na rozpoznaniu cech krajobrazu. Zmienia się więc rola krajobrazu – z przedmiotu ochrony staje się on ideą integrującą rozwój przestrzenny, płaszczyzną spotkań interdyscyplinarnych.

nych, ogniskującą różne perspektywy badawcze. W praktyce oznacza to konieczność stosowania spójnych i transparentnych metod identyfikacji i oceny krajobrazu, zwłaszcza w kontekście związku tych metod z planowaniem przestrzennym oraz ich przydatności dla rozwoju obszarów wiejskich. Artykuł prezentuje wybrane metody identyfikacji i oceny krajobrazu stosowane obecnie w krajach europejskich, a także metodę opracowaną i promowaną przez Europejski Ruch

Odnowy Wsi – ECOVAST. Celem artykułu jest wskazanie, co oznacza „myślenie krajobrazowe” na różnych poziomach planowania i zarządzania przestrzenią wiejską. Autorka prezentuje wyniki własnych badań i projektów, realizowanych na terenie Wielkopolski. Przedstawia też swoje doświadczenia ze współpracy z instytucjami, samorządami i społecznościami lokalnymi w ramach tych projektów.

Nature and man as stimulators of village development

ZBIGNIEW KURIATA, IRENA NIEDŹWIECKA-FILIPIAK

Wrocław University of Environmental and Life Sciences

Abstract: *Nature and man as stimulators of village development.* The valley of the Oder, near Wrocław, is a very beautiful area with a variety of riverine landscapes where nature and the element of water dominate. This is complemented by the cultural landscape shaped in a clear and transparent manner by man, who has used the best agricultural lands in this region from the beginning of time. The shape of this space is a record of historical events, the rhythm of life and the stewardship of previous generations, which should be respected while also introducing new elements related to satisfying the current needs of users in a way that ensures maximum use. In 2002 the Partnership of the Central Oder Valley, which now links fifteen communities along the river, was established. Due to the specific landscape occurring in this region, the main objective of the association is to protect and regulate existing and potential tourist development. Six towns situated on the Oder water route between Wrocław and Brzeg were included in the cooperation between the University of Environmental and Life Sciences in Wrocław and the Partnership. These are villages attempting to use existing resources and opportunities for their future and for better development. The tasks this entails include the maintenance and restoration of the architectural, aesthetic and emotional values of the selected places. This needs to be accomplished while transforming the surrounding space, maintaining existing values, raising the standard of living and securing the further development of individual towns and villages. The formation of the new landscape, especially where nature dominates, must be preceded by thorough analysis and understanding of the space and by a definition of the limits to compromise between mind and matter. The studies presented include an idea for a network of ecomuseums as a form of active protection for natural and cultural heritage. Where possible the role of the Oder itself was taken into

account when creating new projects for the selected localities.

Key words: rural landscape, spatial development, village, cultural heritage, local society

INTRODUCTION

The valley of the Oder, near Wrocław, is a beautiful area, full of a variety of riverine landscapes where nature and the element of water dominate. It should be noted that the landscape of a river valley consists not only of the trough zones, but also of the entire river basin [Kozieł, 2010]. This is complemented by the cultural landscape shaped in a clear and transparent manner by man, who has used the best agricultural lands in this region from the beginning of time. In this way the Oder Valley area has been shaped and changed over the centuries and a variety of forms of land use can now be distinguished there.

In transforming the surroundings around him man gives to space forms and certain meanings which are based on his ideas of beauty. This may sometimes be the result of fashion or the influence of foreign cultures, or of the needs arising from social or political conditions. The variations in the shaping of space amount to more than just a history of form: they also make up a history of the concepts we have used to read the land-

scape [Gawryszewska and Królikowski, 2004]. Józef Tischner [2004] said ‘... stewardship is an expression of reciprocity, and the fruit of this reciprocity is place’.

The shape of this space is a record of historical events, the rhythm of life and the stewardship of previous generations [Claval, 2005], which should be respected while also introducing new elements that can satisfy the present needs of users in a way that produces maximum use. Contemporary residents of Lower Silesia, staring at what they do not see, must seek links between the past and present [Tischner, 2004]. The continuity of the tradition of Lower Silesia was interrupted in 1945, when, subject to international agreements, population resettlement occurred. It took a good deal of time and generational changes before new relationships between people were forged and before there was acceptance of the nature of this stretch of land, its wealth, diversity and centuries-long tradition.

MATERIAL AND METHODS

In 2002 the Partnership of the Central Oder Valley, which now links fifteen communities along the river, was established. Due to the specific landscape occurring in this region, the main objective of the association is to protect and regulate existing and potential tourist development. Six towns situated on the Oder water route between Wrocław and Brzeg were included in the cooperation between the University of Environmental and Life Sciences in Wrocław and the Partnership: Bielszów, Dziewin, Lubiąż, Malczyce, Przyborów and Wietszyce (Fig. 1).



FIGURE 1. Map of the villages (P. Filipiak)

As rural space has three very important functions (as an economic space, a living space and a relaxation space) it should be developed accordingly. It may be stated at the same time, though, that there is no other space with the qualitative attributes to replace the functions of the village in this respect [Wilczyński, 2003].

Field work was carried out and materials and data were collected by the direct method to properly identify the existing resources of the individual villages. Meanwhile, the analytical-conceptual work was based on data collected in the field and on the available planning, cartography and iconographic materials (indirect method). The procedure and scope of the individual analyses and studies aimed at revealing the specific character of the locality [Niedźwiecka-Filipiak and Kuriata, 2010] was developed based on the experience the authors

gained over almost ten years of working in the Village Renewal Programme. This took place both in the Lower Silesian and Opole Provinces, where the authors wrote studies of development plans for 160 villages.

In the final stage of the work attempts were made to create a new image for the village, which used pre-defined distinguishing features and characteristic elements [Muir 2004; Kuriata, 2005; Niedźwiecka-Filipiak, 2009].

To enable the broadest representation of residents in the work on the plan, the representatives of the university organized village meetings, where the development aims of the locality were discussed. In this way the basic rule of public participation in shaping the image of the village was implemented. The involvement of the entire rural population in working on the plan and in discussions, presentations and considerations of the conclusions made by the interested parties guaranteed that they would take responsibility for implementing its provisions. It was not the intention here for the citizens to replace the authority. However the residents have to support the initiatives when they have taken real forms [Kuriata, 2006]. This process guarantees that space management will be more efficient through the effective social control exercised by those actively involved in the design [Niedźwiecka-Filipiak, 2007].

Results and discussion

The villages lie in an area of the Oder Valley that is a part of the Oder Trail project to protect the Oder wetlands as a valuable natural landscape.

These are villages attempting to use existing resources and opportunities for their future and for better development. The tasks this entails include the maintenance and restoration of the architectural, aesthetic and emotional values of the selected places. This needs to be accomplished while transforming the surrounding space, maintaining existing values, raising the standard of living and securing the further development of individual towns and villages. The formation of the new landscape, especially where nature dominates, must be preceded by thorough analysis and understanding of the space and by a definition of the limits to compromise between mind and matter. The examples presented here indicate the possibilities inherent in the elements of the characteristic localities. The distinguishing feature in most of them, which became the inspiration for themed museums

Bieliszów: the “museum without walls” forest settlement

This is a picturesque village situated amidst the forests that extend over the Oder River terraces and the Barycz River. This area is densely wooded and of a fairly uniform altitude. It is a small village, which now has only twenty five parcels of land that are developed in various ways. Its greatest assets are its size and the unique landscape. Its location in a large glade, where the horizon is closed on either side of a wall of trees, lends the place a striking and mysterious mood, which is what prompted the idea to establish the “museum without walls” in Bielizów, whose nature, culture and history will be presented directly at their source.

The area has recreational and holiday facilities, such as a campsite and parking near to the forest. An additional advantage is the proximity of the Oder River, which makes the connection with the Oder River Trail and its bicycle paths and kayak runs.

Dziewin: the ecomuseum of fine arts and the “Dziewin: Kazimierz Dolny of the Oder” artistic creation

Dziewin lies in the valley of the Oder River on the flood terrace, which means that there are many variations in relief throughout the locality. The village stretches along the road toward the former Oder crossing, which was important for the region. The highest part of Dziewin is the centre, where the gothic church, the manorial-park complex (with the greatest renaissance court in Lower Silesia) and the housing development are (Fig. 2). The village is part of the Natura 2000 area and has considerable habitat diversity and oxbow lakes, as well as interesting topographical features due to the relief of the land [Studium ..., 2010].

The idea to establish an ecomuseum of fine arts and artistic creativity (Fig. 2) was prompted by Dziewin’s attractive village location, the preserved spatial layout and building development, the ways of work and life of the people that live there and its natural landscape attributes. The need to protect precious natural and cultural resources that are unique in Europe, to give them proper prominence and make them available for residents and tourists led to the proposal to preserve and emphasize the natural relief of the land. This is one of the village’s greatest assets and one that will be



FIGURE 2. Sculpture near the church in Dziewin (photo by I. Niedźwiecka-Filipiak, 2007)

enhanced by the development of the river and waterside for rest and recreation and the reconstruction of the historical, English park complex at Dziewin court.

Lubiąż: Cistercian Order Ecomuseum – sound stewardship; landscape as a work of human hands

The museum is on the Oder in a unique and distinctive place, where the river changes its course from the parallel to meridian direction and so creates large bends. In the twelfth century this was the site of the first settlement of the Cistercian Order in Silesia and, at the turn of the seventeenth and eighteenth century, the largest baroque monastery complex in Silesia was erected here. The overall impression is complemented by the splendid gardens, where a dedicated wa-

ter supply was connected to feed their numerous waterspouts and fountains [Soldek and Skrzywanek, 2009]. In the thirteenth and nineteenth century the village itself was a town; it is now a type of multi-way village [Nejman, 2012].

The slogan “The Cistercians: Sound Stewardship” was coined for Lubiąż. The main aim is to use the monastery complex to promote various forms of art and culture, whose meaning and impact will extend beyond the regional level. It will also be important to restore shipping ties with Malczyce and continue these on to Wrocław (former tourist routes). Landing and mooring areas for ships, kayaks and canoes, as well as camping facilities, will be required for this purpose.

Malczyce: Ecomuseum of navigation

The village of Malczyce is located within the ice-marginal valley of the Oder, which narrows there due to the gorge that cuts through the Trzebnicki escarpment. The first written records come from the twelfth century. The social changes, and those in production, which occurred in the eighteenth century resulted in the destruction of the typical agricultural character of the rail route, whose construction began in 1844 and connected Wrocław to Berlin.

Malczyce is now a form of multi-way village with a very diverse building development. Its industrial splendour has, it must be admitted, passed into history, though extensive technical infrastructure has remained to support inland navigation, including a small river shipyard, a harbour and a marina [Studium..., 1998].

Taking into account the position of the village and its cultural and natural re-

sources it was assumed that the ecomuseum of navigation could take advantage of most of the existing technical infrastructure related to the past and current activities on the river, including the harbour.

The project is founded on the partial restoration of the village’s old function, which was port activity related to passenger services, such as along the old Wrocław – Lubiąż tourist route. Besides this, the museum is expected to portray the original, primary function of this area through exhibits of machinery and port facilities and by representing the beginnings of tourism (Fig. 3). It is also intended to restore the river crossing that was first established here in the Middle Ages and to provide a canoe harbour at the port.



FIGURE 3. Fragment of the port construction in Malczyce (photo by I. Niedźwiecka-Filipiak, 2007)

Przyborów: the Przyborów meander

Przyborów was founded in the twelfth century as a manorial village with a palace-manor complex situated on its western side. This original seat of nobility is a rectangular mansion with two wings. An ornamental garden, which in

the late nineteenth and early twentieth century was transformed in naturalistic style [Studium..., 1999], was established later to the west and north. The garden was laid out in these directions because a large area of the Oder River oxbow wetlands lay to the west. The village is surrounded by forests which, combined with the significant number of ponds and streams, lends it an unrepeatable character.

The Przyborów meander was designed here because of the picturesque landscapes of the great river valley with the old river bed approaching the village from the west, the riparian forests that are rich in flora and fauna and the numerous monuments of material culture. The name refers to an existing ecological use in the village and includes the old riverbed of the Oder, which in the past was turned into a pond for the palace.

Wietszyce: Ecomuseum dziadoszan

The village stands in the immediate vicinity of the Oder on the former oxbow lake (Fig. 4), which means that there are, especially in the northern part, a number of small and large ponds in the settlement. The west side of the village is directly adjacent to the levees that were built in the eighteenth century to defend the area from frequent flooding. The spatial layout is that of a fork village with dense building development along the main street.

The residents of Wietszyce based the development of their tourist attraction, the Ecomuseum Dziadoszan, on the previous ways of life and work of the village. It is an open thematic museum with much to offer visitors – especially during the summer. The key regular event at the



FIGURE 4. The landscape around Wietszyce (photo by I. Niedźwiecka-Filipiak, 2007)

moment is the “Feast of the Dziadoszan” which is held as part of a canoeing trip on the Oder River. To the west of the village, near the Oder embankment, there is a common area designed as a meeting place and for regular large-scale events. It is one of the places that must be visited to take best advantage of the village’s attractions.

CONCLUSIONS

Due to the special role of river valleys in the free movement of animals and plant species and because (being linear) they are the best ecological corridors, a substantial part of the course of the Oder Valley has been recognized as part of the EECONET, which is concerned with important natural sites contributed to the Pan European Ecological Network. The

creation of parks, reserves, protected landscape areas and other forms of protection demonstrates the growing importance of ecological corridors and is also a factor in securing them.

This study includes the idea of an ecomuseum network to pursue the active protection of natural and cultural heritage. Where possible, the role of the Oder River in the execution of new projects for the selected localities was taken into account. An attempt has been made in this paper to use the fact that each village is located either by the river, in its immediate vicinity or on its terraces. This makes it possible to combine the various sites into one network and become identified as a functioning whole for the development of a rich and diverse base for tourism, whose outstanding attractions rest on the distinctive and characteristic elements of a given area. The vision for developing new uses for existing resources and the possibility of enhancing them with new elements rests on the nodal points of attraction embodied in the villages. All of these resources are linked together in a cultural and natural landscape that is unique in Europe. One important aim for these sites is that they should be easily accessible, have a reasonably diverse offer in terms of places to eat and accommodation, including campsites, with full sanitary facilities and that they should be properly promoted using online reference databases.

It is difficult to answer the question of whether nature or man is playing the more prominent role in this space. The two forces must be balanced, but with considerable respect given to the existing natural world. Without it, these places would not be available as enchanting

settings for the creation of new dimensions of development.

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Streszczenie: *Przyroda i człowiek jako stymulatory rozwoju wsi*. Dolina Odry, w okolicach Wrocławia, to bardzo piękny obszar, pełen różnorodnych krajobrazów nadrzecznych, w których dominuje przyroda i żywioł wody. A wszystko przy współdziałaniu pejzażu kulturowego, ukształtowanego

w sposób jasny i przejrzysty przez człowieka, który od zarania dziejów wykorzystywał rolniczo najlepsze w tym rejonie ziemie. Kształt tej przestrzeni to zapis wydarzeń historycznych, rytmu życia i sposobu gospodarowania poprzednich pokoleń, który należy uszanować, jednocześnie wprowadzając elementy nowe związane z zaspakajaniem obecnych potrzeb użytkowników, w sposób maksymalny wykorzystać. W 2002 roku zostało zawiązane Partnerstwo Doliny Środkowej Odry, które łączy obecnie 15 gmin położonych wzdłuż tej rzeki. Ze względu na specyficzny krajobraz występujący w tym rejonie, głównym celem organizacji jest jego ochrona oraz określenie możliwości wykorzystania istniejącego potencjału pod kątem zagospodarowania turystycznego. Szesć miejscowości leżących na szlaku wodnym Odry, pomiędzy Wrocławiem a Brzegiem nad Odrą, objęto opracowaniem w ramach współpracy między Uniwersytetem Przyrodniczym we Wrocławiu a Partnerstwem. Jest to przykład wsi, w których próbuje się wykorzystać istniejące zasoby i możliwości do ich przyszłego, lepszego zagospodarowania. Postawione zadanie do zrealizowania to zachowanie oraz przywrócenie wartości architektonicznych, estetycznych i emocjonalnych wybranych miejsc, a jednocześnie takie przekształcenie otaczającej przestrzeni, aby zachować zastane wartości a jednocześnie podnieść standard życia i spowodować dalszy rozwój poszczególnych wsi. Powstawanie nowego krajobrazu, szczególnie tam gdzie dominuje natura, musi być poprzedzone wnikliwą analizą i zrozumieniem tej przestrzeni oraz określeniem granic kompromisu między myślą a materią. Przedstawione opracowania uwzględniają pomysł sieci Ekomuzeów, jako aktywnej ochrony dziedzictwa przyrodniczo-kulturowego. W miarę możliwości uwzględniono rolę samej rzeki Odry w realizacjach nowych projektów dla wybranych miejscowości.

Aesthetic values and the perception of suburban landscapes

AGNIESZKA ALEKSANDRA JASZCZAK^{1*}, LINDA SZŰCS²,
BEATA DREKSLER³

¹University of Warmia and Mazury in Olsztyn

²Georg-August University of Göttingen

³Warsaw University of Life Sciences – SGGW

Abstract: *Aesthetic values and the perception of suburban landscapes.* Every suburban area is individual in character, which results primarily from the location, the extent of a given town, the industrialisation processes as well as economic and social significance. The protection of landscape values, especially in those areas which are slightly changed, is an essential landscape planning issue. The main goal of this research study is to analyse the historical and current situation of the Kerstlingeröder Feld suburb in Göttingen (Lower Saxony, Germany) in the context of the protection of aesthetic values, including cultural, natural and historical ones. In order to do this, it was necessary to identify the visual landscape elements that influence the area analysed. Furthermore, the landscape preferences of visitors to Kerstlingeröder Feld were analysed using an interview based on historical pictures to find their opinions on the historical development of the landscape. The interviews showed that the preferred landscape was the one from 1940, whose natural and cultural elements could be clearly identified. The results of the study confirmed that aesthetic values (natural, cultural, historical) identified by experts and the opinions of participants about their landscape preferences are both essential factors in landscape planning issues.

Key words: aesthetic values of landscapes, landscape preference, suburban area, Göttingen

INTRODUCTION

‘»Culture« is the word we have assigned to the force that assists us in iden-

tifying which of our many sensations we should focus on and apportion value to’ [de Botton, 2010]. Landscape blends all of the visual elements in an area abounding in natural and cultural features. A visual image plays a huge role in determining the final state of this area and its components [Atik et al., 2010]. A more differentiated approach to the issue of nature and beauty is described by de Botton [2010]: ‘We each settle naturally on a fitting idea of beauty, it seems that our visual and emotional faculties in fact need constant external guidance to help them decide what they should take note of and appreciate’. This “external guidance” should be based on certain norms and guidelines that determine the appropriate relations between nature and the material that is artificially introduced into it. Only then will it help to achieve harmony between people and the environment.

But why was it important to involve historical analysis in the study? The roots of nature conservation in Germany lie in the protection and preservation of the natural and cultural values of historical landscapes which are, as with the pre-industrial ones, largely defined by natural elements. These kinds of landscape

*tel. +4889 523 41 82, e-mail: agaj77@tlen.pl

scenes are often used as guidelines (in German Leitbilder) in planning processes [Szűcs, 2012]. Since the appearance of large scale landscape conservation in the 1970s, the practice of nature protection has been dominated by these historical guidelines, which are mostly orientated towards nineteenth century landscapes characterized by more diverse habitats. However, these landscape scenes are strongly idealized. Penker [1986] calls them “high-performance ecological landscapes” with an unprecedented “ecological efficiency” [Raffelsiefer, 2000]. The next related question is this: Could the scenes of that time serve as a paradigm in landscape planning processes?

The main goal of the research is to analyse the historical and current situation of the Kerstlingeröder Feld suburb in Göttingen (Lower Saxony, Germany) in the context of the protection of aesthetic values, including cultural, natural and historical ones. In order to do this, it was necessary to identify the visual landscape elements that influence the area analysed. Then, it was important to investigate the preferences of visitors regarding the historical and actual scenery of the landscape. The questions posed by the empirical section of the research were: Do the visitors like the historical or actual landscape? Why do they like the historical or actual landscape? The other purpose of the study was to find out which elements of the landscape are valued most. The participation of respondents would appear helpful in proposing future aims and directions for the development of Kerstlingeröder Feld.

MATERIAL AND METHODS

The research and the choice of the area are a consequence of actions implemented under the C I .3. Graduate School Interdisciplinary Environmental History project funded by the German Research Funding Organisation (Deutsche Forschungsgemeinschaft).

Historical research was needed first of all to analyse the historical and cultural values of the area. This involved monographic [Lücke, 1927; Deppe and Troe, 1956; Prietzel, 1990; Meineke et al., 1993] and cartographic sources¹, as well as a photographic data collection, which helped identify unique areas and objects for sustainable use and aesthetically important visual elements of the landscape. Old photographs, paintings and copper engravings collected from the Central State Archive in Hannover and the City Archive of Göttingen were essential sources drawn on in the research. Furthermore, individual landscape units were distinguished within the structure of the area (manor area, orchard, acres and avenues) based on an actual visual analysis.

Four photographs (Figs. 1–4) were chosen from the historical data collection as materials for the preference study about the research area. These pictures were selected for the following reasons: the copper engraving from 1800 (Fig. 1) and the painting from the middle of the nineteenth century (Fig. 2) represent an intensive anthropogenic use as well as the agricultural function of the area, while the picture from 1940 (Fig. 3) illustrates a pasture landscape

¹Cartographic materials obtained from Göttingen City Archive (digital orthophoto map from 1999), NLWKN in Hannover (historical Prussian map dated on 1878).

with both natural and cultural elements. Finally, the actual photograph (Fig. 4), which was taken from the same perspective as the pictures before, shows the natural character of the landscape. It was possible based on these sceneries to analyse which characteristic elements leave the greatest impression on visitors.



FIGURE 1. Copper engraving of the manor of Kerstlingeröder Feld from 1800 (Göttingen City Archive)



FIGURE 2. Painting of Kerstlingeröder Feld from the nineteenth century (Göttingen City Archive)



FIGURE 3. Picture of the research area taken circa 1940 (Göttingen City Archive)

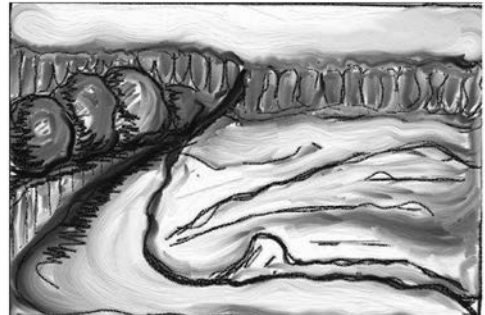


FIGURE 4. Picture of the study area in 2010 (sketches by L. Szücs)

The respondents were asked to give their opinion about the landscape on a Likert scale (very good, fairly good, average, below average, don't like it and don't know). Afterwards, they were asked to answer and justify the summary question of whether they like the landscape of today or that of the past. The data were analysed statistically using SPSS software.

RESULTS AND DISCUSSION

The significance of aesthetic experience in landscape analysis

One of the main issues in spatial planning, and especially in the planning of visual space, should be knowledge of behaviour and psychological human needs [Osikowska and Przetacznik, 2007]. Basic human needs can be assigned to specific landscapes [Lanninger and Langarova, 2010]. Landscape elements are defined as functional elements related to individual behaviour [Lanninger, 2010]. According to Myczkowski and Forczek-Brataniec [2007] it is important to work with identification of the cultural and natural heritage in the context of visual relations. These are named as visual aspects too.

Regarding the aesthetics of a landscape, the most important approach is the perception of aesthetic and non-aesthetic factors by an observer – primarily by means of the senses of sight and hearing as well as of touch and smell. According to Goodchild [2007] a landscape includes everything that is in view and that can be seen or perceived by the eye in the mind or in the imagination. It also includes everything that is related to parts

or aspects of the view. Under the special conditions related to spatial planning, properly phrased legal provisions are of particular importance. The perception of visual values with reference to natural and cultural determinants is an important issue for planning activities.

Elements affecting the perception of a landscape

One way in which the components of a landscape may be visually analysed is in terms of areas, objects and details [Goodchild, 2007]. Perception is most frequently affected by spatial forms, colours, light-and-shade effects and motion-related changes of the layout. The most highly rated elements are those that are interconnected compositionally and that harmonise with each other. Therefore, aesthetic qualities consist of features positively affecting the perception of a harmonious landscape. As regards colours, regional diversity, varied topography and different climatic, natural, cultural and social conditions may be referred to. These issues are examined according to the methods of colour geography developed by the French colourists, J.P. Lenclos and D. Lenclos. It should be noted here that the concept of colour geography has been repeatedly supported by numerous researchers, including Tarajko-Kowalska and Kowalski [2007]. In 1860 Gottfried Semper concluded that, when selecting a particular colour tone, one should be guided by the climate as well as by the customs and traditions of a given region. The colours of space – particularly extra-urban space – are affected by an area's land use and its vegetation cover.

Another important factor is the composition of species. This is especially true of trees, as well as of broadleaved and coniferous shrubs. The tints of leaves and shoots are also important – if only indirectly so. Throughout the growing season trees take on particular shades of green according to the species and variety, while in the autumn their range of colours becomes diverse. The native (in this particular case, central-European) species of trees, *inter alia* those planted along avenues, turn yellow, while the leaves of alien, introduced species turn red, orange or occasionally purple [Jaszczak, 2008].

The research area

The research area of Kerstlingeröder Feld (202 ha) is situated in a forest area southeast of Göttingen (Figs. 5, 6) within the protected landscape of the Weser-Leine-Bergland in south Lower Saxony. The area, which is part of the conservation area of the Göttingen Forest, was shaped by Middle Triassic limestone and

represents a relic of a cultural landscape whose land use history goes back to the fourteenth century.

The origin of the landscape is connected to the foundation of the village of Kersthelingerode in 1346. Despite ample resources of water and wood the village was already deserted in 1387, but the fields remained in continuous agricultural use. At the beginning of the sixteenth century the village was founded a second time, with a new manor building. From then until the twentieth century the landscape was shaped by agricultural use as field and pasture [Meineke et al., 1993]. Numerous historical guidebooks and almanacs from the eighteenth and nineteenth century mention Kerstlingeröder Feld as one of the most popular recreation areas of Göttingen and also point out the aesthetic value of the landscape as perceived by students and other visitors.

In 1928 some parts of the area were transferred to a military zone and, from 1937, the whole field was used as a military training ground. From 1945–1957 it

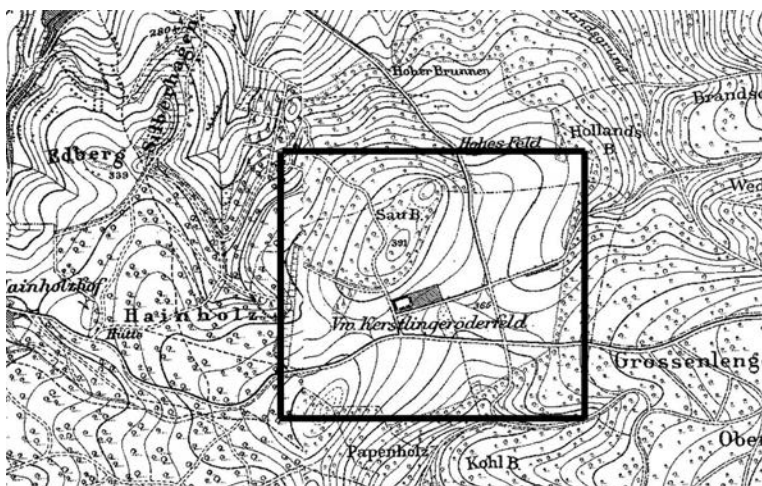


FIGURE 5. Kerstlingeröder Feld marked with a line on an historical map from 1878 (NLWKN)



FIGURE 6. Digital Orthophoto from 1999 (Göttingen City Archive)

was used by British troops and after that until 1993 by the Federal Armed Force.

By the 1990s it had already been nominated as a flora-fauna habitat conservation area [Niedersachsen No.138], which status was confirmed by the European Commission in 2004 [EU No. DE 4325-301]. In 2001 it came under the guidance of the City of Göttingen as part of the Forestry District of Göttingen. Nature conservation strategies and a management concept for the area were arranged by the BUND (Friends of the Earth Germany) and by NABU (Nature and Biodiversity Union Germany).

Landscape sketches for Kerstlingeröder Feld

Following the completion of the historical and visual analysis of the research area, characteristic landscape elements were chosen to be recorded in photographs and documented as sketches.

The analysis of a small number of significant but different landscape pictures can be more effective than examining large numbers from the same point of view. A classical graphic evaluation provides more information about the elements of a panorama and how they are related to each other [Byrski, 2007]. The role of landscape analysis, which includes the analysis of panoramas, is described by Myczkowski and Forczek-Brataniec [2007]. As regards the perception of views, distinguishing panoramic views with simultaneous division into remote and close views was of huge importance. At the same time, panoramic analyses from a number of observation points made it possible to define the conditions for the protection of visual elements of the landscape.

The individual landscape units were distinguished within the structure of the area which, as is apparent from the community interview conducted amongst selected users of the area, are of particular

aesthetic significance for the landscape. These include:

1. The manor area. This unit is separated from the area by dense woodlots and the ruins. The structure of the unit's walls is open owing to plant material, which enables the perception of expansive views, while the remains of buildings (the ruins) constitute single building shapes that accentuate the unit.
2. The areas in agricultural use (pasture). Within the space under analysis a number of units have been separated, whose boundaries are marked by the forest edge and internal roads and sometimes by a roadside avenue (fruit trees) or field shrubs. The structure of this unit is homogenous and provides extensive perceptual impressions.
3. The orchard is outlined by rhythmically repetitive stands of fruit trees, which form a uniform whole.
4. Another element which can be distinguished within the space is the road and its surroundings, namely the avenues along the internal roads. The avenues are distinctive formations within the landscape. Their origin is associated with distant times in relation to the history of culture and art. Throughout the centuries, avenues have played a significant role in the development of space and in the formation of landscape compositions not only in park complexes but also in built-up and suburban landscapes. Within the boundaries of the research area they clarify the layout and, thanks to the rhythmic pattern of plantations, prevent the landscape from becoming monotonous. As regards remote open

landscapes, the viewing links are of importance.

Determining the dominant feature, that is, the element to which all others within the structure are subordinated, required a complex analysis and in-depth knowledge of the research area.

The question related to the history of the chosen research area is that of how people now perceive the historical landscape scenes and whether they could serve as a paradigm in landscape planning. Most of the respondents indicated the attention-attracting, uniform "natural shape" in the form of a group of tree plantings in the central part of the area being researched, whereas the largest part of the remains of the barracks is thought of as the architecturally dominant feature. There are characteristic features in the form of boulders, individual trees and shrubs that are distinguished by their structure or colours, but also deadwoods and landscape elements that have been introduced, such as seats and a stone acting as a guide-post.

As regards the Kerstlingeröder Feld area, the colours are primarily related to the structure of the vegetation cover, the topography, the weather conditions, the season and the light (in the twenty-four-hour cycle). The significance of colours and light relates to both expansive and close views, since these impart the impression of either remoteness or closeness. Because it changes over the twenty-four-hour cycle, the light enables changing perceptions of a diverse range of hues and tints in the landscape.

Moreover, a landscape similar to a natural one provides a person with spiritual experiences by embodying and ex-

pressing a certain stability in the renewal of nature, the recurrent patterns of the regeneration of life, the succession of the seasons and the day-and-night cycle. Nature itself, though, expresses instability, the passing of time, and constant changes and their consequences.

Interviews on landscape preference

The interviews regarding historical and actual landscape preferences showed that the preferred scenery was that of 1940 (39.2%). It features pasture land and the manor building still in anthropogenic use. On the other hand, many of the interviewees (41.8%) judged the landscape from 1900 as “fairly good”. The agricultural landscape from the nineteenth century was assessed as “average” or “fairly

good”. In comparison with the scenery of today, the actual landscape was generally accepted as “very good” (29.4%).

To sum up 78% of the visitors liked the landscape of today more because of its natural character, open landscape and restorative function. Furthermore, 22% liked the landscape of the past that was linked to cultural values and intensive anthropogenic use of the landscape (Fig. 7).

The results confirmed that less intensively used landscape (in this case the pasture land) was the most popular because of its natural and cultural values. The pictures that showed agricultural use or in which only “pure” nature could be clearly identified were rated as either “fairly good” or “average”.

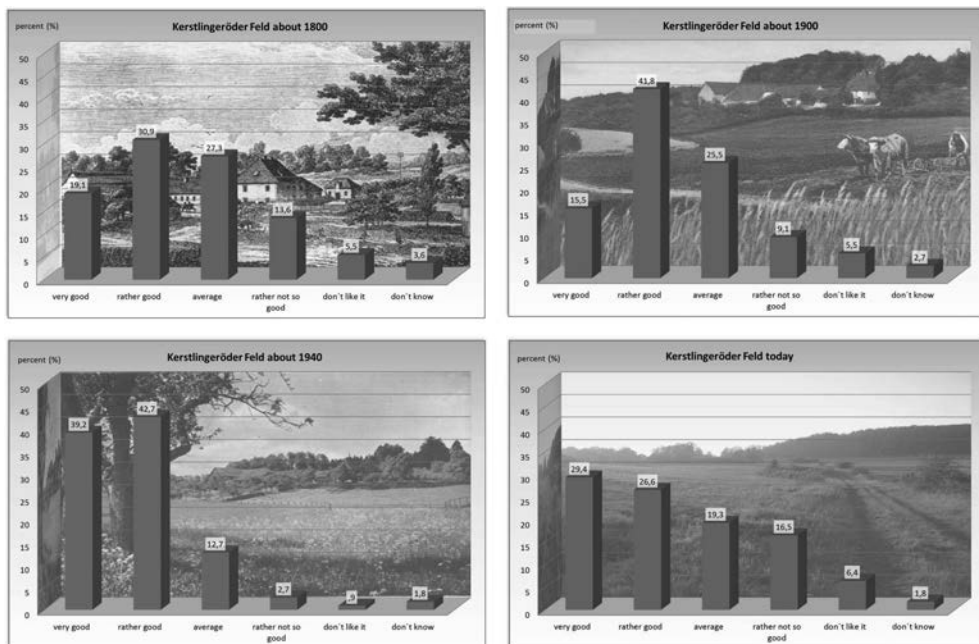


FIGURE 7. Analysis of historical and actual landscape preferences (L. Szücs)

CONCLUSIONS

Suburban areas have a combination of the functions of urban and rural zones and a range of relationships with both. It is the urban and rural zones that have changed the most in economic, social and environmental terms and this has influenced the transformation of the suburbs in between. Nevertheless, these (suburban) areas could be understood as a significant reservoir of natural elements and be used for sustainable recreation.

The main issue of the research was the identification of the landscape's character by historical analysis and analysis of the actual terrain. Historical research and visual analyses of the current state of landscape structures will enable the identification of trends and the formulation of possibilities for the further use of Kerstlingeröder Feld and will also allow comparisons to be made with suburban areas with similar issues. The second important goal was to investigate the views of visitors concerning the area that is used for recreational activities.

Kerstlingeröder Feld in the suburban region of Göttingen was chosen as a research area for the preference study because of its natural values, such as the open panorama, the forest, the flora and fauna habitats, and because of its cultural and historical values, such as the ruined manor, the orchard and the pasture.

The replies to the question asked to Göttingen inhabitants of whether they prefer past or present scenery revealed that landscapes with both cultural and natural elements were most popular.

Most of the inhabitants would like to maintain the area in its present form, while some would be interested in seeing it under anthropogenic use as it was in history. Furthermore, aspects such as the open panorama (causing feelings of freedom), diversity (increasing interest in the landscape) and closeness to nature were named as positive attributes of the area researched.

Our conclusion is that the area studied should continue to be protected because of its natural potential. On the other hand, its unique aesthetic and visual assets represent an opportunity for the development of light-recreational uses.

Taking everything into consideration, including the methods and the analysis of old photographs and sketches, it is possible to show the influence of aesthetic values on the way people perceive landscape. It is also important to define future development prospects based on environmental protection principles and on the needs of Göttingen's inhabitants. This refers to the characterization of landscape values in the field of spatial planning and to the protection of Kerstlingeröder Feld.

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Streszczenie: *Walory estetyczne oraz percepcja krajobrazów podmiejskich*. Każda strefa podmiejska ma swój charakter zależny przede wszystkim od lokalizacji, zasięgu danego miasta, procesów industrializacji, znaczenia gospodarczego i socjalnego. Ochrona wartości krajobrazowych, zwłaszcza na obszarach mało przekształconych, jest ważna z punktu widzenia planowania krajobrazu. Głównym założeniem pracy jest analiza historycznego i aktualnego stanu terenu podmiejskiego Kerstlingeröder Feld w Getyndze (Dolna Saksonia, Niemcy) w kontekście ochrony warto-

ści estetycznych, włączając elementy kulturowe, przyrodnicze i historyczne. Aby tego dowieść, istotną była identyfikacja elementów wizualnych mających wpływ na analizowany teren. Ponadto wykonano badania ankietowe dotyczące odbioru krajobrazu przez odwiedzających Kerstlingeröder Feld, przy czym wykorzystano historyczne obrazy. Badania ankietowe pokazały, że najlepszy

odbior krajobrazu dotyczył jego stanu od 1940 r., gdzie przyrodnicze i kulturowe elementy były jasno zidentyfikowane. Wyniki potwierdzają również, że wartości estetyczne (przyrodnicze, kulturowe i historyczne) są niezbędnymi czynnikami w planowaniu przestrzeni, niezależnie od zdania ekspertów czy respondentów odwiedzających badany teren.

EU-Teach – the implementation of relevant European teaching contents in the studies of landscape architecture. Results and perspectives

CHRISTINA KÜHN¹, MARKUS REINKE¹, JOHANNES SEIDEL¹,
KRZYSZTOF HERMAN²

¹University of Applied Sciences Weihenstephan, Triesdorf, Germany

²Warsaw University of Life Sciences – SGGW

Abstract: *EU-Teach – the implementation of relevant European teaching contents in the studies of landscape architecture. Results and perspectives.* This article presents the results of a yearlong international research project that was focused on obtaining knowledge about teaching programmes in universities around Europe with regard to European policies, strategies and regulations. The project also aims to create stronger bonds between professional practice, the employment market and landscape architecture education in the European context. “EU-Teach – Implementation of Relevant European Teaching Contents in the Studies of Landscape Architecture” (EU-Teach) between November 2010 and October 2011. It was supported by the Lifelong Learning Programme of the European Union and led by the Weihenstephan-Triesdorf University of Applied Sciences. One of the main goals of the EU-Teach project was to develop a comprehensive list of European teaching contents relevant to landscape architecture education. This list was disseminated and consulted within professional landscape architecture organizations. It is based on the structure provided by the ECLAS education guidance “Tuning Landscape Architecture Education in Europe”, but was enhanced with a focus on European contents. A list of 118 different aspects in nine areas was elaborated. The project was also designed to learn about the state of European contents as these are currently taught at European universities. All aspects of the list developed in the first step were assessed by EU-Teach partner universities and then by practicing landscape architects (EFLA). The results of the survey indicated which contents of European relevance are currently part of landscape architecture education and showed

where there are gaps in teaching programmes. The EU-Teach project made recommendations for future action based on an analysis of the “List of Relevant European Teaching Contents”. One of the recommendations is to establish Europe-wide teaching clusters. These would allow universities to focus on their core competences and, at the same time, make it possible for students to be offered courses with relevant European contents at a high professional level throughout Europe. This strategy would ensure that students at participating universities are able to become experts in their areas of special interest in a European context.

Key words: education, teaching programmes, European cooperation, European policies

INTRODUCTION

The work of landscape architects is increasingly influenced by the specifications of the European Union. It is therefore essential for European universities to expand their teaching by offering teaching contents relevant in the EU context. This is essential if graduates are to have a better chance of being prepared for the European employment market and being active on it. The contents under discussion are directives, guidance publications or standards that may, for example, refer to the rules of competitions and tenders.

The “EU-Teach: the implementation of European teaching contents in studies of landscape architecture” project aims to contribute to improving academic education in the field of landscape architecture. It also aspires to support the development of a pan-European network for the teaching of landscape architecture based on teaching clusters.

The yearlong project was inaugurated on 1 November 2010. It was funded through the Erasmus Lifelong Learning Programme of the European Union and was run by a consortium of European universities and landscape architecture associations. The partners involved were the Corvinus University of Budapest, the University of Kassel, the University of Sheffield, the Weihenstephan-Triesdorf University of Applied Sciences (lead-partner), the European Council of Landscape Architecture Schools (ECLAS) and the European Federation of Landscape Architecture (EFLA). The project’s target groups were primarily the European schools of higher education in landscape architecture and the students of landscape architecture closely connected with them who could benefit from an enhanced education.

MATERIALS AND METHODS

The aim of the project was to anchor knowledge about European ideas, strategies and regulations more firmly in the higher education of landscape architects. In order to achieve these goals the project was broken down into several steps:

1. Definition: What are the “relevant European teaching contents” a landscape architect should know?

2. Actual condition-analysis: Which of these contents are actually taught in the higher education of landscape architects?

3. Conclusions: What is going well? What is not going well? What improvements must be made?

Step 1 involved drawing up a definition called List of Relevant European Teaching Contents in the Studies of Landscape Architecture. Its structure (fields of work) was oriented towards the definitions of the International Labour Office (ILO, 2009) and towards the ECLAS – LE: NOTRE Tuning Project (2010). Both were assessed in terms of the aim of the project and each field of work was defined. The relevant European topics, such as biodiversity and sustainable urban planning, and the more substantial laws and strategies concerning this field of work, were collected by the project partners. Each partner called upon the relevant chair holders at their university to complete the list. ECLAS surveyed their members to gain further insights. An additional survey by EFLA ensured that the assessments of practicing landscape architects could also be incorporated into the list. Finally, a comprehensive list of 118 topics was ready to be presented as a recommendation for the higher education of landscape architects (see Results below for the details).

To find out if and to what extent the contents of the list of relevant European teaching contents are actually taught, the four partner universities compared the list to their current study programmes. The list was modified into a matrix and independently evaluated by the project partners for this purpose. In the follow-up the four individual analyses were

summarized and EFLA consulted their members to contribute experience from the point of view of practicing professionals.

The aims of the analyses were:

- The listed relevant European teaching contents should be classified according to their importance within the study offers (the columns were “important for bachelor level” and “less important for bachelor level”);
- The participants in the survey should give their opinion regarding whether the content is important for bachelor or master’s level;
- Finally, the survey should indicate which contents are already taught, taught in part or not taught yet. (The EFLA completed a matrix without this column).

All of the universities consulted several professors of different subjects and each university gave a short description of its analysis. The EFLA received responses from sixteen members, which included representations from six European countries. Thus there was a sufficient number of classifications/responses for a summary. Nevertheless the results, especially in the column “taught in this university” can only record tendencies in outlooks (How important are the single relevant European contents?) and offer a brief insight into the current situation (Which relevant European teaching contents are already taught and to what extent?).

The project partners were able to draw conclusions regarding ways to improve higher education for landscape architects linked to relevant European teaching contents based on steps 1 and 2. These conclusions were incorporated into the

“Draft paper for the establishment of an exemplary European Teaching Cluster” (see below).

RESULTS AND DISCUSSION

In accordance with the approach described above EU-Teach produced three fundamental results:

- The List of Relevant European Teaching Contents in the Studies of Landscape Architecture (Fig. 1);
- An evaluation of the current courses studied at the universities involved;
- Recommendations for the development of teaching clusters.

1. List of relevant European teaching contents in the study of Landscape Architecture

Landscapes are the result of natural and/or human factors. Landscape architecture is concerned with rural, peri-urban, urban and cultural landscapes and their aesthetic, environmental, social, functional and economic aspects. Landscape architects develop solutions in this broad field for all scales: national, regional and local, as well as for sites where the future of landscapes is shaped in accordance with the latest scientific knowledge in these fields.

Depending on the task, the List of Relevant European Teaching Contents considered the work of landscape architects in nine fields:

- **Theories and methodologies** are needed for the understanding of the complexity of landscape;
- The planning, design and management of landscapes are the core competences of landscape architects. They can be further differentiated

ument. It should instead be regarded as a practical framework and set of recommendations for teachers and students of landscape architecture. Its aim is to improve the dissemination of knowledge about landscape architecture in and for Europe. But “working in/for Europe” also means respecting the specialities of each country in Europe. The List of Relevant European Teaching Contents is not intended to introduce an egalitarian solution somehow equalising the curricula of European universities. Quite the contrary: the list provides an opportunity for a university to review its teaching contents and to enhance its strong points.

2. Analysis and evaluation of what is currently taught

All of the partners involved agreed that the time-intensive basic knowledge which is connected with practical skills and the realisation of plans should be taught at the bachelor level. However the nature and extent of this basic knowledge differs between the EFLA and the universities on some points. Deep knowledge, such as that of spatial planning, sectorial planning, topics with an international focus and the field of funding is important at the master’s level. There remained uncertainty about fields in which a lot of new regulations had lately been issued, such as those regarding environmental information and staff transfers.

These were predictable outcomes. Much more interesting was a list of about thirty topics which were classified as “very important” but which were not being taught. These topics could be foundation stones in the development of teaching clusters for all landscape architecture students in Europe (see below). By evaluating their current study offers

the universities involved were able to get an impression of possible gaps, but also of special strengths, in their education.

3. Recommendations for the development of teaching clusters

The idea of Europe-wide teaching clusters in landscape architecture was developed during the project. Teaching clusters are meant to add study options (for example, lectures, seminars, study trips and project tasks) to the specific EU-relevant topics which are offered jointly by several universities (see Conclusions). The project concluded with the first recommendations and questions for the establishment of teaching clusters, such as those concerning formal requirements for participation, didactic agreements and quality assurance.

CONCLUSIONS

As the analysis of the List of Relevant European Teaching Contents demonstrated, the teaching of European topics is not yet sufficiently widespread (even if the results of EU-Teach are not completely representative for Europe). However, gaps were exposed even in large schools like Sheffield, Kassel, Budapest or Weihenstephan. This result leads to the conclusion that small universities might find it even harder to meet future challenges to find the balance between local, regional, national and European topics within their curricula.

For this reason the idea of a teaching cluster network was discussed at the EU-Teach closing event in October 2011 (Fig. 2). The participants agreed to form a consortium to establish a much broader, European-wide consortium to put the



FIGURE 2. Group photo with partners and guests at the closing EU-Teach event in Freising (October 2011)

idea of a European cluster network for landscape architecture into effect. To do so, the Weihenstephan-Triesdorf University of Applied Sciences, which is also the lead partner in EU-Teach, began to acquire partners for the second phase of EU-Teach to apply for funding within the “academic networks” programme of the EACEA.

The project’s bid for a second phase, “Start EU-Teach: Start Up a European Network of Teaching Clusters in Landscape Architecture” is under review by the Education, Audio-visual and Culture Executive Agency. Within two months the consortium grew in number from the six EU-Teach partners to a strong consortium of thirty-four partners representing twenty-six countries. The aim of the project is to develop course material for teaching clusters in five different fields. These fields will be **Strategic Landscape Management** led by the Weihenstephan-Triesdorf University of

Applied Sciences, **Professional Practice in Europe**, led by EFLA, **European Open Space Design Approaches**, led by Warsaw University of Life Sciences, **Participatory Planning in Europe** led by Kassel University and **Digital Landscapes** led by the University of Sheffield. The clusters themselves will be formed by groups varying in number from five to eight partners. In a three-year project to begin in October 2012, the consortium plans to define guidelines and develop and implement modules for a test run planned for the winter semester of 2014.

The Start EU-Teach consortium is a strong community of twenty-nine universities, EFLA, ECLAS, LE:NOTRE and other associations ensuring a combination of sophisticated national knowledge from almost all European countries. Start EU-Teach can help to prepare the study of Landscape Architecture for the challenges of future developments. With a development of five modules open to

students from all participating institutions the project will help Europe to come closer and give students the opportunity to become specialists in the fields that interest them.

Close cooperation with the LE: NOTRE network is planned in order to support each other's ideas. For further information stay tuned at: www.eu-teach.eu.

Acknowledgements

EU-Teach was and will remain a consortium project. The authors would therefore like to thank all of the EU-Teach project partners. In addition, we wish to thank the entire Start EU-Teach consortium for joining in with the idea of a European cluster network. Special thanks go to Prof. Dr Diedrich Bruns and Prof. Fritz Auweck (on behalf of ECLAS and EFLA) for their strong commitment during development of the project, as well as to Prof. Richard Stiles on behalf of LE: NOTRE for his experienced input.

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Streszczenie: *EU-Teach: Wyniki i perspektywy związane z wdrażaniem europejskich treści nauczania w programach studiów architektury krajobrazu.* Artykuł prezentuje wyniki rocznego, międzynarodowego projektu badawczego, który koncentrował się na uzyskaniu wiedzy na temat programów nauczania architektury krajobrazu na uniwersytetach w Europie, pod kątem europejskich rozporządzeń, strategii i prawodawstwa. Prezentowany projekt miał także za zadanie zacieśnianie relacji pomiędzy praktyką zawodową, rynkiem pracy i edukacją w architekturze krajobrazu, także w kontekście ogólnoeuropejskim. Projekt „EU-Teach – Implementation of Relevant European Teaching Contents in the Studies of Landscape Architecture” (EU-Teach) trwał od listopada 2010 do października 2011 r. Wsparty został przez Lifelong Learning Programme Unii Europejskiej, a liderem był University of Applied Sciences Weihenstephan-Triesdorf. Jednym z głównych celów projektu EU-Teach było stworzenie pełnej listy treści o znaczeniu europejskim istotnych dla nauczania architektury krajobrazu. Lista ta została rozprowadzona wśród europejskich organizacji zawodowych zrzeszających architektów krajobrazu. Jest ona oparta na strukturze opracowanej przez ECLAS w dokumencie „Tuning Landscape Architecture Education in Europe”, wzmocnione zostało w niej jednak nastawienie na treści istotne w kontekście europejskim. W ten sposób lista 118 różnych aspektów uczenia o wiadomościach „europejskich” stworzona. Projekt był także nastawiony na uzyskanie informacji o tym jak i czy naucza się istotnych w kontekście europejskim treści. Wszystkie aspekty listy, która powstała jako pierwszy krok badań, były ocenione przez uniwersytety partnerskie w programie EU-Teach oraz przez zrzeszenie zawodowe architektów krajobrazu (EFLA). Wyniki tej ankiety pomogły zrozumieć, które z istotnych europejskich treści są w tej chwili nauczane, oraz zasygnalizowały braki w programach nauczania. Opierając się na analizie „listy treści o znaczeniu europejskim istotnych dla nauczania architektury krajobrazu”, projekt EU-Teach dał możliwość rekomendacji przyszłych rozwiązań. Jednym z nich jest propozycja utworzenia europejskich grup nauczania. Dzięki takim grupom uniwersytety będą mogły skupić się na ich bazowych kompetencjach, jednocześnie oferując kursy zawierające istotne europejskie treści

na wysokim poziomie, dostępne w całej Europie. Strategia ta dałaby pewność, że uczestniczące w programie szkoły mają możliwość specjalizowania się w konkretnych obszarach wiedzy z zakresu treści europejskich.

Annex

The following list presents an analysis of the evaluation of the List of Relevant European Teaching Contents developed during the EU-Teach project. The aspects below were rated as **very important** for bachelors or masters programmes by either participating universities or EFLA members, but are under-represented in the current curricula at the universities involved.

Legend:

- *Rated as very important by Universities, but not taught at an appropriate level*
- *Rated as very important by EFLA members, but not taught at an appropriate level*
- **Rated as very important by both evaluators, but not taught at an appropriate level**

1.2. European basics/relevant European contents

- **History of European societies/cultural development**

2.2. Theory and methodology in landscape architecture/relevant European contents

- Landscape narratives, diversified meanings of landscape (i.e. the language of landscape) and/or its multi-layered meanings in Europe

2.4. Theory and methodology in landscape architecture/implementation details

- **Needs-based assessments (socio-geographical)**
- **Scenario approach**
- *Scenario prognosis*
- **SWOT-analysis**
- **DPSIR model (Driving forces, Pressures, States, Impacts and Responses)**

3.1.2. Different fields of landscape architecture/Strategic landscape planning, design and mgmt./relevant European contents

- **Different design approaches (artistic, rational, strategic...) pursued in different European countries and schools**

3.1.4.3. Different fields of landscape architecture/Strategic landscape planning, design and mgmt./information/networks

- **International and world-wide networks in the field of landscape planning and environmental protection which are related to the discipline of Landscape Architecture, such as IALE [International Association of Landscape Ecologists], European Biodiversity Clearing House Mechanism (with UN) and IUCN [International Union for the Conservation of Nature]**
- **European networks in the field of landscape planning and environmental protection which are related to the discipline of LA, such as PEEN (Pan European Ecological Network), EEA (European Environment Agency and the EUROPARC Federation)**

3.2.2. Different fields of landscape architecture/Open space planning and design/relevant European contents

- Basic European and exemplary national standards for building regulations/building codes

3.2.3. Different fields of landscape architecture/Open space planning and design/European aims/ strategies (examples)

- Protection of cultural heritage and historic towns/villages and settlement areas, such as the Charter for the Conservation of Historic Towns and Urban Areas (Washington Charter, 1987)

3.2.4.2. Different fields of landscape architecture/Open space planning and design/funding

- *Examples for detailed funding programmes to clarify the structure and demands of funding proposals, such as examples from European states to get funding from URBACT II, JESSICA (Joint European Support for Sustainable Investment in City Areas)*

3.3.4.2 Different fields of landscape architecture/Conservation, development and management for historical parks and gardens/funding

- *European Cultural Contact Point*

3.4.2. Different fields of landscape architecture/Landscape construction and materials/relevant European contents

- Technical requirements, such as European codes/standards for materials and best practice in construction

3.4.4.1. Different fields of landscape architecture/Landscape construction and materials/laws/binding documents (examples)

- *Directives focusing on environmental protection, such as directive 2004/35/*

/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage and the directive on the classification, packaging and labelling of dangerous substances (Council Directive 67/548/EEC)

3.4.4.3. Different fields of landscape architecture/Landscape construction and materials/information/network

- Information/networks focusing on traditional construction methods, such as dry stone walling and rammed earth technology: the International Scientific Society for Dry Stone Interdisciplinary Study S.P.S.

4.2. Participatory planning/relevant European contents

- **Differences in participation in Europe/other countries, for example in developing countries**
- **Different participation cultures in different European regions, such as the Mediterranean and Scandinavia**

4.3. Participatory planning/European aims/strategies

- *Towards a reinforced culture of consultation and dialogue: general principles and minimum standards for the consultation of interested parties by the Commission, COM(2002) 704 final, Brussels, 11.12.2002 GREEN PAPER on a European Citizen' Initiative, COM(2009) 622 final, Brussels, 11.11.2009*
- *Rio Declaration of Environment and Development, 1992 (Section III); Chapters 25–32 of Agenda 21*

5.2. Information techniques in landscape architecture/relevant European contents

- Available European data: European soil database, CORINE land cover database, GMES urban atlas, IMAGE 2000, soil atlas of Europe, NATURA 2000 sites, CITES data base, IUCN standards on endangered species (Red data book, European spatial data)
- Software used throughout Europe: e.g. 3D visualisation (ISPRS, including LIDAR, Ikonos...), Remote Sensing, GIS and Space Syntax (e.g. GIS Forum Danube), EURO-STAT

5.3. Information techniques in landscape architecture/European aims/strategies

- *Exchange of data: e.g. International Commission for the Protection of the Elbe River*

5.4. Information techniques in landscape architecture/implementation details

- European data protection rules: e.g. Data Protection Directive 95/46/EC

6.2. The professional practice of landscape architecture in Europe/relevant European contents

- Conditions of the European labour market
- European competition rules/designs

6.3. The professional practice of landscape architecture in Europe/European aims/strategies

- *Funding e.g. ESF*

6.4. The professional practice of landscape architecture in Europe/implementation details

- Networks: e.g. EFLA (European Federation of Landscape Architects), IFLA (International Federation of Landscape Architects), European Landscape Contractors Association (ELCA), European Council of Landscape Architecture Schools (ECLAS)
- Directives focusing on the protection of ideas/intellectual rights, such as the legal protection of designs (98/71/EC) and the enforcement of intellectual property rights (CIVIL) (2004/48/EC).

Protecting and reinforcing the power of landscape in landscape parks through social cooperation

JULIA JANKOWSKA, KATARZYNA TOKARCZUK-DOROCIAK
Wrocław University of Environmental and Life Sciences

Abstract: *Protecting and reinforcing the power of landscape in landscape parks through social cooperation.* Landscape parks (nature parks) are important aspects of the system of nature conservation in Poland. The resources in these parks are managed by park authorities through the Landscape Park Protection Plans, as constrained by the Act on Nature Conservation (2004). Nonetheless, few of the parks have a Protection Plan in force. This paper focuses on the importance of public participation both in preparing the Protection Plans and in implementing their ideas. The current state of landscape management in landscape parks is assessed and the main problems are identified, with an emphasis on the lack of human resource management. The arguments are presented based on two examples from the Lower Silesia region of Poland: The Valley of Jezierzycza Landscape Park and the Chelmy Landscape Park.

Key words: landscape protection, landscape parks, nature parks, landscape management, social cooperation

INTRODUCTION

In recent years we have witnessed many global processes which are or can be a threat to our environmental and cultural values. These processes (growing population, intensification of agriculture, developing industry) have resulted in certain phenomena (urban sprawl, loss of biodiversity, pollution, vanishing local culture and customs) that magnify the need for a sustainable economy and the protection of the remaining values. As we

face globalization, we also face a global call to protect local nature and culture. As these two factors meet in the concept of landscape, effective landscape protection is something we urgently need.

Nature protection objectives are nowadays best achieved in protected areas. According to IUCN, a protected area is ‘a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values’ [IUCN, 2008, p. 8]. The IUCN recognizes six categories of protected areas according to their objectives, distinguishing features and role in the landscape or seascape [IUCN, 2008, p. 11]. In this paper the authors want to focus on one of the IUCN Category V protected areas in Poland – the landscape parks.

Category V describes protected areas ‘where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values’ [IUCN, 2008, p. 20]. Polish landscape parks are legally authorized by the Act on

Nature Conservation (2004) and defined as an 'area protected due to the natural, historical, cultural and landscape values in order to preserve and popularize these values in terms of sustainable development' [Polish Journal of Laws 2004, No. 92, Item 880]. Generally, landscape parks are recognized as a lower category protected area, where human activities are allowed as long as they do not harm the environment (housing, agriculture, forestry, environmentally-friendly business, recreation and tourism are permitted). This makes landscape parks places where sustainable development objectives can be implemented in practice, but also places where difficulties in achieving effective nature protection can arise [Locke and Dearden, 2005].

People will always fight for their sacred right to property, but may be badly informed or insensitive regarding the need for nature protection and the benefits that they can derive from it. The same happens in landscape parks. Farmers might be afraid of changes in their past ways of management or of earning less income, which sets them against the creation of new parks [Fjellstad et al., 2009]. Investors are angry about regulations and bureaucracy hindering their actions, and they often appeal to higher and higher courts where they receive conflicting opinions. The landscape park objectives are often not well understood by the public and local government, which can cause many organizational and operational problems. These will be discussed elsewhere in this study.

Polish landscape parks are managed individually, in groups, or as a part of regional administration, but do not come under any national association

[Kistowski, 2004. p. 62]. The management of the park, or group of parks, is required to work to achieve nature protection objectives. There is also an advisory body that can be appointed to the park or group of parks, which is known as the Landscape Park Council. This body consists of representatives of the scientific community, local government, NGOs and practitioners.

The official document that defines protection objectives in the park is the Protection Plan. It is established by the landscape park director or by the director of a group of parks. The Plan specifies the threats to natural and cultural values in the park, divides the territory into zones with different protection objectives and regulations and recommends action to be taken to meet the protection requirements. The details of the information that should be collected and taken into account during the project-development process (before establishing a Protection Plan) are described in a regulation of the Minister of the Environment [Polish Journal of Laws 2005, No. 94, Item 794]. The plan should:

- define the current state of nature components, landscape and cultural values, economic activity, spatial policy and tourism in the park,
- diagnose the threats,
- develop a plan for operations serving to protect the natural and cultural values of the area.

According to article 18 of the Act on Nature Conservation, protection plans have to be established within five years of the creation of a landscape park. Nevertheless, many parks still lack a protection plan, which is mainly because of the high costs involved in preparing

them and having them accepted by local councils.

As provided for by article 19 of the Act on Nature Conservation, a local community can participate in developing a project (leading to a plan) which, when it is complete, must be submitted to local government for approval. At the end of the process, the plan is given legal force by the regional government (articles 19 and 20, Act on Nature Conservation, 2004).

The involvement of local communities in preparing protection plans mainly involves meetings organized by the director of a landscape park with the team of experts selected to prepare a project for a protection plan.

The process of public participation and the problems this entails will be presented through two examples: the Valley of Jezierzyca Landscape Park and Chełmy Landscape Park. They are both part of the Lower Silesian Landscape Park Administration, which is in charge of twelve parks in the Lower Silesia Region of south-west Poland.

The Valley of Jezierzyca Landscape Park covers some 8,000 hectares in the area of two community councils: Wołów and Wińsko. It is sparsely populated and approximately 80% of the surface area is forested. Chełmy Landscape Park is about twice as large (close to 16,000 ha) and lies within the Męcinka, Paszowice, Złotoryja, Krotoszyce and Jawor community council areas. It is characterized by hilly terrain and diverse forms of land use. Both of the parks have a protection plan in force, but the park authorities faced some difficulties during the decision-making process.

In the case of the Valley of Jezierzyca, two meetings were held with the participation of the Wołów and Wińsko community councils to disseminate information when the Protection Plan was being prepared. Afterwards, the draft plans were presented to the community councils. The community of Wołów, which was actively involved in preparing the Plan, approved it, while in the Wińsko community two additional meetings were required for consultations and presentations about the objectives of the Protection Plan and its consequences for community economic development. The Plan was then approved.

The approval process was much more complicated in the case of the Chełmy Landscape Park. Some communities did not understand that their areas included portions of a landscape park and that this would require them to include protection objectives in the spatial policy and development strategy of their communities. In the case of three of the communities the areas included in the park are really small and approval for the Protection Plan was given automatically. Two further communities had different approaches to the idea of nature and landscape protection in the park. In the community of Męcinka the problems mostly concerned the incompatibility between current and planned spatial policy and the land use provided for in spatial management documents (Study of Aims and Conditions for Spatial Management and the local Spatial Management Plan). A compromise between the Protection Plan and the local Development Strategy was reached at the discussion stage and the community council approved the plan. Elsewhere, in the community

of Paszowice, it proved impossible to get approval as the local government's opinion was that the Plan would rule out local economic development. As many as four meetings were held between the planning team and the community council representative in this community but, unfortunately, the strong belief that the Park would have a negative impact on the economic situation in the community meant a consensus was not reached. This opinion only changed when new community councillors beginning their terms of office were persuaded that the presence of the Park could contribute to improving the well-being of local people¹.

DISCUSSION

People have a legal right to present their opinions and proposals on Protection Plans. The local community is represented by local government, which has to agree to the Plan before it is officially recognized. In principle, public consultations concerning landscape parks are limited to local councils. The process of public participation in shaping conservation policy varies in different communities according to the members of the council, their capacities, the scopes of their roles and changes in their terms of office. The situation that occurred in the community of Paszowice proves that a local council that is unaware of the real influence that a landscape park can have

on a local economy and its development can block the legal procedure and cause many difficulties for landscape park management and their protective measures. By way of contrast a local government that takes an interest in the planning procedure from the beginning can help to achieve effective cooperation between the local community and park management, which was seen in the case of the Valley of Jezierzycza Landscape Park.

This preparation and adoption procedure for protection plans shows that the process does not in itself ensure the involvement of society, which should have the greatest influence on the development of parks from the very beginning. Public participation is only implemented through the approvals of community councils. This could be sufficient if the councillors and local government – aided by park management – worked to educate the inhabitants and took a proper role in shaping co-responsibility for the Park areas. We should refer at this point to the role of public awareness in securing nature and landscape protection objectives.

Most inhabitants of landscape parks are aware of their presence and see the benefits they bring for nature protection and the local economy. Unfortunately, many of them do not participate in the decision-making process and do not play any active role in shaping the environment around them. Studies from another Lower Silesian landscape park, the Valley of Barycz, have found that only around 15% of inhabitants are interested in local government decisions and react if they are not satisfied with them [Lubaczewska, 2009, p. 148]. The hope is that we will see a high number of positive initia-

¹Information obtained during work on the Protection Plan project for Chelmy Landscape Park coordinated by the National Foundation for Environmental Protection, which is based in Warsaw. One of the authors took part in the work of the team responsible for spatial planning analysis.

tives, including the educational activities that are of particular importance, from the Lower Silesian Landscape Park Administration in the Lower Silesian landscape parks. One of the best examples so far has been a series of seminars and meetings held with inhabitants of landscape parks².

CONCLUSIONS

The examples described show that the current procedure of public participation the law provides is insufficient if nature and landscape protection objectives are to be reached. In terms of nature conservation we are faced with a genuine legal mess: some authors claim that there are even crucial mistakes in the Act on Nature Conservation itself [Radecki, 2008]. Landscape park management can only act within the existing law. Nevertheless, some action to improve stakeholder dialogue during the preparation of protection plans can be taken.

After analysing the examples given, the authors reached the following conclusions:

- every park needs an individual approach; some of them are more “problematic” in terms of local political and investment conditions – the procedure for the preparation and approval of protection plans should be adapted to these conditions,
- educational activities in “problematic” parks should be conducted with particular attention to the adult inhab-

itants, investors and decision makers, who are rarely aware of their impact on the landscape,

- there is a strong need to build cooperation with different stakeholders at the preparation stage of protection plans as public participation is now limited only to consultation with community councils,
- the action taken to protect natural and cultural values in the parks require a systems-based approach and should be subject to long-term planning, which could be pursued through voluntary agreements and strategies,
- park managements lack human resources: a team of experts is needed to coordinate the difficult process of integrating nature-protection objectives with local economic development.

Landscape park management possesses limited financial resources, which hampers many of their initiatives, but they are always allowed to apply for external funding. This depends on the initiative of the particular management team and how it develops cooperation with local communities to achieve maximum effectiveness in landscape protection.

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²The meetings were held as part of the “Popularisation of knowledge about landscape parks and land management rules in the protected areas of four landscape parks” project.

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Streszczenie: *Ochrona i wzmocnienie siły krajobrazu w parkach krajobrazowych poprzez partycypację społeczną.* Parki krajobrazowe to bardzo ważny element systemu ochrony przyrody w Polsce. Zasobami parków zarządzają ich dyrekcje poprzez plany ochrony, zgodnie z ustawą o ochronie przyrody (2004). Mimo to wciąż niewiele parków dysponuje obowiązującymi planami ochrony. Artykuł przedstawia istotną rolę, jaką odgrywa społeczność lokalna podczas tworzenia planów ochrony oraz wdrażania ich zapisów. Oceniono tu stan obecny zarządzania krajobrazem w parkach krajobrazowych i zidentyfikowano najważniejsze problemy związane głównie z brakiem efektywnego zarządzania zasobami ludzkimi. Problem przedstawiony został na podstawie dwóch przykładowych parków krajobrazowych z województwa dolnośląskiego: Parku Krajobrazowego „Dolina Jezierzycy” i Parku Krajobrazowego „Chełmy”.

Protecting cultural landscapes in rural areas by economic means

JÓZEF HERNIK

Department of Land Management and Landscape Architecture, University of Agriculture in Kraków

Abstract: *Protecting cultural landscapes in rural areas by economic means.* The article presents a study of the importance of pilot projects for the protection and preservation of the cultural landscapes of rural areas in which no activities have so far been undertaken to ensure this protection. A number of pilot projects have been conducted in the rural communities of the Małopolska province in the south of Poland linking actions to protect and preserve the cultural landscapes of rural areas with specific business enterprises at the local level. The presence of cultural landscapes cannot hinder the economic usage of the areas they occupy. Using empirical research methods, the protection and preservation of the cultural landscapes of rural areas through pilot projects has been examined. To begin with, extensive data on the rural cultural landscapes of Małopolska was methodically researched (broad approach). Based on this analysis, two characteristic communities in Małopolska were chosen for detailed research: Miechów and Wiśniowa. Next, characteristic landscapes were selected from the other cultural landscapes for development as part of pilot projects in the area concerned (selective approach). In this way it was possible to test for the most appropriate action to take to conserve the cultural landscapes of these municipalities. In Miechów the action selected concerned renewable energy, while in Wiśniowa it was agro-tourism. The example of Miechów showed how it would be possible to obtain renewable energy from biomass, which is important in stimulating the development of agriculture and at the same time protects the agricultural landscape. The investments made in Wiśniowa, such as lake reconstruction and the restoration of the astronomical observatory, have made the area more attractive to tourists. These activities were based on the assumption that the great potential for development in Małopolska's rural cultural landscapes has not been exploited because of lack

of infrastructure. The pilot studies made in these two counties are aimed at demonstrating the relationships at the local level between action taken to protect cultural landscapes and business enterprises. The pilot projects showed that it is possible to preserve the cultural landscape while obtaining economic benefits.

Key words: cultural landscapes, rural areas, protection, preservation, renewable energy, tourism

INTRODUCTION

It can be seen in rural Polish communities that the cultural landscape has often been misunderstood and underestimated. In this way it has often lost out in the planning and forecasting phases, as well as later in those of implementation and construction, to more pressing requirements [Hernik, 2009]. This paper presents results of research on the importance of pilot projects for the protection and preservation of cultural landscapes in two selected Polish communities in Małopolska: Miechów and Wiśniowa. The projects were conducted within the terms of an international project of the Interreg III B CadSES EU programme “Protecting Historical Cultural Landscapes to Strengthen Regional Identities and Local Economies” [European Landscape Convention, 2000]. In Miechów and Wiśniowa pilot projects were carried out to demonstrate model examples of positive links between actions for the

protection and preservation of cultural landscapes and specific business ventures at the local level.

A new approach to cultural landscapes is coming into progressively clearer focus nowadays. The scenery is not only a protected good of historical and environmental significance, but it also has the potential for local and regional development [Bloemers, 2008; Gawroński, 2008; Dixon-Gough, 2009; Hernik, 2009; Van der Valk, 2009; Röhring, 2010]. However, additional instruments, plans, methodologies and, ultimately, tools for implementation are needed if such an approach to landscapes as a resource for local and regional development is to be taken [Hernik, 2010]. Cultural landscapes represent a specific value when they are properly taken into account in shaping the wider environment and spatial planning [Linke and Hernik, 2010]. However, improper planning and programme design can produce considerable risk and potential can be underestimated and, therefore, under exploited. In recent years, cultural landscapes have been regarded mainly in terms of the passive protection and preservation of historic structures and landscapes. It is well known that cultural landscapes should be protected, but this protection should be active and contribute to gradual, forward-looking local and regional development of a socio-economic character [Röhring, 2010].

MATERIAL AND METHOD

Selection of the test area

Efforts were made based on empirical research to examine the potential for

protection and preservation of the cultural landscapes of these urban-rural and rural areas through pilot projects. In this article these empirical investigations outweigh my own qualitative analysis. The research has been in progress since 2003 in Małopolska in the form of an in-depth study of two of its communities: Miechów (Miechowski District) and Wiśniowa (Myślenicki District). In the initial stage of research an extensive table of data about the cultural landscapes of the urban and rural areas of Małopolska (broad approach) was established [Hernik, 2008]. Two typical Małopolska communities were then selected for more detailed studies: urban-rural Miechów and rural Wiśniowa. The landscapes which are important for the development of each place in the pilot projects, including in terms of historical sources, were then selected (selective approach). The analysis was prepared based on frequent visits as well as on a number of source materials: local development plans, a study of the conditions and potential aims of spatial planning, the community development strategy and cartographic materials, including historical records of land and buildings, tourist maps and guidebooks. As a consequence, the selection was once again significantly amended. Cooperation with a number of people from these communities also had a great influence on this modification, so that the “view from the outside” on the landscape was complemented by a “view from the inside” given by the local population. This made it possible to select the most appropriate pilot projects for the conservation of cultural landscapes in Miechów and Wiśniowa. In Miechów the selected ac-

tion involved renewable energy, while in Wiśniowa it involved agro-tourism.

The pilot projects

The activities in Miechów and Wiśniowa are important pilot projects designed to show specific model examples of links between actions for the protection of cultural landscapes and specific business ventures at the local level (the protection of cultural landscapes through economic activity). The Miechów case shows the possibility of obtaining biomass for renewable energy, which is an important stimulator of the development of agriculture that also protects the traditional landscapes of the town. Rising energy prices and environmental considerations mean that biomass is likely to become a popular source of energy in rural areas. The effects on the landscape are also very interesting in this regard. In Wiśniowa there are investments in train for sustainable tourism within the project. These can influence the attractiveness of tourist locations very significantly and so entice investment which, for the most part, will be linked to tourism. This initiative is based on the finding that the great potential for the development of rural cultural landscapes in Małopolska remains unexploited due to deficiencies in infrastructure. The example of Wiśniowa also shows that it is worth investing in a place, where neglected areas can be revitalized and a contribution can be made to preserving the open cultural landscape of rural areas.

RESULTS AND DISCUSSION

Miechów: Małopolska'a renewable energy centre

The main function of the Miechów municipality is agriculture. The natural conditions of the community, which include its high-quality agricultural land and the favourable climatic conditions, are very helpful. Of the agricultural entities, private farms, of which only a few pursue non-agricultural activities, play an important role. Arable land, which accounts for approximately 96% of agricultural use, predominates. The main crops cultivated are wheat and barley, which account for approximately 90% of arable land use in the Miechów area. The other notable crops are oats and rye. After collecting the grain farmers have to recycle the remainder of the straw. The potential for processing it to make pellets means that the straw can be consumed and that efficient, environmentally friendly and cost-efficient fuel can be obtained. This means that interest in the processing of straw into pellets is high among the local farmers. What is more, farmers burn fields with large quantities of corn and rape straw every year. The crop structure in the community is very beneficial for the project as most farmers are able to recycle the straw remaining after the grain harvest and so receive a cheap and efficient fuel in the form of pellets. In this way the pilot project contributes on the one hand to improving the environment and helping to preserve the cultural landscape (fields) and on the other to protecting the cultural heritage of the area.

Miechów has been working for several years now to promote and implement solutions based on renewable energy sources and is one of the few communities in Poland to have done so. There are two aspects to the Miechów Renewable Energy Centre:

- a production line for briquetting and pelleting straw,
- creating a conference and training centre.

One of the most important points is that the Renewable Energy Centre does not conduct commercial activity: the farmers bring their straw for pelleting and receive the entire resulting product, while the costs they incur are used only to cover processing and to maintain production. This investment, which creates an opportunity to develop local agricultural raw materials and may also provide an alternative source of income for residents, will contribute positively in the long run to economic development throughout the community. As a consequence, the pilot project will help in preserving the agricultural landscape of a typical community. This very carefully selected project has had a positive influence on the cultural landscape of the area. It must be emphasized, however, that not every renewable energy project has a positive influence on the cultural landscape of a specific area.

Reconstruction of the historic small reservoir in Wiśniowa

Wiśniowa has all the qualities necessary to serve as an area for leisure and outdoor pursuits including the pursuit of recreational sport in exceptional natural surroundings. Its submontane location, mild climate, natural beauty and abun-

dance of wildlife provide excellent conditions for passive and active recreation, winter sports and extreme sports in the summer [Świtała, 2007]. It is for these reasons that tourism has been recognized in Wiśniowa's strategy as the primary impetus for its economic development. The beauty of the landscape is diversified by the existing monuments in the area, which also has excellent conditions for recreation, hiking and biking. It has a mild mountain climate, it is located in the Beskidy mountains away from the industrial centres and it is surrounded by extensive forests. This community has carried through an investment project involving the historical reconstruction of a small reservoir with an area of 0.68 ha, a capacity of 11,100 m³ and an average depth of 1.63 m, which is used for tourism and recreation. The reservoir has had an especially strong impact on increasing the attractiveness of the district.

The establishment of a model tourism farm attraction in Wiśniowa

The aim of this project is to protect the historic landscape of Wiśniowa and to strengthen the community identity of the regional and local economies through the establishment of a model tourism farm as a foundation for the development of a farm tourism base in Wiśniowa. The farm homestead was built to be in keeping with the traditional, historic buildings of Wiśniowa and therefore has the following features:

- ecological building – use of natural resources,
- use of local building materials,
- richly decorated facades that reflect the rich culture and high quality of local carpentry craftsmanship.

The project involved revitalising one of the community's original old buildings as a model development. Several potential sites that were unused and rapidly deteriorating were identified for this project. After analysing the options a building in Kobielnik was chosen, which was then renovated and adapted for agro-tourism. The project has therefore contributed to saving a historic building typical for the area of Wiśniowa from complete destruction.

This farm house was modernized, converted to a homestead in the style of a local folk-building and offered for lease. The project has therefore produced a fully-equipped model homestead built in the traditional Wiśniowa style with a total floor space of 155.5 m². The long-term goal is to open more farms such as this one as an example of a model agro-tourism farm and as an interesting example of the direction the farm tourism base could take in the Wiśniowa area.

Pilot projects as a stimulus for action

The projects and pilot activities in Wiśniowa and Miechów have been conducted as models for the positive links that can be established between the protection of cultural landscapes and specific business ventures at the local level [Hernik, 2009].

Miechów and district is an agricultural community struggling with serious problems. The most pressing of these are high unemployment, which has resulted in the depopulation of the villages, and the economic recession, which has particularly affected agriculture. It is for these reasons that, several years ago, Miechów began working on the promotion and implementation of

solutions based on renewable energy sources. This involved the extraction of energy from biomass, which was mostly straw. The biomass is entirely derived from the community and its source, the cereal crops, are an important part of the cultural landscape. The fields are typical for Małopolska, which means that they tend to be bounded by stands of trees, have ridges left unploughed in the body of a field or between fields, and be highly biodiverse. The renewable energy centre in Miechów was established to produce cheap and clean energy to meet the expectations and needs of society. It serves in particular to promote the use of biomass and other renewable energy sources and their impact on preserving the historic agricultural landscape.

The most important aspect of Wiśniowa's strategy is the development of tourism. To pursue this it has implemented a development programme for tourism infrastructure that takes account of the rich historical and cultural heritage and the attractive submontane landscape. It is only now, though, in a time of economic development and plummeting agricultural production due to low profitability, that the preservation of the landscape and cultural heritage has taken on a special significance. The resulting reservoir and agro-tourism projects are being used for tourism and recreation. These projects have raised the attractiveness of the community while preserving the distinctive cultural landscape of the area.

The activities being pursued in these communities are based on the assumption that the great potential for the development of Polish rural cultural landscapes has so far not been extensively exploited

due to lack of infrastructure. These examples have also shown that it is worth investing in a place where you can revive neglected areas and preserve historic cultural landscapes. It must be emphasised however that the pilot projects described involve activities that conform with the targeted profile of the two places concerned and cannot be directly (on a large scale) transferred to other communities on the assumption that the same results will be obtained. In such cases the new pilot projects must be chosen according to the approach outlined at the beginning of this study.

CONCLUSIONS

The pilot schemes in Miechów and Wiśniowa provide an example of the links that can be forged between the protection of cultural landscapes and business ventures at the local level. It is vital, however, that these projects are very diligently selected in line with the approach outlined at the beginning of the study. The study has shown both a practical approach to projects directed at protecting cultural landscape and how it may be possible to profit from them.

The example of Miechów shows that it is possible to obtain biomass for renewable energy, which is important in stimulating the development of agriculture and also protects the traditional landscapes. Rising energy prices and environmental considerations make biomass a potential source of energy in rural areas. In Wiśniowa sustainable tourism projects are in train or have been completed. These have involved the reconstruction of the reservoir, the development of ad-

acent areas for tourist infrastructure and the renovation of the model farmstead. These investments can have a significant impact on preserving the typical landscape of the community while increasing the attractiveness of these areas for economic development.

The management of cultural landscapes at the municipal level should be integrated with spatial planning, urban and cultural policy, environmental, agricultural, social and economic policy, as well as with any other policies that can have a direct or indirect impact on the landscape. It is evident, though, in Polish communities, and particularly in rural areas, that the nature and true potential of the cultural landscape has been neglected or has passed unnoticed.

The pilot projects in Miechów and Wiśniowa show that it is possible to preserve the cultural landscape while simultaneously obtaining economic benefits. Projects of this kind should therefore be adopted to secure the future of valuable cultural landscapes.

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- Streszczenie:** *Ochrona krajobrazów kulturowych obszarów wiejskich poprzez działania gospodarcze.* W artykule przedstawiono badania dotyczące znaczenia projektów pilotażowych na rzecz ochrony i zachowania krajobrazów kulturowych obszarów wiejskich, tam gdzie to tej pory nie podjęto tej ochrony. W wybranych gminach wiejskich województwa małopolskiego (południowa Polska) są prowadzone działania pilotażowe mające na celu pokazanie związków między działaniami na rzecz ochrony i zachowania krajobrazów kulturowych a konkretnymi przedsięwzięciami gospodarczymi na poziomie lokalnym. Na podstawie badań empirycznych przeanalizowano ochronę i zachowanie krajobrazów kulturowych na poziomie gmin wiejskich poprzez projekty pilotażowe. Na początku metodycznego podejścia do badań utworzona została rozległa tabela danych o krajobrazach kulturowych gmin wiejskich obszaru województwa małopolskiego (podejście rozległe). Na podstawie tej analizy wybrano dwie charakterystyczne gminy Małopolski do badań szczegółowych: Miechów oraz Wiśniowa. Następnie, spośród krajobrazów kulturowych gminy Miechów i gminy Wiśniowa wyselekcjonowane zostały krajobrazy o charakterze szczególnym dla

rozwoju danej gminy w ramach projektów pilotażowych (podejście wybiórcze). To pozwoliło na wybranie do badań projektów pilotażowych o najbardziej odpowiednich działaniach dla zachowania krajobrazów kulturowych tych gmin. W gminie Miechów wybrano działania dotyczące odnawialnych źródeł energii, a w gminie Wiśnio-wa agroturystyki. Działania w tych gminach stanowią interesujące działania pilotażowe mające

na celu pokazanie na konkretnych przykładach związków między działaniami na rzecz ochrony krajobrazów kulturowych a przedsięwzięciami gospodarczymi na poziomie lokalnym. Projekty pilotażowe w tych dwóch gminach pokazały, że możliwe jest zachowanie krajobrazu kulturowego i uzyskanie w tym samym czasie korzyści ekonomicznych.

Relicts of agricultural and settlement landscape in the Biedrusko military training ground

AGNIESZKA WILKANIEC, ANNA GAŁECKA, EWA de MEZER,
MARZENA JELENIEWSKA
Poznań University of Life Sciences

Abstract: *Relicts of agricultural and settlement landscape in the Biedrusko military training ground.* The area of Biedrusko has been a vast military training ground since the early twentieth century. Until the end of the nineteenth century there were seven villages there. When it was taken over by the military the local inhabitants were displaced and buildings were partly demolished. Since that time it has been used intensively by the military as a training ground, but not throughout its entire area. Its unused part has undergone processes of re-naturalisation. After one-hundred-and-ten years in operation, the training ground retains certain elements of the former cultural landscape in the form of still-preserved villages, while remnants of the road network, of composed plantings (particularly avenues of trees) and of housing development are still evident. The exceptional research value of the training ground for specialists in many academic fields stems from the opportunity it affords to observe changes occurring in a landscape that is not used intensively. Following spontaneous changes in the cultural landscape, investigating the visibility of landscape structures and evaluating their durability are all of interest to research teams.

Key words: cultural landscape, durability of landscape elements, historical rural landscape, military training ground

INTRODUCTION

Poland has many areas of abandoned landscapes, that is, agricultural and settlement areas from which local populations have been displaced. Their original

agricultural use has changed dramatically as a result of different historical conditions, such as wars or geopolitical transformations [Kijowska et al., 2010]. The greatest number of displacements in the present territory of Poland occurred in the first half of the twentieth century. Despite the fact that this is a common phenomenon of the Polish landscape, only a small number of cases have so far been studied, such as the village of Choceń [NID, 2003]. The studies conducted in the Bieszczady Mountains by Wolski [2007], which are cited in this paper on many occasions, are an exception in this respect.

Abandoned landscapes, such as military training grounds, are subject to only limited anthropopressure, which enhances their natural value. Interest in military training grounds as areas promoting the preservation of biodiversity, as indicated on the official website of NATO [NATO, 2012] or the World Association of Zoos and Aquariums [WAZA, 2012], is evident in Polish, European and global research trends. The Biedrusko military training ground has served as the site for studies of flora and fauna conducted by researchers from the Poznań University of Life Sciences and from the Adam Mickiewicz University of Poznań [Bo-

rysiak and Brzeg, 1994; Walczak, 2002; Konwerski and Sienkiewicz 2005]. Less attention, though, has been devoted to the preserved elements of the former cultural landscape in the military training grounds. The identification, valuation and interpretation of landscape relicts could prove a valuable source of knowledge of the historical landscape and the durability of its elements. The research made it possible to identify the most valuable elements of the cultural landscape. The main reason for examining the landscape is to discover how to protect current landscape structures – especially where land use has changed.

As is the case with other areas that have seen population displacement [Wolski, 2007], or which were abandoned as a result of destruction caused by warfare and thus whose use changed dramatically within a short period of time, military training grounds constitute interesting objects of investigation. In the normal development of rural areas what we find is the gradual accumulation of elements that combine to form the cultural landscape [Chojnacka and Wilkaniec, 2009]. The values connected with local traditions, the *genius loci*, are preserved along with the memories of the former inhabitants and the heritage passed from generation to generation [Affek, 2011]. When its composition and structure are visible and comprehensible in its historical context [Antrop, 2005] the cultural landscape maintains its character and value with reference to the concept of *genius loci*. Affek [2011] raised the question of whether landscape that has seen powerful transformations maintains its values or loses its former character. Affek's response was that the radical

changes landscape is subjected to lead to former values losing their importance and being replaced by others (natural value instead of cultural values).

The moment chosen to begin studies of the Biedrusko military training ground was not a coincidence. There is a plan to close a number of military training grounds in Poland in the near future [Górka, 2012], which may mean that their unique landscape value is lost.

The aim of the investigations was to identify the preserved elements of the cultural landscape connected with its former function as an agricultural and settlement landscape. Another research issue was to check and test the durability of individual landscape elements. An attempt was made to determine which elements may be considered more durable and stable and, where elements had become degraded, to identify the primary causes.

There were seven villages (Chojnica, Glinienko, Glinno, Knyszyn, Łągiewniki, Trzuskotowo and Tworkowo) as well as four small settlements (Czerwona Niwa, Janowo, Łysy Młyn and Okolewo) in the researched area prior to the establishment of the military training ground. The history of the village settlements reaches back to medieval times [Pilarczyk and Rewers, 1991]. Chojnica and Glinno were sites of small fortified settlements from the early Middle Ages [Chruszczewski, 2010, p. 21]. In the fourteenth century Trzuskotowo and Łągiewniki were founded based on German law charters [Chruszczewski, 2010, p. 23]. Trzuskotowo had a village green typical of medieval villages founded based on German law charters that could be seen on archival maps until the end of the nineteenth

century. Most of this area, which is now occupied by a military training ground, belonged to the estate of the Cistercian nunnery in nearby Owińska. Following the secularisation of the religious order in 1797 the estates of the nunnery were sold to the German von Treskow family [Chruszczewski, 2010, p. 30]. In 1901 Arthur von Treskow sold Knyszyn, Tworkowo and Trzuskotowo to the Prussian military, with Biedrusko being sold in 1904 [Ingot, 2006, p. 87].

The inhabitants of Knyszyn, Tworkowo and Trzuskotowo were displaced and the buildings were demolished. After some further buildings had been demolished, a military camp was established in Biedrusko. The former von Treskow family palace remained along with some of the manor buildings, which were adapted to the needs of the military [Ingot, 2002, p. 43]. The military training ground was extended in 1943 (Fig. 1) to include Chojnica, Łagiewniki, Glinno and Glinienko [Chruszczewski, 2010, pp. 89, 99]. Even before that date Chojnica had been partly located within the military training ground: the boundary

cut across the northern part of the village [WIG 1925, 1928]. At first, none of the buildings in the villages were demolished. The decision to incorporate further lands into the military area was also pursued after the end of WWII so that in 1947 the inhabitants of Chojnica, Glinno, Glinienko, Łagiewniki and Okolewo were forced to leave their farms, while the buildings were earmarked for demolition [Chruszczewski, 2010, p. 111].

The lands were used intensively by the military as a training ground, although the operations did not cover their entire area. In this way the unused portions underwent processes of re-naturalisation. After one-hundred-and-ten years in operation, the training ground retains certain elements of the former cultural landscape in the form of still-preserved villages.

MATERIALS AND METHODS

The settlements that no longer exist in the military training ground were identified based on source literature and on

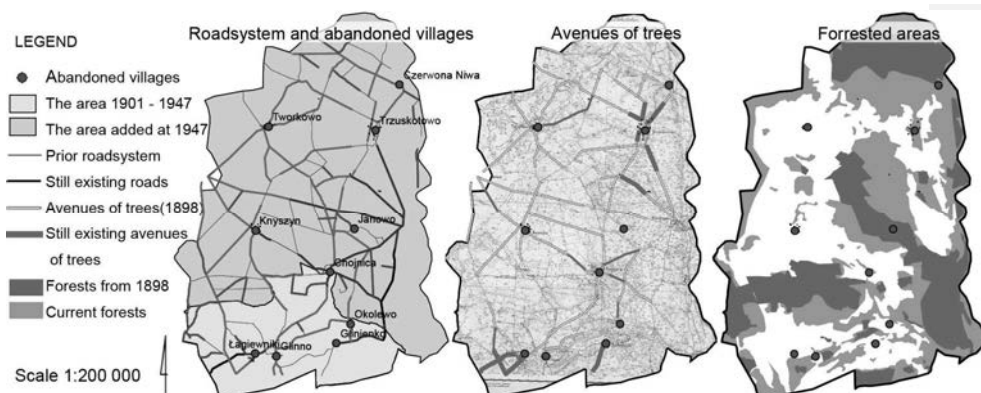


FIGURE 1. A review map of the military training ground (boundaries, areas incorporated after 1947, location of villages)

iconographic and cartographic materials. This information was supplemented by data collected from the Geographic Dictionary of the Kingdom of Poland and other Slavonic countries [Sulimierski et al., eds., 1880–1902] and data contained in contemporary publications concerning the history of the Suchy Las community council [Pilarczyk and Rewers, 1991; Chruszczewski, 2010]. The contemporary and archival cartographic materials [Mestischblatte 1898, 1911, 1944; WIG 1925, 1928; contemporary 1:10 000 topographic maps] received the bulk of the attention. They were used as time references for the analysis of changes occurring in the landscape, while precise calculations were made possible using GIS tools. The archival materials were georeferenced to assign spatial references to the individual data contained in the maps. The analysis of geobase objects, which constitute direct reference points for individual time intervals, helped to determine the extent to which individual elements of the cultural landscape had been preserved.

Investigations which involved collecting photographic documentation of the identified traces were conducted on the site at the same time. The remnants of the elements that formed the original structure of the cultural landscape were identified. The first analyses were conducted on the road network, the composed plantings, the greenery around the building development, the traces of building structures and the sacred buildings. As there had been a considerable degree of landscape transformation, the coordinates for the characteristic points on site were inventoried using GPS equipment. The points were then trans-

ferred to GIS software onto spatially referenced grid layers of the archival maps mentioned previously. This made it possible to definitively locate and identify objects. The authors created an original scale of evaluation scores to analyse the state of preservation of cultural landscape elements, which was adapted to the individual categories of objects. In the case of roads and avenues of trees the length of their preserved courses was established. The scoring scale was based on the percentage ratio of the preserved objects to the original state as presented by the archival maps [Mestischblatte 1898, 1911, 1944; WIG 1925, 1928]. The percentage method was also used to express changes in the area where land use was maintained. The extent of preservation of building structures and their accompanying green areas was assessed using a descriptive scale covering several points (see the legend for Table 1). The aim of the scale that was adapted and applied to the categories of objects was to make the evaluation of landscape elements more objective. In an approach known as landscape stratigraphy [Raszeja and Gałęcka, 2011], the current forms of cultural landscape were interpreted by explaining their genesis and by following the transformations they had undergone.

RESULTS AND DISCUSSION

It was shown that all of the above mentioned categories of cultural landscape elements are found in the Biedrusko military training ground. The state of preservation of these objects, which is presented in detail in this section, con-

TABLE 1. Evaluation of the preservation of individual elements of the cultural landscape in the Biedrusko military training ground

Road network	Avenues of trees	Building development	Green accompanying building development	Land use form	Others
1	2	3	4	5	6
Chojnica					
2	1	2+	3	2	cemetery
Glinno					
3	2	1	1	1	former fortified settlement
Łagiewniki					
4	3	1	3	1	
Glinienko					
2	3	1	1	2	
Okolewo					
3	2	1	1	2	
Trzuskotowo					
2	2	2+	2	2	
Tworkowo					
3	1	1	1	2	
Knyszyn					
3	1	1	1	2	
Janowo					
2	none	4	2	4	
Czerwona Niwa					
4	2	0	0	2	
Łysy Młyn					

Table 1 (continued)

1	2	3	4	5	6
3	none	4	1	3	
Scoring scale:					
preserved in relation to original status (%) 1. 0–25 2. 26–50 3. 51–75 4. 76–100	preserved in relation to original status (%) 1. 0–25 2. 26–50 3. 51–75 4. 76–100	0. no traces 1. remnants (single ruins, hollows, rubble left from building structures) 2. evident traces of building development (evident fragments of foundations) or single preserved objects of different degrees of deterioration or destruction (denoted with + in the table) 3. transformed building development (not found in the analysed area) 4. preserved building development	0. none 1. single specimens 2. numerous specimens of different species 3. evident green arrangements	changes concern area, in which land use was preserved (%) 1. 0–25 2. 26–50 3. 51–75 4. 76–100	remarks on evident objects not included in other columns

siderably hindered the reading of landscape structures.

The course of the roads found in the military training ground had changed significantly. In 1911 there were 277.38 km of roads. Of this, only 139.10 km remain, which is just over half (50.15%) of the historical system (Fig. 1). The roads that formerly linked the individual villages and settlements most probably appeared at the same time as the settlements themselves and declined in importance at the time villages were destroyed. Sections of former roads, which lead from the villages that exist now and are located outside the boundaries of the military training ground, have been preserved. These are, for example, the road that starts in Biedrusko (which remains the military camp's HQ), the road linking Biedrusko with Chludowo (located outside the military training ground) and the road leading from Chludowo towards former villages that were incorporated into the military training ground.

Roads that used to link displaced villages, such as those between Trzusko-towo and Knyszyn, and between Knyszyn and Chojnica, are barely traceable or practically impossible to identify on site as they were not always recorded in land survey plans. The original system of main transportation routes has been considerably depleted. What is more, the status of roads has changed. According to archival maps, many of the arteries that constituted the main transportation grid of the area in the early twentieth century are now barely passable dirt roads. In several places original cobbled stone pavements have been preserved.

The road system is considered a relatively durable element of a landscape

[Wolski, 2007, p. 181]. This may be true in the case of agricultural landscapes that have been gradually transformed and whose leading land use function, cultivation, has been preserved. In such a case the road network continues to be developed when new sections are added, the rank of roads is changed or when, occasionally, older routes disappear [de Mezer, 2009]. The areas occupied by villages of medieval origin located in the Lednicki Landscape Park, which have been covered by similar studies [Chojnacka and Wilkaniec, 2009], serve as examples of road network development of this kind. Very few former roads are still used in the military training ground in Biedrusko. The older road system has been partly replaced by a new system of dirt roads, whose routes correspond to military needs. A new transportation route system was also introduced over an extended area of forested land. The contemporary division of forested areas into compartments corresponds to only a limited degree with the former road routes. It may be concluded that the change in the road system is less the result of naturally occurring phenomena and more that of human activity, which has eliminated a former arrangement that no longer meets contemporary needs.

Avenues of trees have survived in only a few cases (Fig. 1), with only 21.72% of their length (14.87 km) remaining compared to the 68.47 km of avenues there in 1911. That avenues of trees are no longer found along the main roads that constitute the transportation route grid for the military training ground, while being preserved along roads which are very much less important than before, is a characteristic symptom. This may be connect-

ed with less intensive use meaning that certain roads have not been attended to or maintained. There are several cases of longer avenues of trees being preserved. They include section along the road leading from Trzuskotowo to Czerwona Niwa (planted with *Fraxinus excelsior* L.) and that along the road leading out of the military training ground from Łagiewniki (planted with *Robinia pseudoacacia* L.). There are also a number of shorter sections, which in the past were probably longer, such as the avenue of trees near Okolewo and the fragment on the western side of Trzuskotowo.

The building development in the villages of Trzuskotowo, Tworkowo and Knyszyn was demolished in the first decade of the twentieth century, while that in Łagiewniki, Glinno, Glinienko and Chojnica after 1947. Only a brick, late-Gothic church, which has deteriorated considerably over time, has survived in Chojnica. Another characteristic building that is a remnant of a former village is the brick chimney remaining from the industrial part of the manor farm in Trzuskotowo. The stone and brick foundation of a tower – an artillery observation post erected by the military at the beginning of the twentieth century in Tworkowo [Ingot, 2002] – is a further relict probably connected with the former manor farm buildings. The demolition works also left behind fragments of brick buildings in the form of heaps of debris, ruins or traces of stone foundation walls in the villages that remain. These are most numerous in former Trzuskotowo and Chojnica and less so in Glinno and Glinienko, while a number of single fragments are found in Tworkowo and Okolewo. Generally, there are no remnants of building devel-

opment in Knyszyn and the former village of Łagiewniki, where the only evident element is an elevation with stairs, which is what remains of a manor house building, over which the Monument to the Victims of Nazism was erected in the 1960s. No clear remains of building development were found in the Czerwona Niwa settlement or at the forester's lodge in Knyszyn. It should be stressed here that the gamekeeper's lodge, Gajówka Janowo, and the Łysy Młyn settlement in the eastern part of the military training ground have the only building complexes still in occupation with well-preserved architectural content. After 1901 building development appeared in the form of numerous shelters, observation posts and other structures connected with the operation of the military training ground. It may be considered of interest that in terms of the preservation of building relicts no distinct differences may be observed between areas previously incorporated into the military training ground (in 1901) and those included in 1947 (Fig. 2). This may indicate that the primary factor causing the destruction of buildings was not connected with natural phenomena, which gradually obliterated traces of human settlements, but was rather due to deliberate demolition work. The scale of the occurrence of building relicts in individual villages is probably connected with the thorough nature of demolition works and only to a lesser degree with the processes of natural destruction of building structures and the passage of time.

The durability of building development in former villages in the military training ground may not be related to examples provided by villages gradually

transformed as a result of the evolutionary development of settlement systems. Instead, it may be better compared to the situation of other villages that were depopulated rapidly. A good example is provided by the Boiko villages in the Bieszczady Wysokie Mountains as described by Wolski [2007]. There is a similarity in the time horizon of the displacements, which took place in the 1940s (the military training ground was extended in 1947), while the differences are probably connected with the types of building structure and the later land use. Studies conducted in the Bieszczady region have revealed numerous remnants of the stone foundations of buildings. Wolski [2007, p. 162] identified the cause of the buildings' destruction as mainly connected with human activity and only to a lesser degree with natural factors.

There are many remnants of the stands of trees that were planted alongside no-longer-existing buildings in the former villages of the Biedrusko military training ground. These are mainly composed of fruit trees, *Syringa vulgaris* L. as well as *Tilia* sp., *Aesculus hippocastanum* L. and *Robinia pseudoacacia* L., found as single specimens or forming linear arrangements in the form of short rows. In individual cases they mark the outlines of former building structures, such as in the rectory yard at Chojnica. Traces of green planting arrangements accompanying the church and cemetery in Chojnica have also been preserved. There are also interesting specimens of monument-size trees (including *Thuja* sp. and *Quercus* sp.) that accompanied the manor house in Łagiewniki when it was still standing. The situation is different in Knyszyn, where the old trees in the park

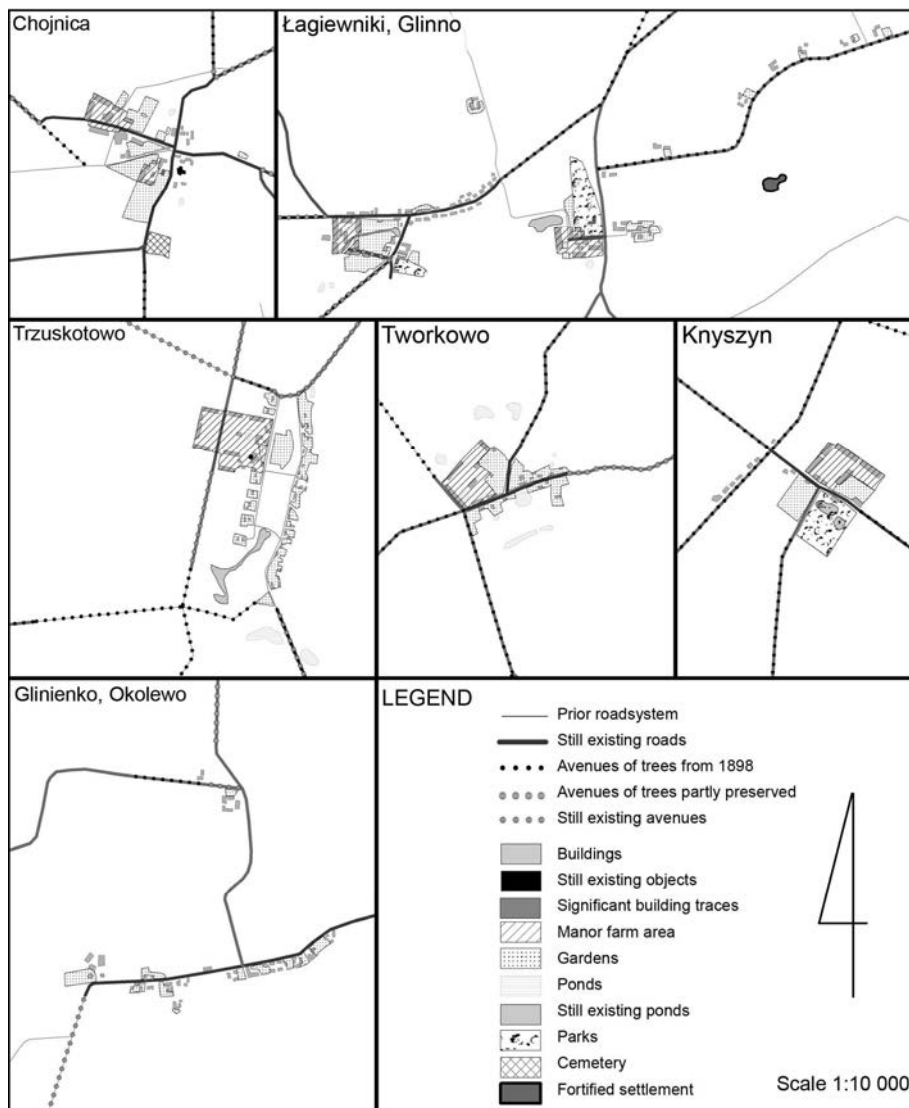


FIGURE 2. Spatial arrangement and building development of villages

have not survived and the only visible element of the former arrangement is connected with two ponds and an island. In many cases it is difficult to discern the composition or layout of the remaining green arrangements as the buildings that previously provided their contextual framework have been destroyed.

As Wolski stated with reference to the displaced Bieszczady villages [2007, p. 183], the common reaction of landscape to the elimination or reduction of anthropopressure involves qualitative and quantitative changes in the vegetation cover. This is also found in the agricultural landscape of the villages that previ-

ously covered the area of the Biedrusko military training ground where human activity connected with land cultivation was replaced with actions resulting from the new military function of the area. The new type of land use is connected with the intensive use of only a fragment of the area covered by the military training ground. The lower anthropopressure has produced phenomena associated with secondary plant succession. Large areas of land formerly in cultivation have been overgrown with clusters of trees and shrubs and now predominate in the military training ground. The forest cover of the area has also increased considerably from 20.51 to 45.73% (Fig. 1). A characteristic example is provided by the village of Trzuskotowo, which was once surrounded by farmland and is now, apart from a narrow belt of fallow field to the east, adjacent only to forest. The few areas currently covered by low vegetation in the military training ground are relatively small areas covered by cultivated fields and areas under more intensive use by the military.

The exclusion of the military training ground from intensive agricultural use has resulted in the establishment of plant communities of considerable natural value, which shelter many animal species, and in the formation of an interesting landscape of exceptional scenic value, where natural elements of secondary origin predominate (Fig. 3). The exceptional natural and landscape resources of the military training ground led in 1995 to the founding of a Protected Landscape Area and Natura 2000 Special Protection Area [Chruszczewski, 2010, p. 146] in Biedrusko. The military training ground is also a potentially attractive recreation

area for the inhabitants of the nearby city of Poznań and the Suchy Las community council area, where housing is being rapidly developed. This applies particularly to the southern part of the area, which is used less intensively by the military.

CONCLUSIONS

1. The studies conducted at the military training ground in Biedrusko showed a slight variation in the degree of preservation of spatial structures of anthropogenic origin in the areas included in the military training ground both in the earlier period (1901) and at the later date (1947). Human activity, rather than natural processes, may have played the major role in the destruction of the anthropogenic elements of the landscape.
2. Of the landscape elements analysed, the plantings of ornamental fruit trees accompanying former building structures were found to be of a relatively high durability.
3. The historical system of roads found in the military training ground is now largely destroyed, while the remains of buildings included in the demoli-



FIGURE 3. Photograph – a characteristic landscape in the military training ground of Biedrusko

tion programme may now hardly be discerned.

4. There has been a considerable reduction in the area occupied by low vegetation as the natural consequence of plant succession and afforestation.
5. It is difficult for those who are not trained to read the historical layers accumulated in the landscape to appreciate the value of the cultural landscape in the military training ground in Biedrusko. Therefore, if the military training ground is to be made more accessible to the public, certain of the landscape structures would have to be made more readily legible.

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Streszczenie: *Relikty krajobrazu rolno-osadniczego na terenie poligonu Biedrusko.* Teren Biedruska od początku XX wieku zajmowany jest przez rozległy poligon wojskowy. Do końca XIX wieku na tym obszarze istniało 6 wsi: Chojnica, Glinienko, Glinno, Łągowniki, Trzuskotowo i Tworkowo. Ciągłość osadnictwa sięgała czasów średniowiecza. W momencie przejścia terenów przez wojsko miejscowa ludność została wysiedlona, a zabudowa wsi częściowo wyburzona. Od tego momentu poligon był intensywnie użytkowany przez wojsko jako teren ćwiczeń, jednak nie na całym obszarze. Niewykorzystywana część terenu podlegała wtórnej naturalizacji. Po 110 latach funkcjonowania poligonu, niektóre elementy dawnego krajobrazu kulturowego, związanego z istnieniem wsi na tym terenie, są nadal zachowane. Czytelne są pozostałości m.in. układu dróg, nasadzeń komponowanych (zwłaszcza alei) oraz relikty zabudowy. Należy podkreślić, że poprzez użytkowanie wojskowe poligon został wyłączony z procesów urbanizacji, którym podlegają pozostałe tereny wchodzące w skład Aglomeracji Poznańskiej. Wyjątkową wartością badawczą obszaru poligonu, dla specjalistów z wielu dziedzin, jest możliwość obserwacji zmian zachodzących w krajobrazie wyłączonym spod intensywnego użytkowania. Celem opisywanych badań było prześledzenie spontanicznie zachodzących zmian w krajobrazie kulturowym, obserwacja czytelności struktur krajobrazowych oraz ocena ich trwałości. Skoncentrowano się na dokładniejszej analizie dostępnych źródeł historycznych w odniesieniu do współczesnych materiałów kartograficznych oraz na studiach terenowych. Poza aspektem poznawczym wyniki badań mogą znaleźć zastosowanie w tworzeniu programu turystyczno-rekreacyjnego dla mieszkańców północnej części Miasta Poznania.

“Landscape power” as a main determinant in the composition of seventeenth-century residences

DOROTA SIKORA

Department of Landscape Art Faculty of Horticulture and Landscape Architecture, Warsaw University of Life Sciences – SGGW

Abstract: *“Landscape power” as a main determinant in the composition of seventeenth-century residences.* One of the basic manifestation of the humanistic outlook and the realistic attitude towards nature was the sense of landscape beauty that first appeared in the Renaissance and was carried through to other epochs. In the seventeenth century it was applied by aristocrats in their designs of residential complexes which were opened to the surrounding landscape through loggias, terraces and pavilions, which provided scenic views. The Mannerist residences situated on the slopes of Frascati hill – Villa Aldobrandini, Villa Ludovisi, Villa Mondragone – served as models for the development of palace and garden complexes in an Italian style [Ciołek, 1954, pp. 49–59]. The major aspect of the composition that made these villas exemplary was their favourable location in the landscape on the hillside to the north overlooking the hilly suburban area, the town of Rome and the ruins of ancient Tusculum [Azzi Visentini, 1998, p. 105]. The model of residential estates developed in Italy became very popular in seventeenth-century Poland. In the first half of the century aristocratic residences, although they were still designed as part of fortress complexes, took full advantage of natural qualities derived from the surrounding landscape. The chief examples of this phenomenon are Krzyżtopór near Ujazd belonging to Krzysztof Ossoliński, Podhorce owned by Stanisław Koniecpolski (now in Ukraine), the Puławy property of Stanisław Herakliusz Lubomirski and many Warsaw palace and garden complexes located on the crown of the Warsaw Scarp. Few of the relationships originally intended between these residences and the landscape are either appreciated or understood these days. Since they represented, as has been pointed out, one of the basic values in the group of selected monu-

ments, they should be restored and protected as part of a process of conservation wherever possible. The Florence Charter states that a historic garden cannot be isolated from its own environment and recommends that it should be preserved and conserved in appropriate surroundings so that its attributes are protected.

Key words: landscape, landscape protection, historic monument, seventeenth-century residence

INTRODUCTION

The need to protect historic landscapes in the face of the negative changes currently affecting the surroundings of heritage sites is a very real problem and a phenomenon clearly evident in relation to historic residences, the majority of which were designed in suburban areas and later assimilated by towns, which resulted in vast changes in local spatial relationships.

Selecting a site for a residence was never a matter of chance: other than functional factors, locations were also dictated by exceptional landscape values, that is, the local “power of the landscape”. The connection between a residence and its associated landscape was of outstanding significance in the seventeenth century (Fig. 1). It is sad that now many of the residences of that period

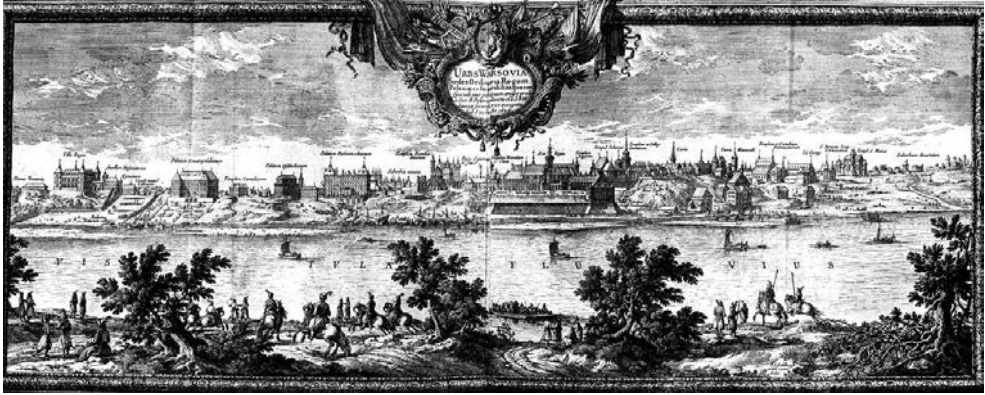


FIGURE 1. A panoramic view of Warsaw by Eric Dahlberg (1656, reprint in author's archives). The relationship between Warsaw residences located on the Warsaw Escarpment and the Vistula River is visible

are now very frequently being stripped of their former spatial context and thus becoming devoid of their fundamental attributes – despite the obligation of contemporary societies to protect the value of heritage sites by both legislation and conservation policy.

Although Polish researchers are now devoting considerable attention to historic urban complexes and the need to protect the value of a landscape's natural environment, the subject of residences in the landscape is seldom studied independently. Some of the leading Polish experts on historic gardens wrote about the landscape context of seventeenth-century residences, among them Gerard Ciołek [1954, pp. 49–59], Longin Majdecki [1981, pp. 353–363] and Janusz Bogdanowski [2000, pp. 61–67]. However, their observations relate primarily to historic aspects with no reference to the current condition of these interrelationships or to the prospects for protecting what remains of them. Their approach contrasts with that of Aleksander Böhm [2007, p. 141], who pointed to the inade-

quacy of contemporary planning legislation in terms of protecting the landscape values of areas linked to residences, and with that of Alberta Campitelli [2007, pp. 25], who takes Rome as an example to illustrate the scope of protection for several hundred hectares of farm landscapes associated with historic villas within the boundaries of the modern city.

Residences and landscapes in seventeenth-century Poland

One of the basic manifestations of the humanist view of the world and of a realistic attitude towards nature was the growing appreciation of the beauty of landscapes, which first emerged in the Renaissance. In the seventeenth century this appreciation was reflected by the manner in which residential complexes were shaped, being opened out as much as possible through the use of loggias, terraces and pavilions that commanded views of the surrounding countryside. It was in this period that the belvedere became a characteristic device employed to connect a residence with its landscape.

In seventeenth-century Europe the model from which Italian style palace-garden complexes evolved was provided by the Mannerist residences located on the slopes of Mount Frascati. These were the Villas Aldobrandini, Ludovisi and Mondragone (Fig. 2). That they were favourably sited in the landscape on a north-facing slope looking out over Rome and its suburban hills, and onto the ruins of ancient Tusculum, was a key factor in their value [Azzi Visentini, 1998, p. 105].

Leon Battista Alberti, whose experience in architecture and urban planning was still a point of reference in the seventeenth century, recommended that the location selected for a residence should afford views of a city, a castle, the sea, a broad plain or recognisable hills and mountain peaks. He further advocated that a seat of this type should be built on the most estimable site on an estate and should provide unrestricted access to the

comforts and pleasures of the wind, sun and scenery [Zarębska, 1998, p. 113].

The model for residences devised in Italy became very popular in Poland during the seventeenth century. The Polish magnates gave serious consideration to the issue of landscape when choosing where to build a residence on their estates and an “Italian garden” was listed as one of eight things sought after by every nobleman [Haur, 1679].

The residences of magnates in the first half of the seventeenth century, though often still incorporated into fortifications, made full use of the values of the natural surroundings. The leading examples of this phenomenon include Stanisław Koniecpolski’s Podhorce (present-day Pidhirtsi in Ukraine), Krzysztof Ossoliński’s Krzyżtopór near Ujazd and Stanisław Herakliusz Lubomirski’s Puławy.

In Podhorce the unencumbered vista stretching out from the palace terraces looked out towards the plains of Volhy-



FIGURE 2. Villa Mondragone, Frascati (photo by D. Sikora, 2006)

nia for tens of kilometres (Fig. 3). The qualities of the view were enhanced by the relative positions of the garden terraces (the “auditorium”) and the landscape (the “stage”). The garden at Podhorce was located on a north-facing slope (part of the Voronyaky hills) and afforded favourably sunlit views of the plain below. This is directly analogous to the location of the Villa Aldobrandini in Frascati, which is hardly surprising given that both the palace and garden at Podhorce were created for Hetman Koniecpolski by Italian designers.

Warsaw residences were also consciously opened out onto the landscapes around them in the seventeenth century – in this instance primarily onto the valley of the Vistula River. It was during this period that the gardens of Warsaw’s Royal Palace were modified and enclosed within a high retaining wall and that new developments were raised on the Krakowskie Przedmieście: these were the palaces of the Kazanowski and

Koniecpolski families and the Villa Regia, all of which were furnished with terraced gardens overlooking the Vistula and commanding extensive views of the lower-lying grounds. The Grand Marshal of the Crown, Stanisław Herakliusz Lubomirski, made full use of the landscape values of his residence in Jazdów on the outskirts of Warsaw, when he opened out his property towards the Vistula. A contemporary Italian dignitary made this remark regarding the style of his residence, ‘it is plain to see that the prince has spent a long time in Italy, namely in Rome, from whence he has transplanted to his homeland the idea of Roman grandeur’ [Kwiatkowski, 2000, p. 19].

By the end of the seventeenth century the need for a strong link between the landscape and its surroundings was ever present, though it was now not merely a matter of displaying the values of the existing landscape, but also of subordinating it to the residence, which resulted



FIGURE 3. Podhorce: view from the residence towards the plains of Volhynia, which have not changed since the residence was built (photo by D. Sikora, 2004)

in the increasingly frequent implementation of the seventeenth-century French imperative *forcer la nature*. One residence which reflected these two ways of perceiving the landscape was Jan III Sobieski's Wilanów. The seventeenth-century art of creating a link between a residence and its landscape is clearly referenced in the Villa Nova Palace. It is appointed in the Italian style with a belvedere, a garden with terraces leading down to the valley of the Vistula and, as at Podhorce, a pavilion with vantage points in the corners of the garden terraces. The landscaping of the residence's west end, which featured a *patte-d'oie* and a clearly accentuated several-hundred-metre-long vista looking towards the Warsaw Escarpment and demarcated by a tree-lined canal was, by way of contrast, an innovative attribute in keeping with the classical French school of landscape design.

Seventeenth-century residences in the contemporary landscape

Few of the former interrelationships between residences and landscapes remain perceptible to this day: most have become obscured by urban sprawl or by the natural succession of vegetation. In view of the fact that, as has been demonstrated, they constituted one of the fundamental attributes of the heritage sites under discussion, conservation activities should strive to define and protect them wherever possible.

The Florence Charter stipulates that a historic garden cannot be separated from its surroundings and recommends that it should remain and be preserved in its original setting and thus retain its attributes [Florence Charter, 1982, art. 7].

By its very nature a landscape is dynamic. In accordance with the European Landscape Convention, modern-day landscape management aims to retain and maintain a landscape's important or characteristic features, giving direction to and harmonising any changes resulting from social, economic and environmental processes [European Landscape Convention, 2000, art. 14]. The focus of landscape studies should be redirected from research into landscape composition to the causes of its alteration [Böhm, 1996, p. 9].

The interrelationships between the residences detailed above and their respective landscapes have survived to varying degrees. Those located in non-urban areas remain very well defined to this day. In Podhorce they survive virtually intact, at Krzyżtopór Castle it is quite reasonable to put forward the bold hypothesis that the historic values of the surrounding landscape are much better preserved than those of the castle itself, which, together with the garden, has remained in a state of permanent ruin since the days of the Swedish Deluge. In Puławy the grounds between the palace complex and the Vistula were never reshaped with any lasting effect. The values of the Vistula's valley landscape were harnessed in the early nineteenth century by Izabela Czartoryska, who used them as the basis for a romantic park. In more recent times only allotments have been introduced to this landscape.

The situation is far worse in the city environments. Among the Warsaw residences outlined in this paper only the Royal Castle's interrelationship with the Vistula landscape remains clearly defined. The situation regarding Ujazdowski Cas-



FIGURE 4. The spatial relationship between Kazimierzowski Palace (now Warsaw University) and the Vistula River has been destroyed by high buildings and trees (source: Google maps)

tle is somewhat worse: although its links with the Vistula valley were emphasized in later years by the Piaseczyński Canal, contemporary building developments on the riverbank in a line with the castle's axis have disrupted this concept. The Villa Regia (Kazimierzowski Palace) has been totally deprived of its historic spatial context as multi-storey residential buildings have been raised between the palace and the bank of the Vistula. It can only be hoped that conservation measures currently being proposed will result in the visual reconnection of the grounds of the escarpment and those at its foot.

The Kazanowski Palace, which had already been converted into a Carmelite convent in the seventeenth century, is in a similar situation: the only reminder of any link between the complex and the grounds at the foot of the escarpment are the vast retaining walls of the terraced gardens. The views overlooking the Vistula have been obscured by trees and residential buildings.

The interrelationship between the Konicpolski Palace (now the Presidential Palace) and the Vistula valley has also been lost, though the fact that this palace and the one in Podhorce were both owned by the same proprietor in the seventeenth century suggests that the spatial context and the views of the Vistula valley were of prime significance at this site. Sadly, these attributes were forfeited with the construction of the National Security Bureau (at the eastern edge of the palace garden), the expansion of the hospital on Karowa Street and by the presence of tall, dense vegetation in the line of vision.

What are the reasons for the poor state of preservation of the landscapes surrounding these residences, particularly those in urban environments? The salient factors undoubtedly include a lack of awareness of the need to protect these areas, urban pressures and the inadequacy of the available spatial planning tools. All of these points were highlighted by Professor Aleksander Böhm when analysing

the state of the cultural landscape associated with the Wilanów residence. In this case the Wilanów Axis is itself subject to several local land development plans whose recommendations often conflict [Böhm, 2007, p. 141].

As has been illustrated by the Italian examples cited above, landscapes associated with residences can and should be protected. Recognising this as a necessity enabled Rome (a city whose population has grown due to urban pressures from 400,000 to 2.5 million over the past one-hundred years) to retain its landscape heritage in the guise of areas covered with natural vegetation and areas of farm landscapes linked to Roman villa-style residences. These areas are just as important as architectural heritage in the context of building a city's identity [Campitelli, 2007, p. 25].

RESULTS AND DISCUSSION

The study undertaken here found that the small number of extant seventeenth-century residences, which are of exceptional artistic value, are now being deprived of their respective spatial contexts. These circumstances have become much exacerbated since they were described by Poland's leading theoreticians of garden design: Gerard Ciołek, Longin Majdecki and Janusz Bogdanowski. This process is especially noticeable in urban areas. Professor Aleksander Böhm sees most of the causes of this state of affairs in the inadequacy of planning legislation and in the limited powers assigned to cultural parks to protect their heritage.

A further reason for the poor state of preservation of residential landscape is that dynamic processes of urbanisation occur at a much greater pace than do the formal conservation procedures involving an entry into the national heritage register for culturally valuable areas.

CONCLUSIONS

1. Seventeenth-century residences form a very valuable group of heritage assets – in terms of their artistic and historic value and also because so few of them survive.
2. Through their links with their surroundings, seventeenth-century residences served as local landmarks and often provided the focal point in the landscape within a radius of many kilometres.
3. Seventeenth-century residences were set in a strictly defined spatial context – any changes to this context detract from their value.
4. The spatial contexts of the group of residences under discussion have survived in much better condition in open rather than in urban landscapes.
5. Legislation should be devised which will guarantee respect for the historic spatial contexts of those seventeenth-century residences which still retain intelligible visual interconnections.
6. Efforts should be made as part of contemporary development processes to make at least symbolic references to residences whose spatial context has been irreversibly altered.

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Streszczenie: *Potęga krajobrazu jako główny wyznacznik kompozycji siedemnastowiecznej rezydencji*. Jednym z zasadniczych przejawów humanistycznego poglądu na świat i realistycznego stosunku do przyrody było rozwijające się

od czasów renesansu poczucie piękna krajobrazu. Poczucie to obecne było i w kolejnych epokach – w siedemnastym wieku zmaterializowało się między innymi w sposobie kształtowania założenia rezydencjonalnych, maksymalnie otwartych poprzez loggie, tarasy, pawilony widokowe na otaczający krajobraz. Model dla rozwoju założenia pałacowo-ogrodowego w stylu włoskim stanowiły manierystyczne rezydencje usytuowane na stokach wzgórza Frascati: Villa Aldobrandini, Villa Ludovisi, Villa Mondragone. Kluczowym czynnikiem decydującym o walorach tych rezydencji było ich korzystne usytuowanie w krajobrazie: na stoku otwartym na północ, z widokiem na pagórkowaty obszar podmiejski i na Rzym oraz na ruiny starożytnego Tusculum. Wypracowany we Włoszech model rezydencji stał się bardzo popularny w siedemnastowiecznej Rzeczypospolitej. W pierwszej połowie XVII stulecia rezydencje magnackie, choć nadal jeszcze wkomponowane w układy forteczne, w pełni wykorzystywały naturalne walory otoczenia. Sztandarowe przykłady tego zjawiska to Krzyżtopór koło Ujazdu Krzysztofa Ossolińskiego, Podhorce Stanisława Koniecpolskiego (obecnie w granicach Ukrainy), Puławy Stanisława Herakliusza Lubomirskiego oraz wiele siedemnastowiecznych warszawskich założeń pałacowo-ogrodowych, usytuowanych na koronie Skarpy Warszawskiej. Niewiele z tych dawnych powiązań rezydencji z krajobrazem jest czytelnych do dziś. Uległy zatarciu na skutek procesów urbanizacyjnych czy też naturalnej sukcesji. Ponieważ, jak wykazano, stanowiły jedną z podstawowych wartości omawianej grupy obiektów, w ramach działań konserwatorskich powinno się dążyć, tam gdzie to możliwe, do ich uczynienia i ochrony. Karta Florencka stwierdza, że ogród historyczny nie może być oddzielony od swojego otoczenia. Zgodnie z jej zaleceniami powinien być zachowywany i konserwowany w krajobrazie, w który go wkomponowano, z zachowaniem jego walorów. Krajobraz, ze swojej natury, ma charakter dynamiczny. Zgodnie z Europejską Konwencją Krajobrazową współczesne zarządzanie krajobrazem ma na celu zachowanie i utrzymanie jego ważnych lub charakterystycznych cech. Instrumenty prawne, jakimi obecnie w Polsce dysponujemy w odniesieniu do ochrony krajobrazu, nie do końca pozwalają na osiągnięcie tego celu.

Warsaw's landscapes of power

ANNA RÓŻAŃSKA, MAŁGORZATA KACZYŃSKA

Department of Landscape Art, Faculty of Horticulture and Landscape Architecture, Warsaw University of Life Sciences – SGGW

Abstract: *Warsaw's landscapes of power.* The contemporary Warsaw landscape has been shaped over the many centuries of the city's existence. Its physiognomy has been influenced by the natural conditions of the site where it was located and by human activity. So it is that both natural and cultural factors have sculpted Warsaw's landscapes of power. Of the natural factors, the most important have been the Vistula River and the Warsaw escarpment. It was in relation to this pair of natural elements that the city's territorial development proceeded. Warsaw was established on the edge of the Vistula valley escarpment near a convenient river crossing. The course of the escarpment ran almost parallel to the Vistula riverbed, which feature determined the city's spatial development. Thus Warsaw grew along the line of the escarpment in parallel to the river. This landscape resulted in a landscape of power and the escarpment was the major feature in forging its identity. The most prestigious secular and religious buildings, along with their garden complexes, were located on the top of the escarpment. Some of them had a great influence on the city's composition and represented the beginning of a new direction in Warsaw's urban development: they imparted a new power to the landscape that stimulated the city's growth. It was possible from the top of the escarpment to admire the river and its far bank, which has retained its natural character until today. Later the city developed according to the road system, whose form was related to the primary natural conditions such as the presence of the river and the shape of the terrain. This regularity can be seen on numerous maps from different periods of the city's history. The last two centuries have seen intense transformations in Warsaw, which have also prompted changes in the cityscape and especially in the relationship between natural and cultural factors. The aim of this paper is to identify landscapes of

power within the Warsaw cityscape: those possessing physical power resulted from the natural conditions of the place and those with psychological power from factors such as location and history. The paper also analyses how these powers are made manifest in the cityscape of today and attempts to answer two questions: Are the landscapes of power now perceived as such? Do they influence urban development?

Key words: Warsaw landscape, landscape identity, cityscape, landscape of power

INTRODUCTION

Landscape is a combination of natural and cultural factors which mark space continuously and create four landscape layers [Rylke, 2010]. The first is the past of a site which exists permanently and leaves its mark in important places that are vital points in the landscape. The second is hidden underground in the geological layers that allow us to reconstruct the past. The third is made up of the elements on the surface which create the cultural landscape, while the fourth and last involves the life that is lived within that cultural landscape. This understanding of landscape is supported by the European Landscape Convention [2000], according to which "landscape" means: '...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or

human factors'. Both factors can lend the landscape a special power. However their meaning and influence are variable: the power of landscape is mutable and can take forms that are purely mental or wholly physical.

MATERIALS AND METHODS

The authors used historical comparative analyses based on archival cartographical and iconological materials, a contemporary city photomap, and their own photographic documentation and publications to identify Warsaw's landscapes of power. The method applied in the research was based on the concept of the interaction of natural and cultural forces. Based on the archival documentation it was possible to indicate which sites in the successive stages of the city's historical development performed the role of landscapes of power and so created its identity. It was also possible to specify the elements of the Warsaw landscape that gave a site its special physical or psychological power and so stimulated the city's spatial and economic development. The research results describe Warsaw's contemporary landscapes of power and state whether the sites that are now landscapes of power are the same ones that performed the role in the past. If they are the same, the research attempts to show how their power is expressed today.

Warsaw's landscapes of power in the past

Warsaw was located in a place of special natural advantages that were conducive to its economic development. The city

was established in the centre of the Warsaw postglacial plain where the Vistula River is extremely narrow, which made it easy to cross the river (Fig. 1). The postglacial plain with its fertile soils – and the surrounding forests – provided food supplies for the developing city [Rylke, 2004]. The steep escarpment abutting the postglacial plain and the river were used for defensive purposes and the many natural streams flowing down from the scarp provided water. The Vistula performed not only an important defensive role but was also the main transportation route. The power of this landscape lay in the nature skilfully exploited by man. The sources of power were the escarpment, the river and the natural vegetation.

Warsaw developed a typical mediaeval urban layout with a central square, a regular system of streets, dense building quarters, a high church and castle

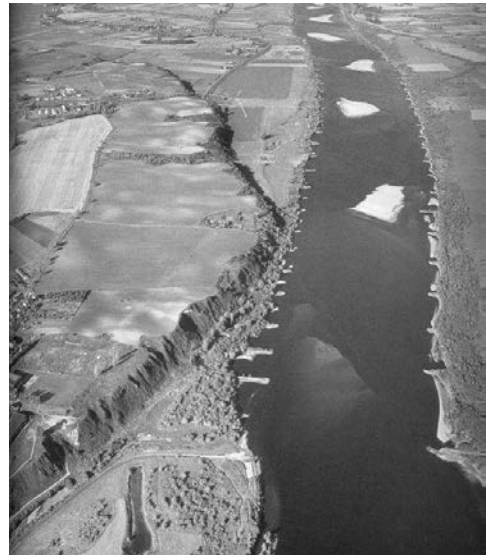


FIGURE 1. Postglacial plain adjacent to an escarpment and big river. The place where Warsaw was established probably looked like this [Ostrowski, 2006]

towers, all of which was enclosed by city walls. A small settlement called Praga, which was on the opposite side of the river, marked the city's eastern limits. The dense city silhouette, located on the top of the escarpment, was a dominant feature visible from a long distance. As Warsaw grew, though, the site lost its specific character and power. This development took the city beyond the walls and along the escarpment to the north and south. The scarp and the river formed the fundamental structure for the new parts of the city. The most important and most magnificent churches and secular buildings were located on there. The system of streets was shaped according to the configuration of the terrain and the superficial water system [Sosnowski, 1930]. The main city streets were staked out along the edge of the escarpment and many others were established based on the small riverbeds flowing into the Vistula perpendicular to the escarpment. The Warsaw landscape of power was still the Vistula River valley but its power has begun to manifest itself in a different way. The river and the escarpment, which formerly performed a defensive role, have

acquired a new compositional function in the urban structure [Wolski, 2007]. The disproportions in the spatial development of the banks of the Vistula are evident from the beginning: the left bank has always developed more rapidly and dynamically. Although the first settlements were established on the right side of the river, they developed much more slowly. Praga, which is located in a depression of the Vistula valley, possessed no favourable power. By contrast, the higher left side of the river was regarded as prestigious and as having a favourable mental power, which stimulated further urban development.

In the Baroque, the flat, vast terrain of the postglacial plain became a landscape of power: the ideal site for the establishment of large-scale royal and magnate residences inspired by Versailles. This power lay in the potential to shape garden and urban compositions. This potential was used to establish several residences surrounded by small gardens, such as those of the Bieliński family and the Orzelski Sanguszkó family, or Brühl's palace (Fig. 2). On the terrain of the postglacial plain nearest to the city

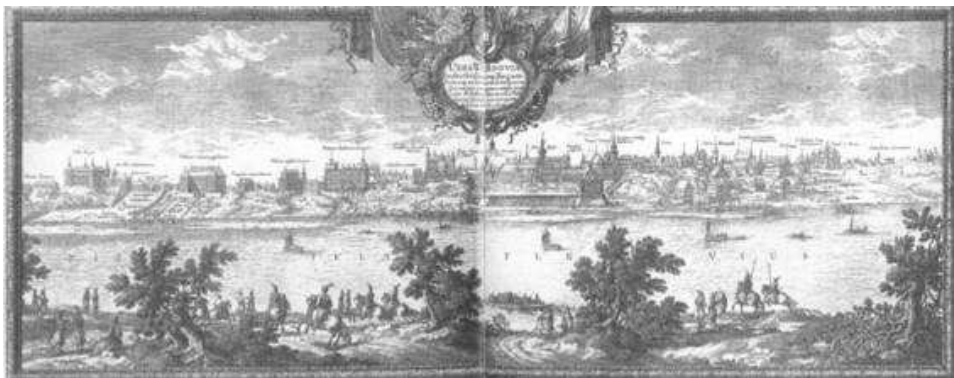


FIGURE 2. Dahlberg's Warsaw panorama of 1655 showing the use of natural landscape power for the localization of prestigious buildings on the escarpment [Atlas historyczny Warszawy, 1999]

centre, King August II Sas established a large-scale urban composition. Known as Sas's Axis, it was laid out between the two highest terrain elevations in Warsaw (Fig. 3). Shaped in this way, variety was added to the composition and it was possible to incorporate a vast space into the urban complex in accordance with the Baroque ideal [Rylke, 1976]. The second urban composition, which was established a little later on the postglacial plain, was Stanisław Poniatowski's Axis, which was traced westwards from one of his former residences: Ujazdów Castle.

In the next stage of Warsaw's development, in the second half of the eighteenth century, the city's landscape of power once again became the river valley with the escarpment. The many residences that were established were located in the landscape of power in the places where the scarp twists or close to the edges of ravines and the valleys of streams crossing the line of the scarp [Majdecki, 1965]. These sites possessed the natural conditions needed to create a garden composition, as well as the visual

attributes afforded by the altitude of the escarpment. Good examples of these residences are Natolin, Rozkosz, Mokotów, Królikarnia and Dynasy. They performed the role of dominant landscape features and determined the spatial composition of their surroundings while also creating their identity [Kicińska, 1993].

The next significant period for Warsaw's landscapes of power came at the end of the nineteenth century when the Russian fortress was built. The two rings of fortifications established on both sides of the Vistula became the city's landscape of power. The Citadel, which was the fortress's centre built on the northern part of the escarpment, dominated the cityscape not only visually but also mentally [Królikowski, 2002]. The city could develop only inside the ring of fortifications. The space between the fortifications and the esplanade of the external ring of fortifications could not be built on for military reasons. The city had therefore to grow in other directions from those previously taken. This was the first time in the city's history that the human factor had had so



FIGURE 3. Hübner's Warsaw plan of 1740 showing the river and the escarpment structuralizing the city's development and Sas's Axis marking its growth to the west [Atlas historyczny Warszawy, 1999]

strong an influence on Warsaw's landscapes of power.

Although many of the fortifications have been destroyed, the Russian fortress determined the urban planning of Warsaw until the beginning of the twentieth century. This period was characterized by two forms of landscapes of power. On the one hand, there was the influence of the power of the double ring of fortifications, which stimulated the centric development of the city seen in the garden cities and parks that were established on the ruined fortifications, and on the other hand there were the transportation routes developed along the escarpment and the course of the river. The Vistula was also the central element in the wedge-ring system planned for the green areas of Warsaw.

World War II caused enormous destruction in the Warsaw landscape, which reached proportions of 80–100% (Fig. 4). The destruction was caused by a human factor unfamiliar to the city: the power of the Nazis [Matusik, 1997]. The first wave of destruction came in

the struggle to defend the city in 1939. Following the uprising of the Jews the ghetto was destroyed. The cityscape suffered further massive depredation during the Warsaw Uprising. The most destructive blow dealt to the Warsaw landscape by the Nazis came from what was known as Pabst's plan. It was designed to divide Warsaw into two parts so that the Germans would be left exclusive use of the left bank while the Poles would be consigned to the right. Thousands of Warsaw citizens were removed from the city and the process of destruction was unleashed. The Germans chose the part of the city with more favourable natural, cultural and mental power for themselves.

After the war, the power of the Warsaw landscapes had to be restored. This time it was the ideological factor that had the greatest influence on shaping the landscapes of power. The Old Town was reconstructed, the historical road system along the escarpment was recreated and attempts to complete large-scale projects, such as the wedge-ring system of green areas, were undertaken. These projects



FIGURE 4. The devastated Warsaw landscape after World War II (<http://gisplay.pl/gis/nawosci-gis/949-przelot-nad-zburzon-warszaw.html>)

revolved either around the ring of fortifications or the natural green wedges of the Vistula and the escarpment. The power of the landscape was restored in relation to the long-term features of the river and the escarpment, but also in connection with the more recent presence of the city's military landscape.

The ideological initiatives taken (for the second time) to restore the landscapes of power and to reshape the cityscape in the next stage of Warsaw's development were no longer favourable ones. The new landscapes of power were established as a result of decisions made by the city authorities, which made no reference to tradition and did not respect the formerly recognized landscapes of power. So it was that monumental buildings such as the Palace of Culture and Science, the housing estates of uniform design, such as Żoliborz and Marszałkowska Dzielnica Mieszkaniowa the new roads (East-West road) and the cemetery-parks established to commemorate the soldiers killed during World War II arose to constitute a new cityscape. The location of some of the new buildings seemed accidental, yet some were placed deliberately in areas the people of Warsaw regarded as prestigious in an attempt to impose a new ideological meaning on the cityscape. Many of the urban development plans that were not ideologically tainted were either amended or deliberately abandoned [Staniszki, 1995].

This policy for city development, which lasted until the 1990s, wreaked enormous havoc on Warsaw's landscapes of power. Paradoxically, the changed social and political system did not improve matters. Warsaw's landscapes of power were perceived as prestigious and as hav-

ing tremendous potential to attract new investment in office buildings or housing estates. Although the error of some of the post-war decisions has now been recognised, it is possible to restore the meaning of former landscapes of power only partially.

The escarpment has lost its meaning in the cityscape. In the city centre, the elevation of the terrain is almost invisible owing to building development. The bulk of the escarpment is much more visible in the landscapes of the southern and northern parts of the city, with their low-density housing. The Vistula, however, with its old riverbed, the area immediately adjacent to it and the large forests still play an important role in the contemporary Warsaw landscape.

The plan to establish the Warsaw Natural System is also an attempt to restore the city's landscapes of power. Its main structures are the river and the green wedges that are diversified into basic areas and supportive areas. The structure refers to the former wedge-ring system of green areas. The basic areas include both the riversides and the wedges parallel to the river in the southern part of the city. In the northern part of the city, the system of basic areas is less distinct. The wedges of the supportive areas which complement the system have been located as close as possible to the city centre. The Warsaw Natural System can restore lost power to Warsaw's landscapes. In some cases it is still possible to restore physical power. In other parts of the city, where changes in landscape are permanent and irreversible, the former power will be restored in the psychological dimension only.

CONCLUSIONS

Warsaw's landscapes of power are an example of dynamic changes, the combined influence of natural and cultural factors and of interludes that saw the landscape's near total destruction and restoration. Despite numerous transformations, the power of the natural landscape remains visible in the cityscape. The fundamental element of the natural power of the Warsaw landscape is the Vistula and the pseudo-natural vegetation of the eastern riverside. Its meaning has been emphasized in the structure of the Warsaw Natural System, whose construction is based on the course of the river. The escarpment, which is the second most important element of the natural power of the Warsaw landscape, is not distinctly dominant in the contemporary cityscape. It has always been perceived as a physically and mentally prestigious place. That it has been intensely developed, then, should come as no surprise. Unfortunately, the power of the escarpment landscape has led to its physical degradation. Today, the prestige and power of this landscape is revealed more in the mental and psychological dimensions, though the influence of the primordial landscape on the city's urban development is undeniable. The escarpment and the river, it seems clear, formed mental as well as physical boundaries. The mental division into the more desirable west and the less desirable east, Praga, persists in the consciousness of the citizens of Warsaw.

Warsaw's landscapes of power have also been influenced by cultural factors. The road system based on the escarpment and the course of the river, as

well as the axes of Sas and Poniatowski, which stimulated the growth of the city to the west, can still be seen in the cityscape today. The Russian fortress has lost its meaning as a landscape of power in the contemporary cityscape. The disproportions between the interior and exterior ring of fortress development have been rebalanced. The power of this landscape is rarely recalled because it evokes negative emotions, while the Old Town reconstructed after World War II retains its importance as one of Warsaw's landscapes of power.

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- Streszczenie:** *Krajobrazy mocy Warszawy.* Współczesny krajobraz Warszawy kształtował się przez kilka wieków istnienia miasta. Na jego fizjonomiczny kształt miały wpływ warunki przyrodnicze miejsca, gdzie ulokowano miasto oraz działalność człowieka. Dwa czynniki: przyrodniczy i kulturowy określały „krajobrazy mocy Warszawy”. Dla krajobrazu Warszawy z czynników przyrodniczych najistotniejszymi były rzeka Wisła i Skarpa Warszawska. W oparciu o te dwa elementy przyrodnicze następował terytorialny rozwój miasta. Warszawę założono na koronie skarpy, w sąsiedztwie dogodnej przeprawy przez rzekę. Przebieg linii Skarpy Warszawskiej był niemal równoległy do koryta rzeki Wisły, co w sposób zasadniczy determinowało rozwój przestrzenny miasta. Warszawa rozwijała się wzdłuż linii skarpy, równoległe do rzeki. Na jej koronie lokalizowano prestiżowe budowle świeckie i kościelne w otoczeniu założen ogrodowych, niektóre o znaczeniu miastotwórczym. Stąd można było podziwiać rzekę i przeciwny jej brzeg pozostający do dzisiaj układem naturalistycznej roślinności. Przestrzenny rozwój miasta następował według formującej się siatki ulic, a ta z kolei powstawała w odniesieniu do warunków przyrodniczych (skarpy i Wisły). Potwierdzają to, między innymi, liczne mapy miasta sporządzane w różnych okresach jego rozwoju. Ostatnie dwa stulecia to okres intensywnych przekształceń Warszawy, które spowodowały także zmiany w krajobrazie miasta, a zwłaszcza relacji czynnika przyrodniczego i kulturowego. Celem niniejszego artykułu jest wskazanie w obrębie Warszawy „krajobrazów mocy”, tych posiadających fizyczną moc wynikającą z warunków przyrodniczych miejsca oraz tych z mocą psychologiczną związaną z ich lokalizacją, historią itp. Artykuł analizuje też, w jaki sposób te siły przejawiają się w dzisiejszym krajobrazie miasta oraz czy „warszawskie krajobrazy mocy” również i dziś są w taki sposób postrzegane i czy mają wpływ na rozwój urbanistyczny miasta.

The role of greenery and traffic calming measures in road infrastructure planning

AGNIESZKA ALEKSANDRA JASZCZAK^{1*}, JOANNA ŻUKOWSKA²,
BEATA DREKSLER³

¹University of Warmia and Mazury in Olsztyn

²Gdańsk University of Technology

³Warsaw University of Life Sciences – SGGW

Abstract. *The role of greenery and traffic calming measures in road infrastructure planning.* The “life” of a town is connected with its infrastructure. So it is that, apart from serving their principal function, motorways, roads, airports and other facilities which make transport possible largely determine contemporary urban design. To achieve balanced forms of urban infrastructure that ensure comfort, safety and spatial order, it is necessary when designing new solutions to adopt a multi-faceted approach that combines everything local residents need and maintains harmony with the existing cultural landscape. Development of this kind should be guaranteed by the town’s authorities and infrastructure administrators. It is therefore necessary to coordinate a number of complex undertakings when planning and developing urban space. The coherent and comprehensive implementation of planned road safety improvements should not only reduce the number and seriousness of accidents but should also lead to an improved quality of urban life and living conditions, more efficient division of urban space, better traffic flow for pedestrians and cyclists, changes in the behaviour of all road users, changes in the structure of the cargoes transported and greater use of safer means of transport. This paper deals with a concept for planning transport infrastructure based on the principle of establishing zones and shared spaces and presents examples of how roads and their environs can be planned in a town.

Key words: traffic calming measures, road safety, transportation, greenery

INTRODUCTION

Creating a cultural landscape connected with communication routes in Europe began in the sixteenth century when development of the economy and civilisation required the construction of new and better roads. Communication routes with lines of trees on both sides have mostly retained their former routes, which have for centuries been incorporated in the diverse topography of the areas they have served.

The neighbourhoods of open, urbanised areas are, therefore, reflected in the long history of road planning and design. In the majority of European regions from the Middle Ages to the nineteenth century, strong physical, psychological and visual borders [Lörzin, 2010] have been implicit in the typical development of settlement structures. The transportation infrastructure has been a significant component of these settlement structures and planning its development is one of the major tasks of spatial planning both in urbanised areas and elsewhere.

The experience of Western countries indicates that the issue of road safety lies deep in planning solutions and that

*tel. +4889 523 41 82, e-mail: agaj77@tlen.pl

it is necessary to consider it as part of an integrated approach that also includes quality of life, the spatial and functional composition of towns and social considerations. An interdisciplinary and coherent approach to transportation, architectural and social problems brings about an effect of synergy whose consequence is to make a contribution to improving the quality of inhabitants' lives. Apart from issues directly related to communication and safety, it is important to base the proper planning of a road and its surroundings on principles of sustainable development and to take into account not only the measurable economic or social benefits but also environmental protection as broadly understood. As a consequence, it is important to shape the surroundings of roads in such a manner as to allow for an increase in areas of greenery. Not only does greenery increase the ecological values of the communication space but, in its form, shape or selection of material, it can also improve road safety.

MATERIAL AND METHODS

This paper deals with an idea of planning for transport infrastructure based on the principle of establishing zones and shared spaces. Examples of how roads and their environs can be planned in a town are presented. This paper attempts to answer an important and by no means rhetorical question: how can a compromise be reached between eco-friendly landscape management, including that of urban green areas, and the considerations essential to planning for transport infrastructure and improving road safety? The monographic method was applied for the

analysis. An introductory analysis of data was performed, which covered the available documents, monographs, historical materials and maps. This made it possible to select the research area and to establish the aims of the study.

RESULTS AND DISCUSSION

The means of shaping transportation spaces

Road safety within the spatial structures of towns, cities and agglomerations may be achieved through urban planning that reduces the need to travel using vehicles by, for example, making it possible to transact the daily business of life and work by bicycle or on foot. From the point of view of model spatial solutions for towns, the highest level of traffic safety is offered by the theoretical model of a linear town based on the zoning of urban functions, public transport services and on concentrating buildings around the hub. The zoning of functions in urban areas means clearly specifying the role of vehicle transport and its permitted speed in a given zone [Gunnarsson 1995].

In its simplest terms, the space where movements are performed may be divided into space for vehicle transport, space for pedestrians and space for calmed traffic, which is intended both for vehicle and pedestrian traffic. Zoning understood in this way proves highly effective – particularly in terms of improving the safety of the youngest road traffic participants (Fig. 1).

As a component of the spatial structure of a town or city, the street network is the most permanent element of an ur-

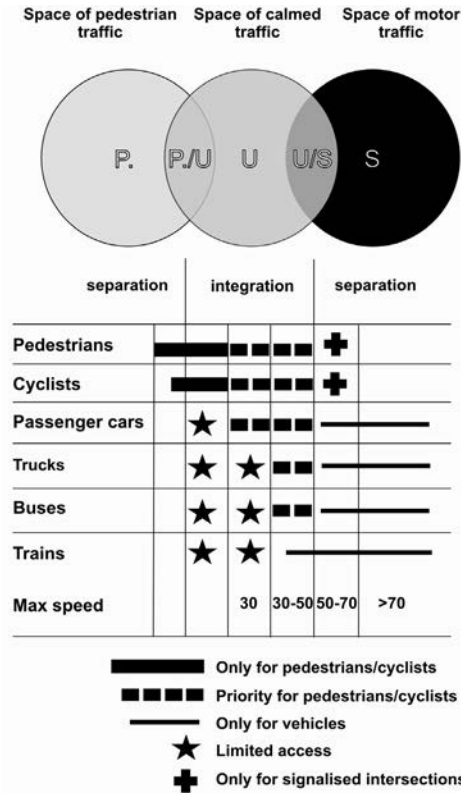


FIGURE 1. Classification of transport spaces in urban areas [Gunnarsson, 1995]

banised area and, at the same time, the most difficult to transform: if this is to be done it should be undertaken with the utmost care. There have been numerous space-shaping concepts that have striven to both integrate and segregate traffic. In the 1960s, the complete segregation of vehicle traffic from pedestrian traffic was preferred, which was exemplified in the planning and design of numerous multi-level pedestrian crossings, which are now treated by their users as a necessary evil [Jaszczak and Żukowska, 2012].

If the best effects are to be achieved, however, planning measures for ensuring safety need to be comprehensively

employed along with other groups of measures which improve the comfort and quality of life in urban spaces. One of them is shaping the landscape, including areas of greenery. In the Polish case, the planning measures most in need of implementation in the towns and cities are as follows: developing a road network with a clear hierarchy, controlling availability, zoning speed limits in the street-and-road systems, developing calmed traffic zones and routes and developing systems of bicycle paths.

This paper describes the means for shaping transportation space in towns and cities by designing calmed traffic zones incorporating vehicle, pedestrian and bicycle traffic. The relevant literature provides a range of definitions of traffic calming. In its simplest terms, this means shaping the public space, the road system and their surroundings in such a manner as to limit the speed of vehicles and, at the same time, reduce transit traffic, achieve spatial order and improve the quality of the inhabitants' lives [Jamrozik, 2009]. Greenery plays an extremely important role in such solutions. Drivers commonly associate traffic calming with difficulties in the form of elements limiting speed on the road, of which the most widely known is the speed control hump. And yet the idea of traffic calming involves a set of comprehensive actions which include the whole hierarchy of a road network, with the diverse functions of roads and the areas they serve taken into consideration. This involves the control of road availability (which reduces *inter alia* heavy vehicle traffic in pedestrian traffic zones) and establishing speed limit zones. Practice in the Netherlands has shown that an impor-

tant aspect of availability management is for streets with a minimum speed of 30 km per hour to have as few junctions as possible. The point is to eliminate collisions, that is, situations which pose a threat of accidents when approaching junctions at higher speeds. Only on such a basis is it possible to locate and design physical traffic calming measures. These measures should definitely be applied as a supportive action in a situation where, having introduced functional hierarchization and availability control, and having established speed zones, there is a need to persuade drivers to maintain the required speed and to make it physically impossible to drive faster [Jamrozik, 2009].

Since the concept of calmed traffic means introducing solutions which would render driving at excessive speeds impossible, various types of components are employed that prevent driving too fast and discourage burdensome transit traffic from moving through particular areas. These solutions include carriageway narrowing, elevated junction surfaces and small roundabouts. The hierarchical division of roads with regard to

the actual functions they fulfil in a given area involves the introduction of speed zones: a 50 km per hour zone, a 30 km per hour zone, and residential zones and pedestrian traffic zones with availability control (Fig. 2).

The traffic calming in question is performed mainly in central and residential zones where there is mixed vehicle, pedestrian and bicycle traffic, which results in speed limits of up to 30–40 km per hour. The traffic calming measures are introduced together with greenery areas and landscaping components that enhance the aesthetic value and spatial order of the surroundings, which in turn improves the comfort and quality of the inhabitants' lives. Moreover, introducing various vegetation formations in the case of diverse types of traffic requires prior spatial analyses and depends on the specificity of a town or city and on its character (arrangements of old town/city areas, new buildings). In the case of vehicle traffic in the town or in city centres, the usual suggestion is, wherever possible, to employ low vegetation due to the limited space available for green cover or to introduce small avenues of

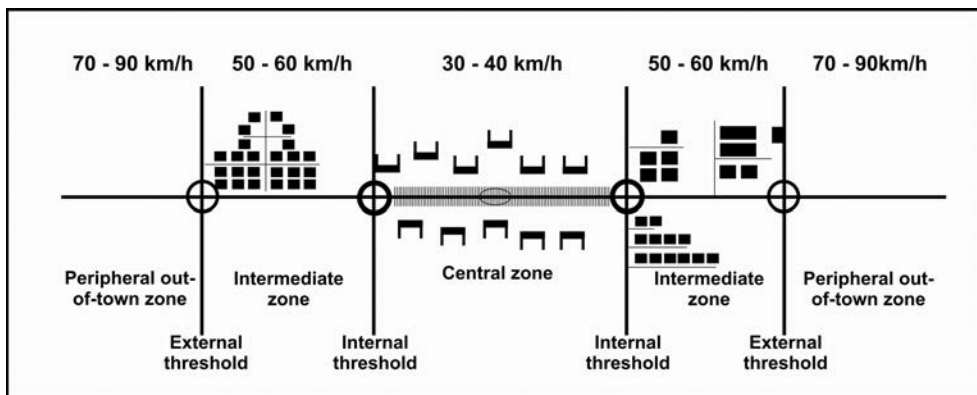


FIGURE 2. Division into zones with speed differentiation [Gunnarsson, 1995]

trees interspersed with trimmed shrubs or perennials. Linear/strip lawn areas are preferred along bicycle paths, whereas in pedestrian zones it is possible to use plants in boxes and pots as well as vertical forms, such as creepers.

Greenery and road infrastructure in towns and cities

Greenery has been employed for centuries for communication systems in the open landscape in the form of linear roadside tree cover and tree or shrub clusters which highlight the entrance to, or the exit from, a town or a local residential complex. Shaped greenery was established in towns and cities inside the urban fabric, but it also served to emphasise and highlight entrances either in the form of an avenue or of a gate with various formations of vegetation nearby. Nowadays, due to the extensive development of suburbs, in many European regions we are witnessing the disappearance of clear points which differentiate between the urban area and the open landscape. The noticeable “sprawl” of the suburban zone, particularly in the Polish case, also generates a range of problems connected with communication, road safety and whether or not it is possible to drive smoothly through these zones – especially in periods of heavy traffic. There are also now more and more buildings with diverse uses in the roadside belt, such as housing developments, and retail and service centres. What is more, the roadsides have been “trashed” with all manner of advertisements and promotional signboards of various sizes and forms.

The over-concentration of billboards and advertisements may also be seen in

the centres of towns and cities, although in a slightly different spatial structure. From the point of view of road communication, this results in reduced driving safety and also lowers the town or city’s aesthetic value. However, it is not only the introduction of inappropriate buildings or landscaping, the poor solutions related to journeys to town, to city centres or to driving in residential areas or the limited space for car parks that contribute to the hazards of driving a car or a single-track vehicle: sometimes similar adverse effects may be caused by faulty arrangement of vegetation formations. This is a consequence of selecting species which, due to their size or morphology, do not fit into small roadside zones, roundabout areas or car parks. There are instances of introducing plantings that are too high or too low, whose parts (sprouts, inflorescences or fruit) pose a threat to people and cause vehicle damage (especially in car parks, or along the streets). At the initial stage of plant growth the problems are not that visible. However, once maturity is reached damage begins to be done. Yet at the same time the mature vegetation presents a powerful case for environmental protection as there will be a tendency to think that green areas that already exist should be preserved. In this way an inappropriate arrangement of greenery frequently leads to conflict, since it comes to be perceived by the public as “a good thing” (which is quite justified). At this stage, of course, it is much more difficult to change its character than at the initial design stage.

Town and city centres are among the areas with the greatest traffic loads. As regards historical systems, and in the old

town fabric in particular, such traffic is in many cases limited to pedestrian traffic with the possible addition of cycling lanes. These solutions require planning access zones that enable access for cars and also parking zones. Ultimately, the main spatial complexes in town and city centres are usually squares and green squares and this is precisely where a great number of renewal projects have been implemented in Europe and in Poland in recent years. The factors of particular importance in the case of town or city squares are the revitalisation programmes and how far the communication system is available and meets the needs of inhabitants and tourists. It is also important not to overlook the introduction of greenery and certain historical considerations – especially in places with heritage structures. For these reasons plans and designs should balance existing and historical needs and values. Nonetheless, the means of new development of roads, streets and paths, as well as the materials employed, often reveal a certain ignorance on the part of planners as well as a unidirectional way of proceeding, which results in the loss of cultural values or, conversely, in a failure to adapt the systems to the current needs of users.

New trends imply an increase in the role of green areas in the utility and production functions in towns and cities. The “urban agriculture” which has been developing more and more rapidly in large agglomerations in the world is a step in the right direction, but its effects in areas with increased traffic, and especially in places where the pollution caused by transport is high, seem doubtful. Ideas for balancing the unfavourable changes in towns and cities by introduc-

ing various forms of greenery to housing estates and utility functions have been presented by Jäggi [2011] using the example of Toronto. In this context, a new approach to tree cover in streets along with what is known as “streetscape agriculture” emerges, where the space between communication routes in a town or city is treated as a production space with high participation of fruit tree cover and low vegetation with consumption value [Lehrer and Rombouts, 2011]. In this case, however, prior analyses are necessary concerning the purposefulness of introducing such greenery, which should account for, among other matters, the safety of those using the tree-covered lanes, including potential fruit pickers.

The role of greenery in the planning of traffic calming measures

People who live in close proximity to crowded arteries not only complain about the fear of being hit by a motor vehicle but also about a range of daily transport inconveniences, such as noise, air pollution or difficulties crossing the road. In many areas these could be remedied by introducing calmed traffic zones.

It is important when introducing limited speed zones that a street’s decoration, design features and traffic management all comply with the speed applicable in that area. On the other hand, drivers would appreciate precise information that they are on a route leading to a zone in which the speed limit is different. Greenery can definitely enhance information about speed reduction and the way this is received by drivers. What is more, if it is properly arranged along the streets it helps focus drivers’ attention. The very same characteristics of

greenery that pose threats along sections of inter-urban roads due to reduced visibility may – if skilfully arranged along the roads – produce the desired traffic-calming effect in specific places on urban roads.

A driver will reduce speed when expecting an obstacle. It is therefore a good idea to introduce an optical narrowing of the road at the entrance to a town or city or at boundaries between zones with different speed limits. One of the ways to achieve this narrowing effect is to establish a gate with posts near the carriageway. A natural gate formed with the use of roadside greenery is, however, more visually attractive. It enhances a calmed traffic zone and emphasises the urban character of the street. A similar effect can be achieved by properly arranged dwarf greenery, for example on a pedestrian island in the median strip. Apart from the proper arrangement of roadside greenery, it is also necessary to select the appropriate tree and shrub species, as well as to carry out frequent care treatments to keep the greenery in good condition. Only then will it properly serve to improve traffic safety.

Traffic calming measures may be divided into three simple categories: horizontal and vertical carriageway diversions, narrowings, and central pedestrian islands [FRIL, 2005]. These may be constructed using various technologies and diverse materials but, if the effect of synergy described above (to improve inhabitants' safety and the aesthetics of the landscape) is to be achieved it is desirable to introduce greenery not only as a complementary component but also as one which enhances engineering solutions. In numerous cases the green-

ery itself may constitute an engineering measure which reduces speed, such as in the form of an entrance gate to a town (Fig. 3).



FIGURE 3. Natural gates to a town in Uelzen, Germany (A. Jaszczak)

The best solution which takes safety principles into consideration is communicating speed changes to the driver with the use of vertical accents, such as trees of appropriate sizes bedded with low, trimmed shrubs. Depending on the category (see above), the relevant literature provides multiple examples of engineering measures for traffic calming, some of which have been briefly introduced and described above. In principle, it is both possible and desirable to apply greenery in all instances. Doing so enhances the speed-reduction effect through the frequent use of the natural elements of the surroundings (Fig. 4).

If greenery is employed properly, the streets in small and big towns may be both safe and aesthetically pleasing. With the use of greenery it is possible to greatly reduce the adverse effects of vehicle traffic in the form of road traffic hazards, excessive exhaust fumes, noise emissions and transport-related vibra-



FIGURE 4. An example of a comprehensive set of traffic-calming measures installed along national road 20 in Kościerzyna, Poland (J. Żukowska)

tions. Moreover, if appropriate arrangements are made greenery can be applied as a natural component of traffic calming and in creating aesthetic and permanent zones of calmed traffic. This is how safe public spaces that are friendly towards local communities and provide them with excellent conditions for a neighbourly and social life are established [Jamrozik, 2009]. The paper presents an example of a comprehensive solution in the next chapter.

The “Dutch Town” in Puławy

The impact of these measures on speed may be further reinforced through the application of a broad spectrum of supplementary measures, including not only a green system but also special road surfaces, street furniture or a combination of these resources. The best effects are achieved by comprehensively equipping roads with traffic-calming measures over extended road segments and throughout large residential areas.

In Poland, the “Dutch Town” in Puławy has become a model solution in this respect. It has made the town known for acting dynamically to enhance qual-

ity of life and for pursuing harmonious development. Part of the reason for this is that the town was selected to implement a joint project of the Polish Ministry of Infrastructure and the Ministry of Transport of the Kingdom of the Netherlands. Puławy’s was not a random selection, since it has a varied geometrical system of streets and different road categories, which means that a variety of traffic-calming solutions can be applied. The project’s approval by the town authorities and their experience in cooperating with the Netherlands were influential factors. The aim of the project was to disseminate practical knowledge and modern ideas on how road engineering and traffic calming can be combined to the benefit of the environment and to promote traffic calming as an effective instrument that can permanently improve the inhabitants’ safety and quality of life. This aim was achieved through the reconstruction of a part of Puławy’s street system using model solutions previously adopted in the Netherlands.

The project covered a section of provincial road 824 and an adjacent area of the Włostowice district (Fig. 5), where a range of road-engineering solutions ensured that the speed of motor-vehicle traffic would be safe and comply with regulations, improved the quality of life and safety of the district’s inhabitants by providing safe routes to school, work and public utilities, took care of the aesthetics of the surroundings, created a safe and friendly road environment and regulated the flow of motor-vehicle traffic. The Figures 6 and 7 present several example solutions that use vegetation as an integral component to comple-



FIGURE 5. Traffic-calming programme in Puławy (K. Jamrozik, 2009)

ment engineering solutions. The project also introduced the following additional engineering solutions: entrance gates to the 30 km per hour zone, bus stops, mini roundabouts, elevated junctions, speed control humps, pedestrian paths and shared bicycle and pedestrian paths (Figs. 6, 7).

The “Dutch Town” project in Puławy was enthusiastically accepted by both the citizens and local authorities. Even though it meant radical speed reductions, which are perceived by many as limiting their freedom and are therefore controversial, there were no objections raised. This proves that a comprehensive approach to quality of life for inhabitants, which not only introduces restrictions, but also offers more aesthetic surroundings and a more comfortable life for inhabitants in the direct vicinity, ensures the success of an undertaking.



FIGURES 6 and 7. Natural barrier and entry to the 30 km per hour zone (K. Jamrozik, 2009)

CONCLUSIONS

The appropriate shaping of public space, including the road system and its surroundings, makes it possible to achieve spatial order, improve the aesthetic value of the surroundings and enhance the inhabitants’ quality of life and safety. The comprehensive solution of traffic calming in residential zones presented in this paper is a way to successfully prevent accidents and other nuisances related to road traffic by preventing driving with excessive speed and by eliminating undesired transit traffic from calmed zones. In undertaking to shape space in these ways the application of a range of engineering measures and the deployment of

vegetation compositions based on species resistant to unfavourable conditions are both irreplaceable complementary elements. The solutions set out in this paper have been employed for many years in western European countries, including in the Netherlands, Sweden and Germany, and they are now being introduced in Poland on an increasingly large scale. A model solution in this respect is the first comprehensive traffic calming programme, which was implemented in Puławy thanks to cooperation between Poland and the Netherlands.

Acknowledgements

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Streszczenie: *Rola zieleni i środków uspokojenia ruchu w planowaniu infrastruktury drogowej. „Życie” miasta związane jest z jego infrastrukturą. Autostrady, drogi, lotniska i inne obiekty oprócz głównej funkcji transportowej w dużej mierze determinują współczesne kierunki projektowe w miastach. W celu osiągnięcia zrównoważonych form infrastruktury miejskiej, które zapewniają komfort, bezpieczeństwo i ład przestrzenny, przy projektowaniu nowych rozwiązań, konieczne jest przyjęcie wielu założeń. Powinny one łączyć potrzeby mieszkańców, bezpieczeństwo i charakterystykę istniejącego krajobrazu kulturowego. Duże znaczenie ma udział w procesie projektowym władz miasta i instytucji związanych z infrastrukturą. Ważne jest zatem wypracowanie kompleksowych przedsięwzięć w planowaniu i rozwoju przestrzeni miejskiej. Spójne i kompleksowe wdrożenie planowanych rozwiązań w zakresie bezpieczeństwa ruchu drogowego nie tylko*

zmniejszy liczbę wypadków, ale powinno także przyczynić się do poprawy jakości i warunków życia w mieście, bardziej efektywnego podziału przestrzeni miejskiej i lepszego przepływu ruchu pieszych i rowerzystów. Wywoła ono również zmiany w zachowaniu wszystkich użytkowników dróg i zwróci uwagę na konieczność powszech-

nego używania bezpieczniejszych środków transportu. Artykuł dotyczy koncepcji planowania infrastruktury transportowej na podstawie zasad oddzielnych i wspólnych przestrzeni. Podano w nim przykłady planowania przestrzeni dróg i ich otoczenia w mieście.

A case study of natural processes as a factor in restoring the functionality of a degraded area: Świętochłowice, Poland

KRZYSZTOF M. ROSTAŃSKI
Silesian University of Technology

Abstract: *A case study of natural processes as a factor in restoring the functionality of a degraded area: Świętochłowice, Poland.* This article poses the following question: which of human activity or processes of natural succession is more important in bringing a degraded area with green cover into cultivation? Brownfields and degraded areas, which are generally regarded as unattractive, are usually converted into industrial or commercial areas, with other forms of development often discounted from the beginning. However, due to the spontaneous process of plant succession, these areas may revert to something approximating wild nature and so become attractive neighbourhoods for residence and provide areas for recreation. This case study assesses the attractiveness of the wastelands and brownfields in Świętochłowice, Poland, and also compares the natural values of that place with its cultural ones. The results of the analysis are consistent with the present master plan for Świętochłowice, where the areas of increasing attractiveness are those with a high level of natural succession.

Key words: aesthetics, brownfields, succession, greenery

INTRODUCTION

Wastelands and brownfields are often perceived as degraded and dangerous areas. The highly urbanised towns of Upper Silesia show such a lack of natural greenery, yet considered aesthetically, even derelict land with spontaneous vegetation in Świętochłowice, for example, is sufficiently attractive to have a bicycle

path system designed for its so-called degraded areas. The surprisingly high landscape value and significant influence on the investment processes this system has was demonstrated in the author's study of it. The findings of that study support the general assertion that the natural dimension of our neighbourhoods and its associated processes should be appreciated [Böhme, 2002].

MATERIAL AND METHODS

The target area is the town of Świętochłowice, which lies in the centre of the Upper Silesian Conurbation. The analysis includes an assessment of its green areas (Fig. 1) and of its cultural values (Fig. 2). The material for the study was collected in 2007. The synergic action of these two assets – green spaces and cultural values – was the pre-requisite for the transformation of the derelict land. The green areas were categorised as follows: of biological value, areas with woody plants and shrubbery, derelict land with meadow-like vegetation, parks and squares, cemeteries, allotment gardens, recreation and sports areas, crop fields and water. The cultural elements involved protected buildings (under conservation), attractive settlements, other categories of buildings and small

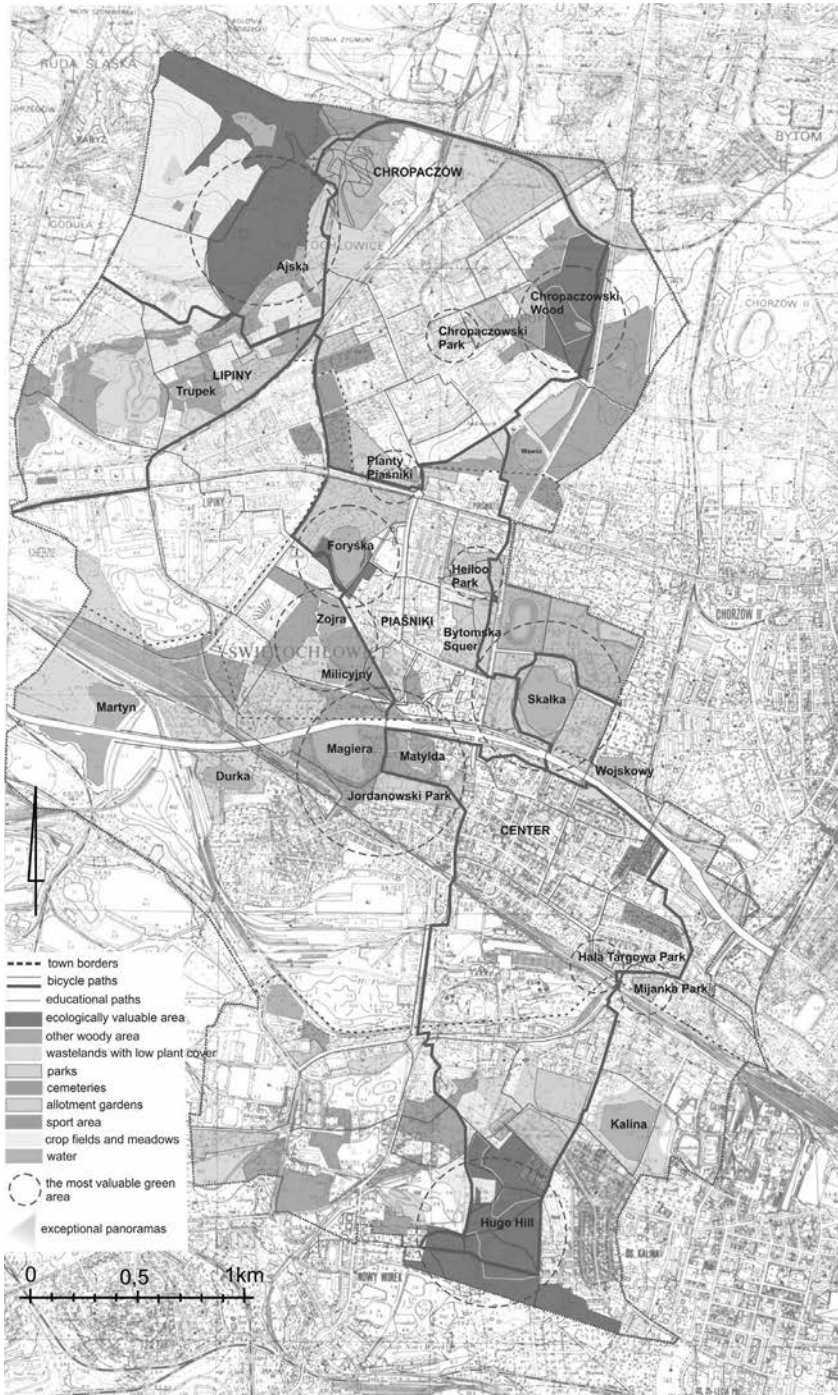


FIGURE 1. Greenery analysis of Świętochłowice

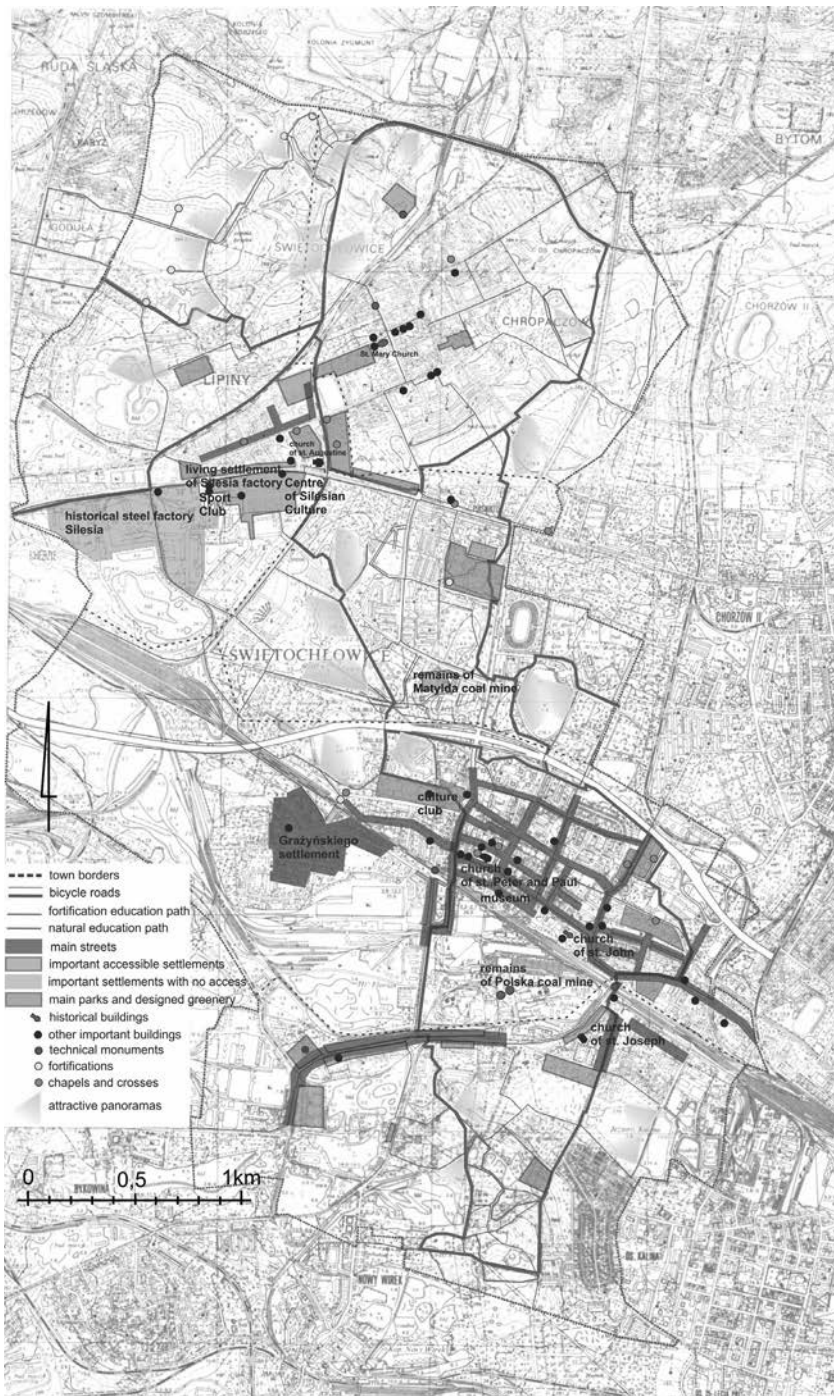


FIGURE 2. Analysis of the cultural elements of Świętochłowice

architectural items of historical value. Both analyses also marked view points, educational trails and bicycle paths. The area concerned was finally assessed according to its aesthetic value and its suitability for recreation. The study included some valuable observations on the landscape values referred to in the literature [Bell, 2004] and the author's own ideas for modelling nature [Rostański, 2012]. The results were compared with the town's current master plan (2010).

RESULTS AND DISCUSSION

Local elements of nature

As the parks are surrounded by densely populated residential areas, their flora does not have free succession. They are attractive but their closely cut lawns and sparsely planted trees leave no room for contact with wild nature, for watching birds or for feeling any sense of intimacy in the place. The more popular walking destinations are the wild woods, which are mostly in the post-industrial areas.

However, some of them lost their industrial character in the middle of the twentieth century or in the years of the 1980s crisis. The features of the post-industrial areas include impressive ponds in the unused clay excavations and the flooded depressions caused by coal mining, which are now popular for fishing. Their recreational function is underpinned by the wild surroundings. In this way, three former industrial areas are now protected for ecological reasons. Two of them have woods that are gradually becoming oak-hornbeam communities (Hugo Hill and The Chropaczów Woods) and one centres on a pond surrounded by allotment gardens, artificial poplar woods planted on a spoil heap and blocks of flats (Pond Foryśka). These areas are all popular for recreation. The plantations introduced there are modelled on the idea of habitat creation [Firbank et al., 1993; Dunnett and Hitchmough, 2008]. The most impressive post-industrial area of the town is that containing the material deposits left by the local zinc factory. The pond located nearby is called Ajska (Fig. 3).



FIGURE 3. Pond Ajska: a postindustrial landscape of exceptional value

Because of these deposits, the habitat is difficult for plants and most of the surface is left uncovered. In the context of the woods, meadows and water the original reddish-brown hill looks unusually beautiful.

Local elements of culture

The most valuable cultural aspects of Świętochłowice are to be found in the town centre near Park Jordanowski and the remains of a clay excavation area that contains Pond Matylda and Pond Magiera. Another valuable cultural site is the Chropaczów district with its many historical elements and pleasant setting between the Chropaczów Woods and Pond Ajska. Yet another is the Silesia Factory Settlement near the valuable green area of Pond Foryśka, which has pleasing architectural details. These green areas, where the plants have created dense green structures and have covered over nearly all of the traces of local industrial history, are all popular for recreation – even the lack of pavements or benches does not deter visitors.

Comparison with the master plan

The current master plan shows the residential development area and the green structure of Świętochłowice. All the places considered in the study to be of high ecological value because of natural succession on the previously degraded areas have been incorporated into the town's green system and are surrounded by locations for low-intensity residential development. As the plan supports the presence of natural processes, these areas will not be allowed to become so-called organized ornamental greenery.

CONCLUSIONS

The study indicates that wastelands of high aesthetic value – real or potential – should be incorporated into the greenery structure of the town and so be protected from any but recreational or natural development. Wastelands of high aesthetic value can increase the attraction of the neighbourhoods they are in because processes of spontaneous succession and naturalization can transform them into attractive green elements of the town. These places do not have to be transformed into well-maintained parks. Yet if people are to be encouraged to use them frequently, it is important to make them safe places with good conditions for visual penetration and some recreational infrastructure.

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Streszczenie: *Naturalne procesy jako czynnik przywracania funkcjonalności terenów zdegradowanych.* Przykład realizacji zasady dla miasta Świętochłowic w Polsce. Artykuł rozważa zagadnienie, który z czynników może mieć większe znaczenie dla rekultywacji terenów zdegradowanych – działalność człowieka czy procesy naturalnej sukcesji. Tereny przemysłowe, zdegradowane, są zwykle uważane za nieatrakcyjne. Pozostają niewykorzystywane lub, jeżeli są zagospodarowywane, to zwykle jako tereny przemysłowe albo o funkcji handlowej z lokalizacją obiektów wielkoprzestrzennych. Procesy spontanicznej sukcesji potrafią im jednak nadać wręcz niebywałą formę, zbliżoną w swej estetyce do ostoi natury. To sprawia, że zyskują walor jako atrakcyjne sąsiedztwo osiedli mieszkaniowych

i miejsce rekreacji. W przypadku Świętochłowic poddano ocenie nieużytki i tereny przemysłowe pod względem ich walorów krajobrazowych i skonfrontowano uzyskane w ten sposób wnioski ze strukturą lokalnych wartości kulturowych. W efekcie wyznaczono tereny bardzo atrakcyjne dla rekreacji. Ich układ przyjęto jako kanwę systemu ścieżek rowerowych (2007). Zdecydowaną większość tych terenów wskazano w obecnie obowiązującym Studium Uwarunkowań i Kierunków Zagospodarowania (2010) właśnie jako tereny zieleni i rekreacji. Można stwierdzić, że w omawianym przypadku sama natura zadbała o atrakcyjną rekultywację terenów zdegradowanych, wyprzedzając w tym względzie świadome działania człowieka.

The influence of environmental impact assessments on the protection and development of landscapes in spatial planning in Poland

MAGDALENA JEŃDRASZKO-MACUKOW

Department of Landscape Architecture, Faculty of Horticulture and Landscape Architecture, Warsaw University of Life Sciences – SGGW

Abstract: *The influence of environmental impact assessments on the protection and development of landscapes in spatial planning in Poland.* An Environmental Impact Assessment (EIA) is the name of a study that assesses the type and degree of potential transformations that can occur within landscapes after the implementation of the decisions in local plans. These studies mainly identify and suggest solutions in cases where the plan may disrupt the landscape. However, the EIA may also have an impact on the quality of the solutions used in the plans, including on landscape design. The influence of an EIA therefore derives not only from its evaluating role, but also from the support it can offer in the process of landscape design. This will result in landscapes that are sustainable and that function better. The purpose of this article is to show the theoretical and practical possibilities for strengthening the support and evaluation roles of EIAs.

Key words: landscape planning, legal aspects of EIAs, assessment of landscape transformation, evaluating role of EIAs, supporting role of EIAs

INTRODUCTION

The implementation of the findings of local plans is generally associated with the occupation of new, predominately undeveloped lands. The consequence of this is the transformation of landscape (not always to its advantage). Therefore, to mitigate the potential adverse impact of these processes, the contemporary local planning process introduced the EIA.

Its dominant role in evaluation is mainly dictated by the current laws in Poland, which stipulate that the primary task of an EIA is to assess the potential transformations that may occur as a result of the implementation of local plans. Based on this assessment an EIA indicates which solutions may disrupt the landscape and which should be eliminated.

Practical experience has shown that restricting an EIA only to the evaluation and identification of solutions that are harmful to the landscape cannot be decisive in their elimination from draft plans. Furthermore, it does not guarantee their elimination from landscapes. Therefore, in order to protect and shape the landscape, the role of EIAs should be expanded so that they also indicate the most favourable landscape alternatives (supporting role of EIA) to the solutions adopted in the plan, and then implement them in the plan. Only such action can guarantee the elimination of errors made in the design phase of plans. It should be noted that the evaluation and support roles of EIAs should not be separated. To identify favourable solutions it is necessary to conduct prior identification and evaluation of proposed solutions that could have an adverse impact on the landscape.

In practice EIAs could potentially be studies which are not limited only to evaluating solutions proposed in plans. Strengthening the supporting role of EIAs depends primarily on two things: changes in the interpretation of the law or clarification of its provisions and the degree of involvement of the authors of these studies in drafting plans.

MATERIALS AND METHODS

Ten local plans drafted for parts of Warsaw, along with their EIAs, were used as the base for analysis. The repealed and existing laws containing provisions on EIAs and the literature on the role of EIAs in the planning process were also reviewed. To determine the vital role of EIAs in landscape planning, legislation concerning EIAs, both repealed and in force in Poland, was analysed. Expert interpretations of the legislation were also consulted.

An analysis of only those legislative records currently in force in Poland, which specify the substantive scope of EIAs, was performed to demonstrate the possibility of expanding the role of EIAs in landscape planning. Based on these analyses and on results and experience gained in practice, we have determined the best method of developing EIAs in practice so that they can help to shape local landscape plans. We have also specified the desired level of involvement of the authors' predictions in the design process of the plan, the possible differences in the use of estimates in practice and the changing scope of the use of estimates in the course of enacting plans.

RESULTS AND DISCUSSION

The role of EIAs compared with the development of legislation

The provisions concerning EIAs in Polish legal acts were always vague enough to allow for free interpretation. For this reason they have never had a clearly defined role and in most cases that role has been defined by their authors.

The term "forecast" was used in Polish planning practice in the 1970s and 1980s. This term described a way of thinking which referred only to predicting how nature would respond to a planned investment [Kassenberg, 1999]. The obligation to prepare forecasts [Kolipiński, 1997] was introduced by the provisions of the Law on Spatial Development (Journal of Laws of 1994 No. 89 Item 415). Less than a year later the Minister of the Environment, Natural Resources and Forestry introduced an act laying down requirements to be met for forecasts of the impact of local zoning plans on the environment (Journal of Laws of 1995 No. 29 Item 150), which led only to a series of discussions among planners about the role of EIAs in the planning process. Some drafters of plans treated EIAs as playing a supporting role with respect to their paper plans in terms of their discussion and evaluation. Others regarded the forecast function as a description, justification and documentation of solutions adopted in the plan [Kolipiński, 1997]. The basic role of forecasting, however, revolved around the role of the impact of evaluation findings on the landscape plan.

The starting point for Polish efforts for accession to the European Union can be considered the moment of break-

through in changing the approach to the role of EIAs. Very quickly it became necessary to adapt Polish legislation, including the issue of EIAs, to European Union (then community) law [Wajda, 1998]. In the case of EIAs, this adaptation was to rely mainly on withdrawal from the concept of impact assessment as the determination of a specific document for how to conduct the assessment of the impact [Rudlicki, 1998]. This meant that there was an opportunity to expand the role of EIAs. The EU accession period was also the time when the role of the authors' forecasts in these studies began to change. This happened because the authors were accumulating practical experience in preparing forecasts. It was thus possible for the ambit of forecasts to expand beyond evaluation and begin to play an additional supporting role.

In 2012 an EIA in Poland remained a study that is first of all conducted to identify and assess the natural environment and the extent of potential transformations in the landscape of the plan area (evaluation role). This is despite the fact that, thanks to the provisions of the Environmental Protection Law (Journal of Laws of 2008 No. 25 Item 150), an EIA has become part of the process of an SEA (strategic environmental assessment). As a part of this process, as in the United States, EIAs could begin to pursue two goals: to anticipate the negative effects of human activities on the environment and effectively counter them [Sas-Bojarska, 2006].

For EIAs to become part of the SEA process in practice and to start to realize both of their goals, work on them should be a continuous process that is closely linked to work on the plan. It would

seem that this is only possible if authors include the EIA process in the draft plan, which requires further legal regulation. There is a need to clarify the potential relationship between these two documents and the way work on the EIA is to proceed in the course of planning. Without these rules EIAs will continue to play only a forecasting role which necessarily limits the help they can offer in shaping planning. For these reasons the role of EIAs in the drafters' predictions and plans depends mainly on how the drafters interpret the legislation.

The obligatory content of EIAs and its potential role in the planning process

The issue of EIAs in Poland is now (2012) regulated by two laws: the Law on Spatial Planning and Development (Journal of Laws of 2003 No. 80 Item 717), which introduced a duty to support project plans with EIAs, and the Law on the Provision of Information about the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessment (Journal of Laws of 2008 No. 199 Item 1227), which defined the substantive scope of this study.

Both of these laws failed to rule on the role of EIAs in the planning process at local level. It follows from reading them that the substantial scope of an EIA is clearly associated with the various tasks it is believed that the legislation should act to develop. In the provisions of the Act concerning the scope of this study, the issue is the intention to divide the contents of the predictions into three sections, which are named in the pro-

vision as introductory, main, and final parts. Each can be assigned to provisions referred to in the Act and are necessarily included in an EIA. Following an analysis of the provisions of the Act, a potential layout for the contents of an EIA can be proposed (Fig. 1).

The final part is a summary of the assessment made in the main body of the EIA. Proposals for alternative solutions designed to ensure improvement to the landscape and natural environmental function should also be placed in this section. The aspects that are most im-

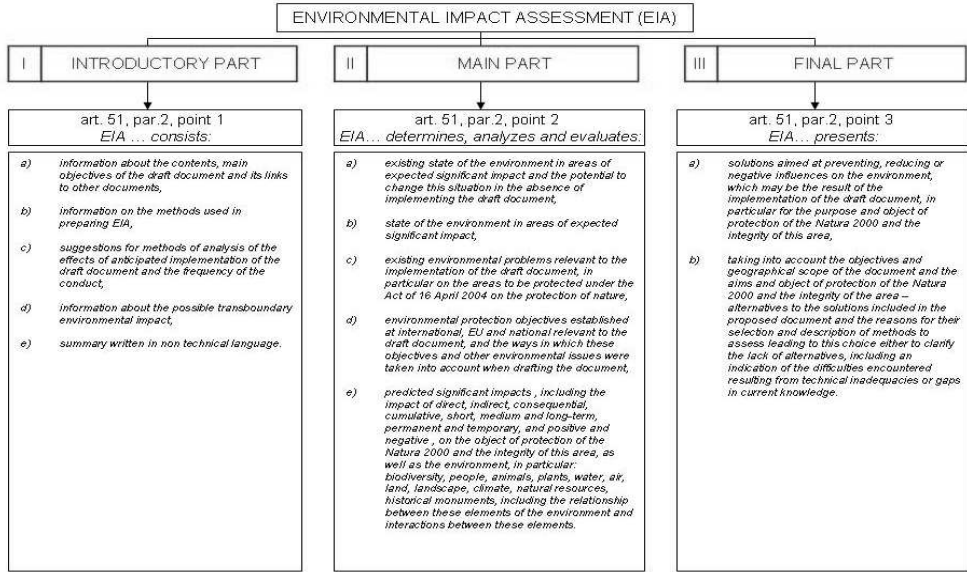


FIGURE 1. Possible content layout for EIAs

The primary task of the introductory part should be to describe the document (here, this is the local plan). There should also be a summary of the evaluation methodology. The information contained in the main part of the EIA should first set out the current state of the natural environment of the areas and then address the issues and problems. Finally, it should set out directions for protecting the environment and link this to the object and purpose of the local plan. This section should also assess the impact of the plan's findings on the environment and landscape.

portant in relation to the basic role of EIAs, that is, identifying solutions that can significantly disrupt the natural environment and landscape, are those assessments included in the main part. The supporting role of EIAs may prejudice the proposals contained in the final part of the document and alternative solutions to those adopted in the plan are likely to change landscapes outcomes in practice. This raises a number of questions: What is the purpose of indicating alternative solutions which are better for the environment at the development stage of the EIA when these are generally developed

after the completion of a plan? How far is it the case that, in spite of everything, the role of an EIA is now limited to one of assessment? Are the proposed alternatives likely to be used in an existing project?

The degree of involvement in drafting a plan

Considering the above questions, it is important to state that alternatives should be implemented during the drafting of the plan. This means that it is necessary to strengthen cooperation between the planning team and the EIA team. The power of the EIA and the opportunity to use the study in an extended range depends largely on the degree of involvement of its authors in the design of the plan (Fig. 2).

There are two possible options for cooperation between the two teams. In the first, the authors of an EIA are not involved in the project plan. The EIA is prepared at the final stage of the plan

when most spatial decisions have already been made. The solutions that affect the formation and functioning of the landscape are indicated only in the EIA. The role of the EIA is largely limited to assessment: introducing most of the changes without having to repeat the planning process is unlikely to be possible. The scope for change is limited mainly to the most important and most significant changes to the arrangements that shape the landscape.

When the EIA authors are involved in the draft plan, alternative solutions are introduced into the draft plan as planning proceeds. In this way it is possible to implement more favourable solutions to the landscape. In addition, the overall effort in creating the plan is greatly reduced, making this option much more beneficial. It not only has a greater impact on the proper management of the landscape, but also on the length of the drafting process. It is only with this type

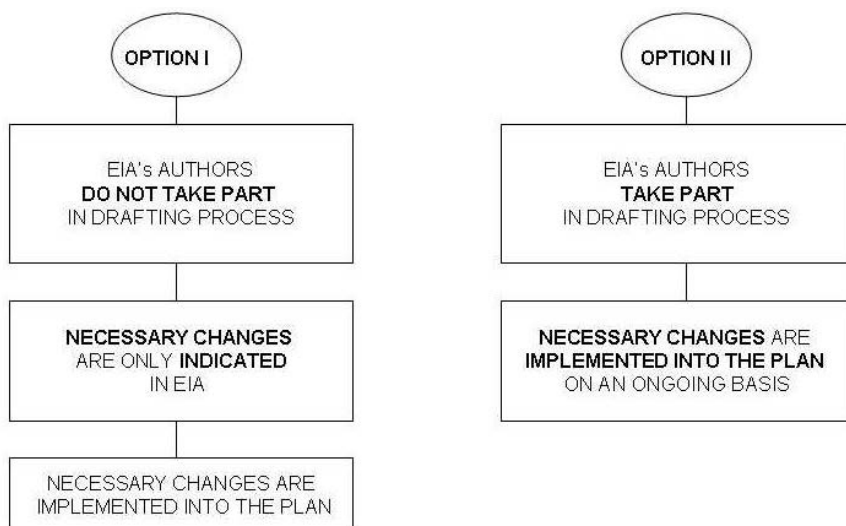


FIGURE 2. The possible degree of involvement of EIA authors in drafting master plans

of cooperation that EIAs become a fully-fledged part of the SEA procedure.

The possible scope of use for EIAs in practice

A dual role for EIAs is only possible with the direct involvement of the authors in the drafting process. Where this is the case it increases the real impact of the EIA on the type of spatial solutions used in the plan. Only then is it possible to include the plan in a broader range of resources that have a direct impact on the protection of the landscape. When both teams work together the authors of the plan provide a draft plan to the authors of the EIA (Fig. 3a). The authors of the EIA assess the impacts of proposed solutions on the natural environment and

landscape and suggest alternatives that can contribute to a better functioning of the landscape. The authors of the plan can become familiar with the negative effects of the solutions they have proposed and then implement alternatives in the plan. This can reduce negative impacts on the environment. Not all of the proposed solutions are put into the plan. The cooperation of both teams of authors is based here on the rules of cooperation combined with collaborative discussion. The course of action described above can be repeated several times. Ultimately, the result of this cooperation should be a draft compromise. Because the alternatives are introduced in a timely manner there is no need to retrofit the EIA into the plan.

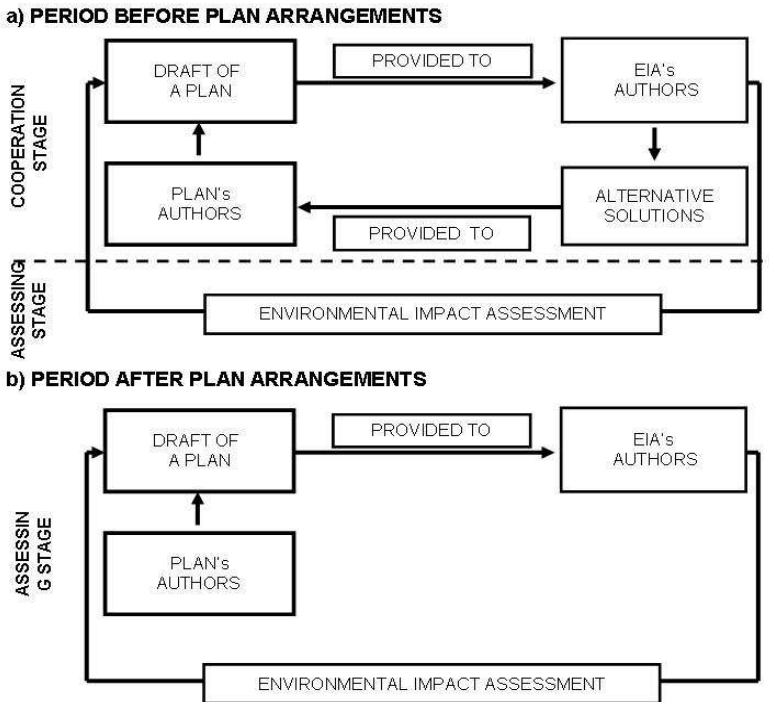


FIGURE 3 (a and b). Scope of use for EIAs in practice

If the role of EIAs is limited to assessment, the entire stage of team collaboration is skipped. In this case the draft plan is forwarded to the EIA's authors. The authors then develop a study and suggest possible alternatives that may be incorporated into the draft plan (Fig. 3b).

The extent of the role of EIAs at different planning stages

The procedure for drawing up a plan can be divided into seven stages. At each stage the degree of progress on the draft plan is larger and the role of the EIA must be varied. This has been made necessary by the statutory procedure for determining the various stages of the project plan. The preparation of an EIA should begin when the concept option is selected (concept stage plan). Even at this stage it is necessary to specify all of the issues relevant to the protection of the landscape. At each of the subsequent stages there can be very close cooperation between the two teams, which lasts until the end stage of external arrangements with the authorities referred to in the Law on Spatial Planning and Development. In this case the EIA fulfils both roles and it is possible to eliminate most of the spatial design errors.

When the master plan has been agreed the role of the EIA must switch to assessment. This is because up to that time the authors of the plan, and therefore also those of the EIA, are limited when it comes to significantly modifying the draft plan. Those stages at which the authors of the EIA are actively involved in the project plan are therefore of most importance in the formation and protection of the landscape. They have a direct impact on the design of spatial solutions

and on the quality and type of spatial solutions used in the plan (Fig. 4).

CONCLUSIONS

If EIAs are used only as a study in which solutions detrimental to the landscape are indicated this would seem to be a significant reduction in its role as the producer of an environmental study for the plan. This implies that the potential for securing sustainable landscapes in this case is also limited. Therefore, efforts should be made to expand the vital role of EIAs. It would seem that the main way to expand the role of EIAs and to enable them to influence the spatial solutions used in the plan, which are later put into effect in the landscape, is to refine the legal regulation. Issues related to the course of work on the EIA should be clarified, especially in relation to the course of work on the plan. It is important to ensure that the authors of EIAs are able to take a greater part in creating plans. This would bring invaluable benefits to the landscape. The effect of broadening the role of EIAs would be to make better-informed design decisions. Greater emphasis would then be placed on the proper development and protection of landscape values in the areas of local plans. The use of the potential power of EIAs as an instrument that has a significant impact on landscape design (in accordance with the principles of environmental protection) also depends on determining the mode of their preparation. This should be done in the light of the procedure for preparing plans and the degree of involvement of their authors in the development plan.

THE PROCEDURE FOR DRAWING UP PLANS IN PRACTICE	THE ROLE OF THE EIA
RESOLUTION OF AN ACCESSION TO A PLAN	LACK OF WORK ON A EIA
REQUESTS FOR A PLAN	
DRAFTING PROCESS	ASSESSING ROLE
ARRANGEMENTS OF A PLAN	SUPPORTING ROLE
SHOWDOWN OF A PLAN	ASSESSING ROLE
CORRECTION OF A PLAN	
ESTABLISHMENT OF A MASTER PLAN	

FIGURE 4. The possible role of an EIA during drafting of a master plan

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Streszczenie: *Sila Prognozy oddziaływania ustaleń planów miejscowych na środowisko w prewencji i kształtowaniu krajobrazu w planach miejscowych w Polsce.* Prognoza oddziaływania na środowisko to nazwa dokumentu, w którym ocenia się rodzaj i stopień potencjalnych przekształceń, jakie mogą zaistnieć w krajobrazie po realizacji ustaleń planów miejscowych. Opracowania te przede wszystkim identyfikują i wskazu-

ją zastosowane w planie rozwiązania, które mogą zaburzyć funkcjonowanie krajobrazu. Jednak „Prognozy...” mogą mieć także wpływ na jakość zastosowanych w planach rozwiązań, w tym na kształtowanie krajobrazu w obszarach planów. Siły „Prognozy...” należy więc upatrywać w fakcie, że może ona nie tylko oceniać (oceniająca rola „Prognozy...”), ale także wspomagać (wspomagająca rola „Prognozy...”) proces projektowania krajobrazu. Efektem tego będą lepiej funkcjonujące, zrównoważone krajobrazy przyszłości. Celem tego artykułu jest wskazanie teoretycznych i praktycznych możliwości ugruntowania oceniającej roli i wspomagającej roli „Prognozy...”, a wskazanie możliwości wykorzystania jej potencjalnej siły jako instrumentu mającego wpływ na kształtowanie krajobrazu.