KAUNO MIŠKŲ IR APLINKOS INŽINERIJOS KOLEGIJA

KAUNAS FORESTRY AND ENVIRONMENTAL ENGINEERING UNIVERSITY OF APPLIED SCIENCES

MIŠKININKYSTĖ IR KRAŠTOTVARKA

FORESTRY AND LANDSCAPE MANAGEMENT

2017 1 (12)

2017

TURINYS
CONTENTS

Šiame leidinyje publikuojama tarptautinės mokslinės konferencijos "Kūrybiniai procesai želdynuose“ pranešimų medžiaga.

This publication includes the proceedings of an international scientific conference "Landscape creation process”.

KONFERENCIJOS MOKSLINIS KOMITETAS
SCIENTIFIC COMMITTEE OF THE CONFERENCE

Pirmininkas/ *Chairman*

Dr. Vaidotas Lygis	Kauno miškų ir aplinkos inžinerijos kolegija, Lietuva *Kaunas Forestry and Environmental Engineering University of Applied Sciences, Lithuania*

Nariai/ *Members*

Dr. Prof. Emilia Janeczko	Varšuvos gyvybės mokslų universitetas, Lenkija *Warsaw University of Life Sciences, Poland*
Dr. Prof. Remigijus Daubaras	Vytauto Didžiojo universitetas, Lietuva *Vytautas Magnus University, Lithuania*
Dr. Asst. Prof. Zsombor Bormisza	Szent István universitetas, Vengrija *Szent Istvan University, Hungary*
Dr. Jerzy Wojtatowicz	Varšuvos ekologijos ir vadybos universitetas, Lenkija *University of Ecology and Management, Poland*
Lect. Kristine Vugule	Latvijos žemės ūkio universitetas, Latvija *Latvian University of Agriculture, Latvia*

KONFERENCIJOS ORGANIZACINIS KOMITETAS
ORGANIZATIONAL COMMITTEE OF THE CONFERENCE

Pirmininkė/ *Chairman*

Vaida Vaitkutė Eidimtienė	Kauno miškų ir aplinkos inžinerijos kolegija, Lietuva *Kaunas Forestry and Environmental Engineering University of Applied Sciences, Lithuania*

Nariai/ *Members*

Dr. Lidia Ozimkowska	Varšuvos ekologijos ir vadybos universitetas, Lenkija *University of Ecology and Management, Poland*
Dr. Laima Česonienė	Vytauto Didžiojo universitetas, Lietuva *Vytautas Magnus University, Lithuania*
Linas Daubaras	Kauno miškų ir aplinkos inžinerijos kolegija, Lietuva *Kaunas Forestry and Environmental Engineering University of Applied Sciences, Lithuania*

FOREWORD

The proceedings of the international scientific conference "LANDSCAPE CREATION PROCESS" consists of scientific articles, issued as print (ISSN 2345-0002) edition.

The conference was held on March 1-2, 2017 at Kaunas Forestry and Environmental Engineering University of Applied Sciences, Liepų str. 1, Girionys, Kaunas distr., Lithuania.

The authors of the articles are landscape architects, scientists and experts from Lithuania, Latvia, Poland, Hungary and Ukraine.

A creative approach to landscape design, protection, management and project publicizing promotes the appearance of functional and aesthetic spaces in our living environment. This topic is relevant not only in our country but throughout Europe.

Each author is responsible for correct information of his/her article.

The articles are compiled for publishing by Kaunas Forestry and Environmental Engineering University of Applied Sciences.

Address: Liepų str. 1, Girionys, Kaunas distr., LT-53101; tel. +370-37-383 082, fax. +370-37-383 140, e-mail. info@kmaik.lm.lt.

Editors

PRATARMĖ

Pranešimų rinkinys yra sudarytas iš tarptautinės mokslinės konferencijos „KŪRYBINIAI PROCESAI ŽELDYNUOSE“ mokslinių straipsnių ir išspausdintas (ISSN 2345-0002) leidiniu.

Konferencija įvyko 2017 m. kovo 1–2 dieną Kauno miškų ir aplinkos inžinerijos kolegijoje, Liepų g. 1, Girionys, Kauno r., Lietuva.

Pranešimus parengė kraštovaizdžio architektai, gamtininkai ir šios srities specialistai iš Lietuvos, Latvijos, Lenkijos, Vengrijos ir Ukrainos.

Kūrybiškas požiūris į kraštovaizdžio projektavimą, apsaugą, tvarkymą, projektų viešinimą skatina funkcionalių ir estetiškų erdvių atsiradimą mūsų gyvenamojoje aplinkoje. Ši tema aktuali ne tik mūsų šalyje, bet ir visoje Europoje.

Kiekvienas autorius yra atsakingas už pateiktos informacijos teisingumą.

Pranešimų rinkinys sudarytas Kauno miškų ir aplinkos inžinerijos kolegijos.

Adresas: Liepų g. 1, Girionys, Kauno r., LT-53101.; tel . + 370-37-383 082, faks. + 370-37-383 140, el. p. info@kmaik.lm.lt.

Redkolegija

FROM LAND TO WATER: COMPLEX PLANNING CHALLENGES TO FIT A NEW THERMAL LAKE INTO THE LANDSCAPE

Zsombor Boromisza, Attila Gergely, Ferenc Szilágyi
Szent István University, Department of Landscape Protection and Reclamation, Hungary

It is equally required to mitigate the probable environmental impacts, to ecologically fit the new landscape lake into the landscape, to serve the needs of the society, to discover the natural values and to schedule the maintenance tasks. In our study we evaluate the design tasks related to the different elements and phases of the development and their connections to each other. The land use in the surroundings of the lake has changed several times during the past 200 years however now it has the highest level of all-time ecosystem services: in terms of habitats it is mosaic, diverse, also conserving elements of the previously typical vegetation, it is a site for several recreational activities, and by its appearance and message it contributes to understanding sustainable lifestyle.

Keywords: landscape architecture, landscape management, ecosystem services, touristic development, nature trail.

Introduction

There are several reasons to create artificial lakes, including flood protection, providing water for irrigation and drinking, fish farming, and by opencast mining a plenty of new lakes appear in the landscape as well. Reservoirs and pit lakes – irrespectively of their primary function – in many cases become areas of touristic-recreational development, moreover they are popular leisure time destinations for locals from their formation. Due to the rapid succession characteristic of water-related habitats and the intense, diverse demand of utilization, the ecological conditions and the environment of the new lakes change at a quick pace (Hall - Härkönen 2006, Ostendorp et al. 1995). In the interest of landscape sustainability (Musacchio 2013, Wu 2013) and the protection and improvement of the ecosystem services of the lake and the lake-shore, changes must proceed according to a plan (Illyés et al. 2016, Paracchinia 2014). In the course of this, it is equally required to mitigate the probable environmental impacts, to ecologically fit the new landscape feature (lake) into the landscape (Bain et al. 2003, Cooke et al. 2005), to serve the needs of the society (Moss 2007), to discover the natural values (Boromisza et al. 2015) and to schedule the maintenance tasks (Mészáros 2016).

In Zalakaros (Hungary) a complex touristic-recreational investment was planned, which aimed to create new facilities for leisure activities beyond the existing thermal bath. A visitor centre, a promenade, a colonnade, a fountain, an artificial lake with an island and bridges, a tale park, a labyrinth, a water obstacle course, a parking, meditation space of the lights, seniors' active recreation park, and a nature trail were among the planned elements. The peculiarity of the lake is its water quality, as it is filled with the drain off water of the thermal bath. In our study we evaluate the design tasks related to the different elements and phases of the development and their connections to each other. (Table 1)

Table 1. Basic data of the different design and construction tasks
1 lentelė. *Skirtingų projektavimo ir įrengimo užduočių pagrindiniai duomenys*

Design task *Projektavimo užduotis*	**Time of design** *Projektavimo laikas*	**Object/area of the design** *Projektuojamas objektas*	**Time of construction** *Įrengimo laikas*
Transplantation plan of the protected plants	September 2013	area of the planned lake, neighbouring forest	October 2013
Planting design of the lake	March 2015	lake bed and tilts	July-August 2015, 2016.
Maintenance plan of the lake	April 2016	lake bed	continuous
Nature trail design	November 2015	lake's neighbouring forest	December 2015

Transplantation plan of the protected plants

The fact that the forest where the lake was going to be constructed was a habitat of protected species: spring snowflake (*Leucojum vernum*) and white hellebore (*Veratrum album*) meant the first challenge of the project. (Fig. 1) To solve the problem we prepared the habitat map of the protected plant species and carried out a botanical analysis of the transplantation site and the area of the new lake. We analysed the adequacy of the transplantation site and presented a suggestion about the transplantation of the protected species.

Fig. 1. *Leucojum vernum* (on the left) and *Veratrum album* (on the right) in the transplantation area, in 2016
1 pav. *Leucojum vernum (kairėje) ir Veratrum album (dešinėje) persodinimo vietoje 2016 m.*

It is important to note that the transplantation of protected species raises many professional (Is it possible to transplant the given species? Which methods have to be used? When have the transplantation works to be done?) and ethical (Do we have to protect/conserve the individual plants, the community or the processes occurring in the community?) questions which can only be answered based on properly documented experiments. In the course of transplantation only individual plants can be saved, at the same time the complex

structure, processes and functions of the original community is perished (Takács 2007). Accordingly, in terms of nature conservation, transplantation of protected plant species should only be applied as a last resort, practically as a part of mitigation measures. The main reason for this is that experience shows that efficiency of transplantation of individual plants – varying with species – is low, the survival possibilities of individual plants uprooted from their communities are often exiguous.

During the analysis, in the case of *Veratrum album* we counted the stems in 20 sampling quadrats sized 5 x 5 m in the range areas, then estimated the number of plants on the whole design area. In the case of *Leucojum vernum* we relied on the results of the analysis of 2004 and 2005 as the geophyte plant growing in early spring had no visible stems above the soil at the end of summer. During the field survey in August 2013 we estimated cc. 1200 stems of *Veratrum album* in the area of the planned lake. Based on the analysis carried out in 2004 and 2005 we determined the number of *Leucojum vernum* in cc. 4000 plants. During the land survey we prepared the species list of the vascular plants present in the design area. The forest community of the area is dominated by common alder (*Alnus glutinosa*), and it is between an alder marsh which contains marsh plants and a riverine ash-alder woodland which contains some elements typical of beech forests, and originally probably it was a young growth.

While the weedy habitat is drying during the summer, becoming uncharacteristic on the edges, its species composition is still natural and colouring elements are present, at the same time the forest's structure is less natural (Bartha 2001, Bölöni et al. 2010, Simon 2000). Based on the analysis it can be ascertained that the ceasing habitat (riverine ash-alder woodland) in the area of the planned lake corresponds with the directly neighbouring transplantation area in terms of species composition and appearance. The species indicate wet and mesic habitat type which is suitable for the transplantation of the protected plants.

The transplantation method of *Leucojum vernum* plants is determined by the species' growth form. It is a bulbiferous species with a so-called geophyte growth form which means the only solution was to hand excavate the bulbs. We determined the planting density of the bulbs in the new area at 50 pcs/m^2 and their ideal planting depth at 5-10 cm.

Veratrum album is a species with a fleshy rhizome. The single stems had to be brought to the surface by hand, using hand tools, with the largest earth ball possible, and had to be transported to the transplantation target area in the form of an earth ball by a wheelbarrow. The planting holes had to be excavated continuously, parallel to the excavation of the plants, in conformity with the size of the earth ball (cc. 30x30 cm). The planting hole had to be watered once. The optimal planting density was determined at 10 pcs/m^2. In the course of the transplantation done in September 2013, 5588 bulbs of *Leucojum vernum* and 1016 stems of *Veratrum album* were transplanted to their new habitat, under professional supervision. These numbers proved the estimations made during the analysis. Unfortunately since then there are no monitoring activities going on about the success of the transplantation, however based on the experiences of regular field surveys it can be stated that high number of individual plants of both species can be found in the transplantation area.

Planting design of the artificial lake

After transplanting the protected plants the lake bed could be formed. The surface of the artificial lake is 12900 m^2, its average depth is 1,5 m (a part of the lake bed is covered by 0,4 cm shallow water), its maximum depth is 1,8 m, its volume is 19000 m^3, the length of the shoreline is 484 m, the banks are with an average gradient in 1:2. The lake is isolated, its water supply is ensured by using the drain-off of the thermal water (the daily amount of the bath's excess water is 6-800 m^3). The salinity of the water is rather high, the conductivity values are around 3 mS/cm which is typical of half-soda and soda lakes. The concentration of nutrients in the water is low, and the water is in strong nitrogen scarcity (nitrogen limited). The second challenge of the design process was to prepare the planting design of the lake – with which contributing to fitting the lake into the landscape in ecological sense.

Besides their aesthetical and habitat significance (providing hiding-place, foraging space, nesting site and spawning ground to several animal species), aquatic and riparian plants have a striking role in the design area from the aspect of water quality: by their nutrient uptake and shading, they can limit the unfavourable excess growth of algae, moreover the oxygen production of some species is notable as well. To prevent the dominance of algae, at least 30-40% of the water surface has to be covered by macrophytes (higher order aquatic and riparian plants) which process might take more years. Consequently, the suggested planting design's primary role is to contribute to conserving water quality, to create ornamental plant cover on the water surface and to form some aesthetical focal points.

The method of planting was significantly influenced by the lake's realized construction works and its structure: the formation and isolation of the bed, its bottom and the formation of the banks. The fact that no planting medium and reed berm were created is a determining factor (so in the case of the banks, a different planting method had to be applied.) In the course of choosing the species and creating the spatial arrangements the lake's natural aptitudes defined the basic criteria: the peculiarity of water quality, exposure to undulation, the morphological aptitudes of the lake – its deepness conditions, temperature conditions and solar access. Considering the above aspects, 6 riparian (1446 specimens), 4 floating leaf (248 specimens) and 2 submersed plant species (20 specimens) were included on the species list.

While carrying out the different planting methods, adequate timing and setting water level needed for construction works were of high importance. The lake's water had to be let down before planting the aquatic plants. The floating leaf *Nymphaea* species were placed at 1 pcs/3m^2 density, in water planting baskets lined with linen sacks. Considering the depth of the lake, the baskets' of younger *Nymphaea* plants were not directly placed on the bottom but raised by brick columns (Robinson 2006).

The submersed vegetation also had to be planted directly to the bottom, in a density of 3 pcs/m^2. Planting on the banks protected by rip-rap demanded an untraditional procedure as well. Proper quality rhizomes had to be collected of riparian plants (mostly: *Typha angustifolia*) that were surfaced from canal dredging in the region. The rhizomes wrapped in jute sacks had to be fixed between the bank's rocks, 30-50 cm under the operating water level (Hawke - José, 2002, Henderson et al. 1999) (Fig. 2). The riparian plants designed in the shallow area were distributed at operating water level, at an average stem distance of

50 cm, placing the planting baskets directly on the bottom. In the interest of protecting water quality and maintaining adequate conditions of the plant cover, we prepared the maintenance plan of the lake as well.

Fig. 2. The image series (from left to right) show the planting process and method of the riparian plants, in the case of rip-rapped bank surfaces

2 pav. *Nuotraukos (iš kairės į dešinę), rodančios pakrančių augalų sodinimo metodą ir procesą*

Design of the nature trail

The interpretation and introduction of natural values were defined as a goal in the transplantation area of the protected species. The next step of the process was to design a nature trail constructed of plank (wooden path). To design and to realize the nature trail required not only technical work, but also to prepare complex, high quality, unique graphical materials based on ecological and pedagogic knowledge (Kiss 2007, Sallay-Bárcziné 2011). Thus it became a holistic process, the foundation of creating facilities which provide adventurous and attitude-changing experiences (Bajor-Lamper 2014, Ceballos-Lascuráin, 1996). The image and the conception of the touristic project, the nature of the expected visitors as well as the design area's landscape and natural aptitudes were all determining factors in the design process of the nature trail. In the interest of meeting the needs of all the functions including education, value protection and amusement, five stations were created, which interpret the neighbouring forest's wildlife, the traditional uses of the forest, other landscape and natural values and attractions of the surrounding region, and the process of landscape changing. The information boards placed at each station and the interactive tools together serve for acquiring knowledge and for experiencing discovery and play. We determined the location of each station and artificial element based on the design of the plank path and the arrangement of different habitats and plant species, while ensuring a rhythmical lay-out (Bell, 2009). The informational surfaces of the boards are based on hand-drawn graphics complemented by explanation text (in Hungarian, English and German) and thematic illustrations. While elaborating the wording and the appearance it was essential to create a stimulating experience by a courageous use of humour (Fig. 3).

Fig. 3: The appearance and graphical style of the nature trail contribute to the amusement, adjusted to the needs of the target group

3 pav. *Gamtinio tako vaizdas ir grafinis stilius yra žaismingi ir atitinka tikslinės grupės poreikius*

In the interest of accessibility in the reception area boards with information in Braille were installed. In this station one board gives information about the nature trail, while four smaller ones depict bird silhouettes which can be recognized by the sense of touch, and the names of the birds are written in Braille as well. The characteristic plant species are presented on separated plant name boards, too.

Conclusions

According to the experiences of the field survey the transplantation of the protected plants was a successful intervention, and the results of the analysis made in the area (habitat, dominant species) were used during the design of the nature trail. In this case the key to success was to establish advantageous cooperation with the nature conservation authority (national park), since they provided data about the *Leucojum vernum* population. The construction was executed by the municipality's own workforce, under the professional supervision of the National Park. To accomplish the project was a key issue for the municipality since without the transplantation the whole project would have failed.

From 2 years perspective the planting of the lake cannot be totally judged yet, spectacular fluctuations of the water ecosystem are expected for years (repression of some planted species, spontaneous appearance of others). In this case a close cooperation between the municipality, the designer and the construction company was required. For us it was a fundamental aspect to form the new lake of artificial character with devastated land surfaces into a lake of a more semi-natural effect and to amplify the diversity of habitats. The motivation of the constituent municipality was strong primary because of water quality, interestingly the aesthetical appearance of the lake was only secondary for them.

The nature trail means a tourist attraction for the municipality which bears a high marketing value itself. The trail is the most visited object of the whole project, detailed analysis of visitors' assessment is our further analysis and research goal. The nature trail itself is a symbol of harmony of nature and built environment, where artificial objects had to be fitted to existing semi-natural elements.

Table 2. The context of the design process
2 lentelė. *Projektavimo kontekstas*

Design task ***Projektavimo užduotis***	**Source of information** ***Informacijos šaltinis***	**The motivation of the constituent** ***Motyvas***	**Basic goal of designers** ***Projektavimo tikslas***	**Participants** ***Dalyviai***
Transplantation plan of protected plants	field survey, National Park's supply of data	launching the project, acquiring authorizations	mitigating environmental impacts	municipality, National Park, designers
Planting design of the lake	field survey, water quality sampling	avoiding water quality problems	drawing the aesthetical image of the project, aesthetically and ecologically fitting the project into the landscape	municipality, construction company, designers
Maintenance plan of the lake	field survey, water quality sampling + planting design of the lake	avoiding water quality problems	avoiding water quality problems, conserving the conditions of the planted plants	municipality, designers
Design of the nature trail	field survey + **transplantation plan of protected plants**	creating attraction	functionally fitting the project into the landscape, environmental education	municipality, construction company, designers

All designs had in common that they recouped or supplemented previously failed, not properly or not in time elaborated documents. Derived from this fact, either the date of the analysis needed for design (it was not possible to observe *Leucojum vernum* in autumn) or the date of the construction works following the design process (planting the lake in midsummer) was not optimal. The project was based mainly on field surveys, significantly not on databases, statistical data, or analysing maps (Table 2). Although they were designs linked to different authorization processes by law, they had to be viewed as a homogeneous "pack", which are aligned and supplementing each other, contributing to fitting the new lake into the landscape. The land use in the surroundings of the lake has changed several times during the past 200 years however now it has the highest level of all-time ecosystem services: in terms of habitats it is mosaic, diverse, also conserving elements of the previously typical vegetation, it is a site for several recreational activities, and by its appearance and message it contributes to understanding sustainable lifestyle.

Literature

1. Bain, M. B., Harig, A. L., Loucks, D. P., Goforth, R. R., Mills, K. R. Aquatic ecosystem protection and restoration: advances in methods for assessment and evaluation. Environmental Science & Policy, 2000. 3. pp. 89-98.
2. Bajor-Lampert, R. A tanösvények szerepe és kialakítási szempontrendszere. PhD thesis, Budapesti Corvinus Egyetem, Budapest, 2014.
3. Bartha, D. (ed.) Természetszerű erdők kezelése. TermészetBÚVÁR Alapítvány Kiadó. Budapest, 2001.
4. Bell, S. European Forest Recreation and Tourism: A Handbook. Taylor & Francis, New York, (Ed.), 2009. 264 p.
5. Boromisza, Zs., Ács, T., Pádárné Török, É. Integrating Applied Lake Ecology into Spatial Planning: Towards a Socially Acceptable Lakeshore Restoration at Lake Velence (Hungary). Landscape and Environment, 2015. 9:1. pp. 27-41.
6. Bölöni, J., Molnár, Zs., Kun, A. (eds.) Magyarország élőhelyei. Vegetációtípusok leírása és határozója. ÁNÉR 2011. MTA Ökológiai és Botanikai Kutatóintézete. Vácrátót, 2010.
7. Ceballos-Lascuráin, H. Tourism, Ecotourism, and Protected Areas: The State of Nature-based Tourism Around the World and Guidelines for Its Development, IUCN, Cambridge, 1996.
8. Cooke, G. D., Welch, E. B., Peterson, S. A., Nichols, S. Restoration and management of lakes and reservoirs. Third edition. Taylor and Francis Group, BocaRaton, (Eds.), 2005.
9. Hall, M., Härkönen, T. Lake tourism. An integrated approach to lacustrine tourism systems. Aspects of tourism 32. Channel View Publications, Clevedon – Buffalo – Toronto, (Eds.), 2006.
10. Hawke, C., José, P. A nádasok kezelése gazdasági és természetvédelmi szempontok szerint. RSPB-MME. Budapest, 2002.
11. Henderson, C. L., Dindorf, C. J., Rozumalski, F. J. Lakescaping for wildlife and water quality. Minnesota Department of Natural Resources. St. Paul, MN, 1999.
12. Illyés, Zs., Pádárné, T. É., Nádasy, L., Földi, Zs., Vaszócsik, V., Kató, E. Tendencies and future urban sprawl in two study areas in the agglomeration of Budapest. Landscape & Environment, 2016. 10:2. pp. 75-88.
13. Kiss, G. (ed.) Tanösvények tervezése. Módszertani útmutató. Bükki Nemzeti Park Igazgatóság. Eger, 2007.
14. Mészáros, Sz. Maintaining Practice of Gravel Pit Lakes Depending on the Post-mining Land Uses, Based on Central-Hungarian Case Studies. In: Acta Scientiarum Transylvanica. Múzeumi Füzetek. Chimica, 2016. 21-22/3. 2013-2014. pp. 77-86.
15. Moss, B. The art and science of lake restoration. Hydrobiologia, 2007. 581. pp. 15-24.
16. Musacchio, L.R. Key concepts and research priorities for landscape sustainability. Landscape Ecology, 2013. 28. pp. 995–998

17.Ostendorp, W., Iseli, C., Krauss, M., Krumscheid-Plankert, P., Moret, J-L., Rollier, M., Schanz, F. Lake shore deterioration, reed management and bank restoration in some Central European lakes. Ecological Engineering, 1995. 5. pp. 51-75.

18.Paracchinia, M.L., Zuliana, G., Kopperoinenb, L., Maesa, J., Schägnera, J.P., Termansenc, M., Zandersenc, M., Perez-Sobad, M., Scholefielde, P.A., Bidoglio, G. Mapping cultural ecosystem services: A framework to assess thepotential for outdoor recreation across the EU. Ecological Indicators, 2014. 45. pp. 371–385

19. Robinson, P. Kerti tavak és sziklák. Gyakorlati útmutató a tervezéstől a megvalósításig. Alexandra Kiadó. Pécs, 2006.

20. Sallay, Á., Bárcziné Kapovits, J. (2011): Greenways = Zöldutak. In: Sallay Á. (ed.): Tájtervezés és területfejlesztés. Budapesti Corvinus Egyetem, Budapest, 2011. 193–203 p.

21. Simon, T. A magyarországi edényes flóra határozója. Nemzeti Tankönyvkiadó. Budapest, 2000.

22. Takács, G. Védett növényfajok áttelepítésének tapasztalatai Győr környékén. IV. Magyar Természetvédelmi Biológiai Konferencia. Tokaj, 2007. március 29-31. Előadások és poszterek összefoglalói, 2007. 11 p.

23. Wu, J. Landscape sustainability science: ecosystem services and human well-being in changing landscapes. Landscape Ecology, 2013. 28. pp. 999–1023.

Zsombor Boromisza, Attila Gergely, Ferenc Szilágyi

Nuo žemės prie vandens: sudėtingi planavimo iššūkiai įrengiant naują terminį ežerą kraštovaizdyje

Santrauka

Vienodi reikalavimai keliami tiek galimo poveikio aplinkai sušvelninimui, tiek ekologiškam naujo ežero įrengimui kraštovaizdyje, tiek visuomenės poreikių tenkinimui bei gamtos vertybių atradimui ir techninės priežiūros darbų planavimui. Mūsų tyrimas įvertina projektavimo užduotis, susijusias su skirtingais elementais, projektavimo etapais bei jų tarpusavio ryšius. Žemės naudojimas ežero apylinkėse kelis kartus pasikeitė per pastaruosius 200 metų, tačiau dabar yra teikiamos aukščiausio lygio ekosistemos paslaugos: kalbant apie buveines kraštovaizdis yra mozaikiškas, įvairus, taip pat išsaugoti ankstesnės tipiškos augalijos elementai. Tai yra vieta, skirta kelioms rekreacinėms veikloms, ir savo išvaizda bei prasme prisideda prie darnaus gyvenimo būdo suvokimo.

Raktažodžiai: *kraštovaizdžio architektūra, kraštovaizdžio tvarkymas*, *ekosistemos paslaugos, turizmo plėtra, gamtinis takas.*

FRUIT ALLEYS – THE WAY OF HISTORICAL RURAL LANDSCAPE CREATION IN POLAND

Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz
Department of Landscape Architecture, Faculty of Horticulture, Biotechnology and Landscape Architecture, Warsaw University of Life Sciences – SGGW, Poland

Fruit trees and shrubs apart from their main practical value (fructification) also have significant ornamental value by offering beautiful and plentiful bloom. Due to their specific practical and ornamental qualities fruit trees have been extensively planted since end of 19th century in Poland, among other along roads as part of a country wide roadside tree planting programme (Fortuna-Antoszkiewicz, Łukaszkiewicz, 2012). As a result fruit tree alleys have been a traditional element of Polish rural landscape for decades.

Keywords: fruit alleys along roads, historical varieties, recreating fruit tree alleys in Poland.

Introduction

Significance of fruit tree alleys, just like other typical roadside trees, relied on their practical properties: providing shade from sun in summer, protecting from strong wind and blown in snow, delimiting the road during dark snowy nights, when it is easy to loose ones way.

Planting of trees along road in Poland was championed by „Ogrodnik Polski" [Polish Horticulturist], a bi-monthly published in Warsaw at the turn of 19th century. In 1899 the magazine was taken over by Towarzystwo Ogrodnicze Warszawskie [Warsaw Horticultural Association] (Jankowski, 1972). Since 1879 the magazine was edited by among other Edmund Jankowski and Franciszek Szanior, prominent experts in the field of horticulture and garden landscape planning. „Ogrodnik Polski" was dedicated to disseminating horticultural knowledge, promoting new gardening techniques as well as popularizing new trends in garden planning (both public and private), urban green area planning and conservation of old trees. The magazine discussed interesting and worthwhile initiatives and their results, but also showcased numerous sites – areas with interesting landscape, parks, gardens, horticultural farms, nurseries, etc. from all over former Polish territories. Many people associated with the magazine have greatly contributed to creating basis for modern horticulture, but also to development of green areas in Warsaw and former Polish lands.

From the onset the magazine strongly promoted active participation of the entire society in maintaining and improving landscape of Poland. This included promoting repair of Polish roads and pathways and intensive tree planting along them. To encourage mass planting of trees along roads and adoption of new trends positive examples were presented (Ogrodnik Polski, 1882). In the following years the magazine was publishing practical guidelines for planting as well as promoting specific species and variations of fruit trees.

The most praised species was **pear** – a tree with unique form and attractive flowers. Russian varieties were especially promoted due to their resistance to cold, such as: *Bezsiemianka* (Bezziarnówka), *Tonkowietka* (Cienkogałęzista), *Duła miodowaja, Gliwa oczeń socznaja* (Jankowski, 1883). For alleys the following additional species were recommended: "sour cherry", "hungarian" plum, mulberry (Sadzenie i prowadzenie drzew

alejowych przez E. Petzolda. In: Ogrodnik Polski, 1880), walnut (Ogrodnik Polski, 1882), cherry (Ogrodnik Polski, 1894).

In the later period, the following fruit tree varieties were recommended:

- **apple trees** – *Boikenapfel,* Grochówka wielka (*Grosser Bohnapfel*), Kuzynek (*Condinot purpurrother*), Kosztela, Reneta Baumana, Reneta Karelska wielka, Reneta Szampańska, Reneta Landsberska, Żeleźniak (*Eiserapfel rother*);
- **pear trees** – Bergamota czerwona jesienna (*Bergamotce rouge*), Urbanistka (*Beurré Colomas d'automne*), Jedwabnica, Pomarańczówka;
- **cherry trees** – Blado-różowa wczesna, Blado-różowa sercowa, Czarne wczesne, Olbrzymka (Olędzki, 1901).

Years later, this campaigning had positive results – the quantity and quality of roadside trees in Poland had significantly improved. Nonetheless, condition of landscape upon regaining independence in 1918 was still insufficient and required further intensive work. This is why in the following years important legal acts were passed which foresaw intensification of activities towards this end (Ustawa z dnia 7 października 1921 roku). In the period until WWII planting of fruit trees along Polish roads was continued. In late 1920-ties, along traditional alley trees, fruit trees were recommended for highroads and high traffic roads – wild cheery, walnut – and for low traffic byroads - cherries, pears, apple trees, plum trees, walnut (Gałczyński, 1928).

Cherry trees and **walnuts** which can be used to create beautiful alleys were most praised. Recommended cherry species: *Guigne d'Annonay, Frogmore early* (Wczesna Frogmore'a), *Rivers early* (Wczesna Riversa), Olbrzymia z Hedelfingen, Czarna wielka also known as Czarna późna and Różowa wielka.

Pears were still seen as best suited to roadside conditions, due to their characteristics (deep root system, high wind resistance, attractive shape, possibility of forming). Recommended varieties: Kalebasa Bosc'a also known as Apremontka (*Beurré d'Apremont*), Wyborna (*Désirée*) de Charneux.

Apple trees were also valued, and were planted mainly for their fruit (can be harvested and sold). Recommended varieties: Grochówka, Ontario.

An important alley tree was **spherical white mulberry** (*Morus alba globosa)* (Gałczyński, 1928).

Due to extensive damage the country suffered as a result of WWII, since 1960-ties intensive renovation of roadside trees in rural areas was undertaken. Fruit trees, mainly apple and pear trees were still being used along with typical alley trees for this purpose. Plantings originating mainly from this period may be still seen in various parts of Poland, such as Mazowsze, West Pomerania, Silesia, Greater Poland.

Research – data collection

However aging fruit tree alleys without renovation begin to vanish from the rural landscape. Currently they may be seen mainly along low-traffic byroads (Fig. 1-6.), while the oldest, relic alleys in older manor parks (Fig. 7.). In recent years number of roadside trees declines among other due to modernization of local roads.

Fig. 1. Apple trees in bloom by an old road, Warsaw-Mory, Mazovia
(photo: P. Wiśniewski, April 2015)
1 pav. *Žydinčios obelys prie seno Varšuva–Mory kelio, Mazovija*
(P.Wiśniewski'o nuotrauka, 2015 m. balandis)

Fig. 2. Apple trees, local road Radonice, Mazovia
(photo: J. Łukaszkiewicz, June 2016)
2 pav. *Obelys prie Radonice kelio, Mazovija*
(J. Łukaszkiewicz nuotrauka, 2016 m. birželis)

Fig. 3. Apple trees, local road Radonice, Mazovia
(photo: J. Łukaszkiewicz, June 2016)
3 pav. *Obelys prie Radonice kelio, Mazovija*
(J. Łukaszkiewicz nuotrauka, 2016 m. birželis)

Fig. 4. Apple trees, local road Kopydłowo-Kopydłówek-Wilczogóra, Greater Poland
(photo: J. Łukaszkiewicz, July 2016)
4 pav. *Obelys prie Kopydłowo-Kopydłówek–Wilczogóra kelio, Lenkija*
(J. Łukaszkiewicz nuotrauka, 2016 m. birželis)

Fig. 5. Cherry trees, local road Nieborzyn-Budzisław Kościelny, Greater Poland (photo: J. Łukaszkiewicz, July 2016)
5 pav. *Tręšnės prie Nieborzyn–Budzisław Kościelny kelio, Lenkija (J. Łukaszkiewicz nuotrauka, 2016 m. birželis)*

Fig. 6. Walnuts, local road, Stara Iwiczna, Mazovia (photo: J. Łukaszkiewicz, August 2012)
6 pav. *Graikiniai riešutmedžiai prie Stara Iwiczna kelio, Mazovija (J. Łukaszkiewicz nuotrauka, 2012 m. rugpjūtis)*

Fig. 7. Walnuts, Wielgie, park, Mazovia
(photo: B. Fortuna-Antoszkiewicz, March 2012)
7 pav. *Graikiniai riešutmedžiai Wielgie parke, Mazovija*
(B. Fortuna-Antoszkiewicz nuotrauka, 2012 m. kovas)

Since 2012 authors of this publication have been observing and documenting existing fruit tree alleys scattered in the rural landscape. The research includes (table 1):

- features of their spatial form (original tree spacing; row spacing; row distance from road);
- tree measurements (breast height circumference; tree height, crown width).

Analysis of individual sites allows to establish level of preservation of the original layout and the estimated age of trees and the entire tree stand.

Table 1. Characteristics of some fruit alleys in selected locations in Poland – example data collected by authors

1 lentelė. *Kai kurių vaismedžių alėjų pasirinktose Lenkijos vietose charakteristika – autorių surinkti duomenys*

Tree species/ general location *Medžių rūšis/vietovė*	Quantity [pcs] *Kiekis, vnt.*	Average stem circumference [cm] *Kamieno apimtis, cm*	Average height [m] *Vid. aukštis, m*	Average crown diameter [m] *Vid. lajos skersmuo, m*	Average spacing [m] *Vid. atstumas, m*	Year of field data collection *Duomenų rinkimo metai*
apple trees (*Malus sp.*)/ Mory by Warsaw	30	122, 131, 132, 156	max. 6,0	7,0-9,0	ca. 10,0	2016
apple trees (*Malus sp.*)/ Radonice by Błonie	45	149, 151, 153	6,0-8,0	6,0-8,0	13,0-13,5	2016
apple trees (*Malus sp.*)/ Kopydłowo - Kopydłówek - Wilczogóra / na pn., pn.-zach. by Konin	181	120, 131, 125	6,5-7,0-8,0	7,0-8,0	13,0-13,5	2016
cherry trees (*Prunus sp.*)/ Nieborzyn-Budzisław Kościelny / pn.-zach. by Konin	50	150, 156	6,5-8,0	6,0-7,0	11,0-12,0	2016
walnut trees (*Juglans regia*)/ Stara Iwiczna by Piaseczno, Warsaw	26	120 - 140	ca. 6,0	5,0-7,0	2,5-3,0	2013
walnut trees (*Juglans regia*)/ Wielgie park – by Radom	21	110/ 118/ 132/ 133/ 141/ 177/ 172/ 188	4,0 - 6,0	4,5 – 6,0	5,0	2012

At the same time in some regions of Poland a renewal of interest in planting fruit trees along roads can be observed (Fortuna-Antoszkiewicz, Łukaszkiewicz, 2013). There's been a special revival of interest in old, rare varieties - rich collections of which can be found in centres such as Mużakowski Park (Hodun, Stachańczyk, 2011) or Bolestraszyce Arboretum (Dolatowski, Prokopiv, 2011).

Summary - contemporary trends in the reproduction of fruit trees plantings in the rural landscape

Some of the initiatives undertaken in recent years highlight the need to preserve (where possible) and recreate fruit tree stands. Fruit tree alleys along field roads, or even individual specimens growing between fields are of great significance for landscape (biocenosis, practical and aesthetic value) (Bałazy, et al., 1998):

- they provide food and a hiding place for small field animals and when in bloom a habitat for insects and a feeding ground for birds, contributing to biodiversity;
- tree stands planted in lines or stripes constitute wildlife corridors aiding animal migration;
- they increase water retention, mitigate microclimate, have a positive impact on neighbouring crop yields and provide fruit themselves or allow bees to make honey;
- they are a characteristic feature of a traditional rural landscape with practical significance (help delimit roads, baulks or property borders) (Pająkowski, 2003);
- they are a part of roadside tree stands in rural areas (practical aspect), the increase aesthetic value of plant composition (landscaping and ornamental aspect).

Ever increasing number of pro-ecological foundations and organizations in Poland let's one hope that the fruit tree stands can be recreated in the rural landscape. There are numerous examples of organised informational and educational campaigns aimed at popularising planting of fruit trees. These are made possible also using EU funds.

One of the numerous initiatives of this kind is **„Historie drzewami pisane"** [Stories written in trees] project of Porozumienie Wzgórz Dalkowskich Foundation and „Zielona Akcja" Ecological Foundation for self-government employees and local community of Wzgórza Dalkowskie area (South-Werstern Poland, at the border of Lubuskie i Dolnośląskie province). According to species selection guidelines for plantings done under this project fruit trees are to be planted along local and low traffic roads in rural areas. The project includes, apart from promoting this idea, making inventory and planting of new fruit trees (Józefczuk, Krukowska-Szopa, 2010).

Other examples include **"Najdłuższa aleja drzew owocowych w Europie"** [Longest fruit tree alley in Europe] from Cracow through Moravia to Vienna. „Kraków-Morawy-Wiedeń Greenways" is an international Polish-Czech-Austrian natural and cultural heritage thematic route along a 780-kilometer bike route connecting heritage cities and towns, as well as rural areas valuable in terms of their natural, landscape and cultural significance in the very heart of Eastern Europe. As part of the greenway initiative people living along the route are encouraged to plan local varieties of fruit trees so that Cracow-Moravy-Vienna becomes one day a longest fruit tree alley in Europe. In Poland the initiative is administered by "Partnerstwo dla Środowiska Foundation" which is supported by numerous donors, partners and strategic partners as well as media (Stowarzyszenie Greenways Polska).

Another example of similar initiatives is **„Analiza bioróżnorodności z naciskiem na stare odmiany czereśni w obszarze Stowarzyszenia Kraina św. Anny i niezbędne działania służące ich ocaleniu"** [Biodiversity analysis focusing on old cheery variants in the area of St. Anna Region's Association, as well as necessary activities for their preservation], co-financed using European Union funds from Rural Development Programme for

axis 4 Leader measures for years 2007-2013. The project sponsored by among others a local activity group - St. Anna Region's Association and Silesian Botanical Garden, envisages recreation of cherry tree stands along roads in the area of St. Ann's mountain in Silesia. In 2010 a detailed inventory of cherry tree alleys at the foot of St. Ann's mountain was done. In 2011 a detailed inventory of alleys along roads connecting the following localities was done: Ligota Dolna and Ligota Górna and a preserved fragment of an alley leading from Ligota Górna towards Wysoka town (Jańczak, Pikuła, 2011).

Positive trends of recreating fruit tree alleys and conservation of this type of relics may be seen in various regions of Poland. It is likely that Polish landscape will regain at least partly one of its characteristic and biologically precious features.

Literature

1. Bałazy, S., Ziomek, K., Weyssenhof, H., Wójcik, A. Zasady kształtowania zadrzewień śródpolnych [Rules for planting midfield trees] In: Kształtowanie środowiska przyrodniczego na przykładzie Parku Krajobrazowego im. Gen. D. Chłapowskiego. [Shaping natural environment – Gen. D Chłapowski landscape park case study.]. Ed. L. Ryszkowski, S. Bałazy. Zakład Badań Środowiska Rolniczego Leśnego PAN, Poznań, 1998. Pp. 49-65.
2. Dolatowski, J., Prokopiv, A. (ed.). Stare odmiany jabłoni w dawnej Galicji Wschodniej [Old apple tree varieties in former Eastern Galicia]. Arboretum Bolestraszyce, Zeszyt 15. Wyd. Arboretum i Zakład Fizjografii w Bolestraszycach, Bolestraszyce, 2011.
3. Fortuna-Antoszkiewicz, B., Łukaszkiewicz, J. Obsadzanie dróg drzewami owocowymi w Polsce – tradycja i współczesność (XIX / XX w.) [Fruit trees along roads in Poland - then and now (19th and 20th century)]. In: Czasopismo Techniczne, Zeszyt 9/111, Wyd. Politechniki Krakowskiej, Kraków, 2012, pp. 127-136.
4. Fortuna-Antoszkiewicz, B., Łukaszkiewicz, J. Wykorzystanie drzew i krzewów owocowych w krajobrazie miasta [Using fruit trees and shrubs in urban landscape]. In: Zielone miasto - osobowość miejsca [Green city - locality character]. Wyd. Agencja Promocji Zieleni Sp. z o.o. Warszawa, 2013. pp. 5-18.
5. Stowarzyszenie Greenways Polska [Greenways Poland Association]. Retrieved from: http://www.greenways.org.pl/en/greenways-w-polsce/ [accessed: 17.09.2015].
6. Gałczyński, B. Drzewa liściaste leśne i alejowe [Forest and alley deciduous trees]. Nakładem Autora, Piaseczno pod Warszawą, 1928. pp. 144, 170-178.
7. Hodun, G., Stachańczyk, R. Piękna z Herrnhut i inne. Historyczna kolekcja dawnych odmian jabłoni w Parku Mużakowskim [Piękna z Herrnhut and others. Historical collection of old apple trees in Mużakowski Park]. Ed. J. Kucharska. Wyd. NID, Warszawa, 2011.
8. Jankowski, E. Grusze przy drogach [Pear trees along roads]. In: Ogrodnik Polski, t.V, Nr 10, Warszawa, 1883. pp. 222-223.
9. Jankowski, E. Wspomnienia ogrodnika [Gardener's memoirs]. PIW, Warszawa, 1972. pp. 10.
10. Jańczak, M., Pikuła, W. Analiza bioróżnorodności z naciskiem na stare odmiany czereśni w obszarze Stowarzyszenia Kraina św. Anny i niezbędne działania służące ich ocaleniu [Biodiversity analysis with a focus on old cherry tree varieties in the area of Kraina

św. Anny Association and necessary activities for their preservation]. Stowarzyszenie Kraina św. Anny, Śląski Ogród Botaniczny, Mikołów – Krapkowice, 2011.

11. Józefczuk, J.I., Krukowska-Szopa, I. Chrońmy aleje śródpolne i przydrożne [Let's protect field and roadside alleys]. Fundacja Ekologiczna „Zielona Akcja", Legnica, 2010.

12. Ogrodnik Polski. t. IV, Nr 12, 1882. pp. 287.

13. Ogrodnik Polski. t. XVI, Nr 4, 1894. pp. 93.

14. Olędzki, W. W sprawie obsadzania dróg [On planting trees along roads]. In: Ogrodnik Polski, 1901, t. XXIII/1901, Nr 19. pp. 456-461.

15. Pająkowski, J. Przyrodnicze znaczenie starych sadów [Biological significance of old orchards]. In: Poradnik sadowniczy starych odmian drzew owocowych. Ed. Renata Sobieralska. TPDW, Świecie 2003. pp. 72-73.

16. Sadzenie i prowadzenie drzew alejowych przez E. Petzolda [Planting and maintenance of alley trees by E. Petzold]. In: Ogrodnik Polski, 1880, t. II, Nr 1. pp. 12-17.

17. Ustawa z dnia 7 października 1921 roku o przepisach porządkowych na drogach publicznych [Act of 7 October 1921 on public roads] Dziennik Ustaw. Poz. 656; Okólnik Ministra Spraw Wewnętrznych z dn. 2.XI.27 w sprawie zadrzewienia kraju (Min. Sławoj Składkowski).

Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz

Vaismedžių alėjos – istorinio kaimo kraštovaizdžio atkūrimo Lenkijoje būdas

Santrauka

Vaismedžiai ir krūmai be pagrindinės praktinės jų naudos (vaisių) taip pat turi didelę dekoratyvinę vertę, nes gražiai ir gausiai žydi. Dėl jų konkrečių praktinių ir dekoratyvinių savybių vaismedžiai buvo plačiai sodinami Lenkijoje nuo 19 amžiaus pabaigos, be kita ko, ir palei kelius, kaip dalis šalies mastu įgyvendinamos medžių sodinimo pakelėse programos (Fortuna-Antoszkiewicz, Łukaszkiewicz, 2012). Kaip to išdava, vaismedžių alėjos buvo tradicinis Lenkijos kaimo kraštovaizdžio elementas ištisus dešimtmečius.

Raktažodžiai: vaismedžių alėjos palei kelius, istorinės veislės, vaismedžių alėjų atkūrimas Lenkijoje.

SILESIA PARK IN CHORZÓW / POLAND - THE SUCCESSFUL RE-NATURALIZATION OF INDUSTRIAL LANDSCAPE AFTER 60-YEARS

Jan Łukaszkiewicz, Beata Fortuna-Antoszkiewicz
Department of Landscape Architecture, Faculty of Horticulture, Biotechnology and Landscape Architecture, Warsaw University of Life Sciences – SGGW, Poland

Silesia Park (The Gen. George Ziętek Voivodship Park of Culture And Recreation) in Chorzów / Poland, with a total area of ca 600 ha was established on land of poor quality, partially degraded by mining and metallurgy industries. 60 years after that event, the authors of this paper carried out a complex examination of the Park's vegetation. The purpose of this study was to identify the degree of preservation of the Park stand's structure in relation to the original design goals and also the direction of any changes - due to the effects of years of land remediation and the flora's natural succession. It was found that vegetation of Silesia Park remains, in general, consistent with its original master plan, however, after 60 years significant changes have occurred, affecting the Park's function, its general form and landscape values.

Keywords: Silesia Park, stand's structure, vegetation, post-industrial land remediation.

Introduction

Silesia Park (The Voivodship Park of Culture and Recreation) in Chorzów is a ca. 600 ha site located in Southern Poland in a large Upper Silesia industrial agglomeration. The park was established on very poor soils and some of its area was heavily degraded by industry (Fig. 1.). The final design (1954) was authored by prof. arch. Władysław Niemirski and a team of associates including employees of Landscaping Section (Sekcja Kształtowania Terenów Zieleni - SKTZ) of Warsaw University of Life Sciences. The park, which despite being officially created in the spirit of socialist realism (as a so called people's park of culture, taking inspiration from similar parks in the Soviet Union) in fact constitutes a conglomerate of objects which are among the best examples of compositions based on classical modernist principles. Park development lasted 18 years since 1950-ties. Today is stands as a shining example of a successful rehabilitation and restoration of anthropomorphic landscape (Fig. 2.).

60 years after its establishment, in the period from August 2013 - December 2014 authors of this publication conducted extensive research of park's natural resources including its spatial, compositional and botanical characteristics. Authors goal was to determine the extent the original tree stand has been preserved and the direction of changes resulting from years of rehabilitation efforts, progressing natural succession and other factors. This is first research of this kind done in the Park (Fortuna-Antoszkiewicz, et al., 2014a,b).

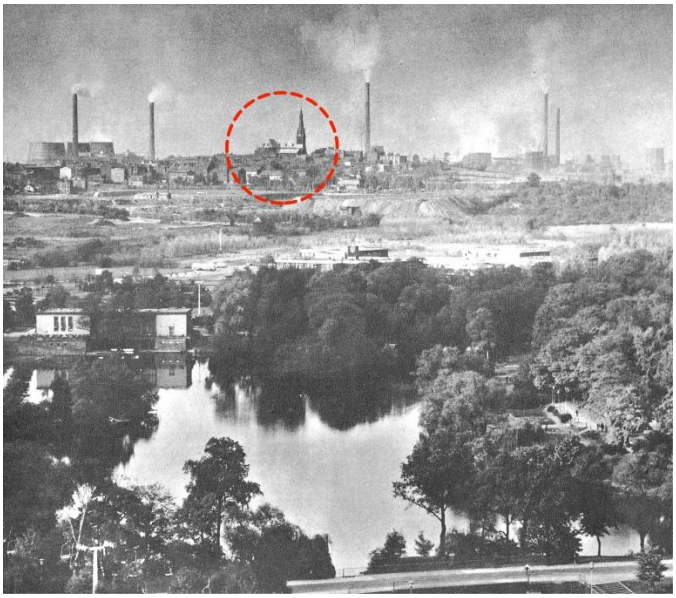

Fig. 1. Silesia Park introduced into industrial landscape - the 50-ties of the XX c**.**
In the middle – characteristic landmark of the church of St Mary Magdalene in Chorzów
(Knobelsdorf, 1972)
1 pav. *Įsiterpęs į pramoninį kraštovaizdį Silezijos parkas 50-iais 20-ojo amžiaus metais*
Centre - būdingas orientyras – Šv. Marijos Magdalietės bažnyčia, Chorzow
(Knobelsdorf, 1972 m.)

Fig. 2. Landscape transformation - Silesia Park vegetation after 60 years
In the middle – characteristic landmark of the church of St Mary Magdalene in Chorzów
(author: Piotr Wiśniewski, 2014)
2 pav. *Kraštovaizdžio transformacija - Silezijos parko augmenija po 60 metų.*
Centre – būdingas orientyras – Šv. Marijos Magdalietės bažnyčia, Chorzow
(Autorius: Piotr Wiśniewski, 2014 m.)

Soil transformation

All environmental constituents of Silesia Park underwent transformation — including soil, which can now be considered as anthropogenic. Prior to its degradation **pine forest was the original, natural vegetation formation** in the area where the park was established. As a result soil gained a podzol character. As time went by the forest was cut down, with only accompanying moors and mountain pine communities remaining (when the Silesia Park was established natural forest was present only in the so called Swiss Valley and constituted a small fraction of park's area – only 7% of the entire site). Soil in those vegetation communities retained its **original character** – **podzol soil** (Niemiec, 1953; Lazar, 1956). Originally some parts this soil were very moist. Mining works caused intensive drying of soil – especially closer to surface in the central part of the area (Lazar, 1956).

Before Silesia Park was established a significant part of this area (approx. 75%) had been agricultural in character but was later used for industrial purposes: mine and steelworks waste dumps, rubbish dumps and sink holes. To repair damage caused by mining industry **extensive earthworks were done** as the Park was established: approx. 3.5 mln m³ of soil was moved, approx. 100 000 m³ of higher quality soil and approx. 50 000 m³ of peat was brought in (Niemirski, Słotwiński, 1963).

As a result most of soil (except northern part) has layers of varying physical and chemical composition and thickness. Generally speaking **three basic agricultural soil classes** can be distinguished in the Park: in the south-eastern part some areas have IIIb class soil1; around Chorzowskie Hill, at the border with park valley mostly IV class soils are present (eg. IVa2, IVa3 or IVa5); at top of the hill and in the central and western part lowest quality soils are present - class Va3. Park soil reaction is within **pH = 6.1-7.8**. A clear incompatibility of morphological and chemical properties testifies to a significantly man made character of Park soil (Lazar, 1956).

Presence of a **0.20-0.30 m thick humus surface layer** is a positive feature, as it allows rainwater penetration benefiting local vegetation (Niemiec, 1953; Majewska-Duriasz, 2014). Mulch or humus which accumulated over the years in soil contributes to formation of soil granules facilitating capillary ascent of water and natural infiltration soil with (rain)water.

Chemical composition of Silesia Park soil is heavily influenced by among other industrial pollution, especially dust particles. As a result of prevailing wind direction in this region (W and SW) and location of former and contemporary emission sources („Kościuszko" Steelworks in Chorzów, „Jedność" Steelworks in Siemianowice Śląskie, zinc and lead steelworks in Katowice-Wełnowiec), as well as proximity of Katowice, Chorzów and Siemianowice Śląskie city centres soil in this area has magnetic properties due to presence of heavy metals (Magiera, et al. 2013). Dust particles industrial and urban in origin which settled in tree crowns were a source of **secondary emission** in the time of highest heavy industry activity. This emission occurs with particular wind speeds. In appropriate weather conditions dust particles falling from tree crowns penetrate into soil pores and accumulate in soil. In forested areas — such as urban parks and forests (as opposed to areas without trees) this strengthens magnetic properties of soil surface layers. Accumulation of industrial dust is related to presence of heavy metals.

Today, high **heavy metal** readings are recorded practically in the entire area of the Park, and especially in its western part (proximity of „Kościuszko" Steelworks in Chorzów and „Jedność" Steelworks in Siemianowice Śląskie). Similar situation can be seen in south-eastern part neighbouring Katowice. The most common heavy metal present in park soil is zinc (Zn) the TLV of which is exceeded even sevenfold. However, threshold limit values for

lead (Pb) are exceeded 1.9 to 8.5 times, and for cadmium (Cd) often the values are exceeded 7 to 20 times (Magiera, et al. 2013).

Mechanical composition of park soil is in general favourable i.e. clay, medium heavy – silty and silty clay soil. Silty fractions originate mainly from dolomite rocks while gravel and sand — presumably from sandstone rocks. Individual glacial pebbles are also present. **Humus content is high (1.72-3.64%)**. Humification level is high, as can be seen in a narrow C:N (9-11) ratio, which testifies to high biological activity (Majewska-Duriasz, 2014).

Silesia Park area due to high variability and frequency of cultivation works stands out from among other parks and urban forests in this region. **Vegetation does not form a typical forest** Park has a great variety of ornamental tree and shrub taxons with large lawns, alleys and pathways. In intensively used, recreational parts of the Park a lower concentration of some soil pollutants was detected. This is connected with maintenance works done in those areas which includes mowing meadows and lawns and removal of leaves in autumn. As a result industrial and urban in origin pollutants are removed along with biomass collected during maintenance works. This is why in parts of Silesia Park which are subject to **intensive maintenance and used for recreational purposes**, despite being located in agglomeration centre, **heavy metal concentration in soil is lower than in urban forests outside of city limits** (Magiera, et al. 2013).

Vegetation

The extensive area of the Park before it was established was utilised in various ways: 49% fields, 2.5% surface waters (Niemiec, Kuszell, 1954)[1], 7% tree stand[2], 3% idle lands, approx. 8% buildings, 0.5% other (allotment gardens, heaps, dumps, pits).

Generally, park tree stand is composed of plants already present in this area. According to inventory taken for the purpose of design works there were 1700 trees in the area, the most common among which were: various species of *Salix sp., Populus sp.; Acer platanoides, Acer pseudoplatanus, Betula pendula, Quercus sp.* (mainly *Q. robur*), *Fraxinus sp., Sorbus aucuparia, Pinus sp*. General condition of trees was good, only pines and birches located higher on the hill showed signs of dwarfing and deformation. Underbrush included shrubs typical to forests, such as *Sambucus nigra, Sambucus racemosa, Cornus sp., Viburnum sp*., and foreign species such as *Prunus serotina*. The hill was originally covered with moors and patches of whortleberry; meadows constituted approx. 4% of the area. Main original vegetation in the area where the park was established was **a degraded pine forest** growing on **podzol soil.** In the area around the foot of the hill (better quality soil) single oaks grew, likely remnants of an oak forest.

Contemporary vegetation was mostly modified according to Park design. Some were treated as a **fore crop** preceding the next, principal tree planting stage.

Vegetation in large park areas was planted basically from scratch. High ground areas were planted with **native species**, typical to Upper Silesia upland, selected considering particular habitat requirements[3] - among other *Quercus robur*, *Quercus petraea* (in highground), *Fagus sp., Carpinus sp., Acer platanoides, Acer paseudoplatanus, Tilia sp.* - especially in wetter areas. The following species were used as a fore crop: *Betula pendula, Populus sp*. (*P. alba, P. nigra, P. tremula*), *Larix sp*.; in undergrowth: dwarf willows,

[1] These included 3 ponds in the valley around the hill (Niemiec, Kuszell 1954, *op. cit.*: 8).
[2] 90% of which was located on a 30 ha area called Swiss Valley (W. Niemiec, B. Kuszell 1954, *ibidem.*).
[3] Mainly considering resistance to haze (W. Niemiec, B. Kuszell 1954, *op. cit.*: 10).

Corylus sp., Sambucus nigra - years later those plants were expected to create appropriate phytoclimate for **introduction of sciophilous species**, especially beech (*Fagus sylvatica*). Coniferous plants were introduced in smaller numbers (due to lesser resistance to haze) - mainly *Abies sp*., *Picea sp*., *Pinus sp*. Near water species typical to riparian forest were used: trees – *Populus nigra* and *Populus alba, Salix fragilis* and *Salix alba, Alnus glutinosa, Acer sp., Betula pendula, Sorbus sp*., bird cherries; shrubs – *Viburnum sp., Euonymus sp., Frangula alnus, Crataegus sp., Corylus sp., Rhamnus cathartica, Cornus sp., Sambucus nigra*. *Humulus lupulus* was used as a complementary and ornamental element. Introduced species and varieties were selected to suit habitat in a particular area.
In the western part of the Park with intensive functional programme, mainly ornamental species were planted, including foreign ones (especially shrubs) to create attractive composition of plants - colour and leaf, bloom and fruit diversity was considered (Niemiec, 1953; Niemiec, Kuszell, 1954).

In general the plantings were done in a grid of approx. 1.0 x 1.2 m, i.e. 8333 pcs per 1.0 ha. **Reduction of forested area** was planned to make space for both large and small park interiors[4], this resulted in a reduction of planting density to 4000 pcs per 1.0 ha. Used plant material included older trees with developed root system, creeper trees, trees supported on stakes, tree plantings and seeds of some species. Shrubs have been planted using nursery material. In the period from 1950 to 1953 approx. 30 000 trees supported on stakes and approx. 600 000 cuttings were planted in the forest part of the park (Niemiec, 1953).

Park tree stand management plan envisioned introduction at a later stage of species which would constitute **target tree stand** (composed of more valuable species) once the **temporary tree stand** would grow to optimum stage of development.

After 60 years the status of Silesia Park's vegetation is the following - 2 basic parts of the Park differing in functional and spatial arrangement can be distinguished:

A/ South-western – intensive part, with a rich functional programme and vegetation arranged using classical spatial forms (individual trees, groves, groups, flowerbeds, hedges) delimiting clearly defined garden interiors (Fig. 3.).

[4] The park-forest region which was designed with quiet recreation in mind covers an area of approx. 220 ha in the central part of the Park — it was designed as a **densely forested area** with **numerous clearings** (interiors), it has a pavilion, kiosk etc. and Observatory building on top of a hill (W. Niemiec, B. Kuszell, *op. cit.*: 9).

Fig. 3. Intensive area of the Silesia Park.
Spatial structure of tree stand – single trees, groups, thickets, alleys and rows (authors: Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz, Piotr Wiśniewski, 2013–2014)
3 pav. *Intensyvioji Silezijos parko zona.*
Erdvinė medyno struktūra - pavieniai medžiai, grupės, krūmynai, alėjos ir medžių eilės (autoriai: Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz, Piotr Wiśniewski, 2013–2014 m.)

This area contains some of the most important programme elements and thematic gardens – which are clearly diversified in terms of composition, and which create formally separate spaces with distinct vegetation; all those elements follow sequential layout and are harmoniously interconnected.

Vegetation layouts in individual parts are dominated by **point** type compositions (individual plants - spatial dominant features) or **patch** type compositions (groups, flowerbeds, groves) formed using various tree and shrub species in contrasting and asymmetrical layouts, mainly **irregular and open** or distinctly **rhythmic** arrangements.

Disparate regular **linear layouts** composed of tall vegetation (trees) were originally intended by authors along park alleys (in various configurations[5]) or espaliers along main park ways:

Extensive **garden interiors** (a large central circular interior, so called Duża Łąka (Big Meadow) and rhomboid Pole Marsowe (Field of Mars) are especially valuable within structure of this part of the Park. The structure (surface area, form) of both those interiors is masterly linked to the structure of the entire Park and follows formal urban planning rules. **Sequences of clearings, view connections and compositional axes** linking various elements and crystalizing far views are key elements in the context of this part of Park composition and vegetation arrangements.

[5] **Alley structure** (original): alternating or opposite layouts; **tree spacing** in alleys: Al. Klonowa – 8.0 m [5.5-8.0 m]/ Al. Główna - 6.0 m / bosquets in Al. Żyrafy - 6.0 x 4.0 m; 5.0 x 2.5 m; 5.0 x 5.0 m; 5.0 x 10.0 m / bosquets in promenade – Berlin poplar 6.0 x 6.0 m; silver maple – 5.0 x 10.0 m, 5.0 x 4.5 m / linden - 7.0 x 7.0 m, 5.0 x 8.0 m / conical English oak every 4.0 m.

Original overall composition of this part of the Park remains **visible and is well-preserved**. A certain risk of deformation of some fragments exists due to spontaneous new plantings done in recent years, and progressing ageing of plants (initially – short-lived tree species).

B/ Eastern part (on a hill) – **extensive**; the area is **dominated by a dense, thick tree-stand**. It is characterised by great variety and complexity of structure resulting from: varied terrain, varied plant species palette, and most of all from planting origin (original tree-stands; plantings during revitalization of certain areas; plantings in areas having a particular function and composition; long-lasting natural succession) (Fig. 4.).

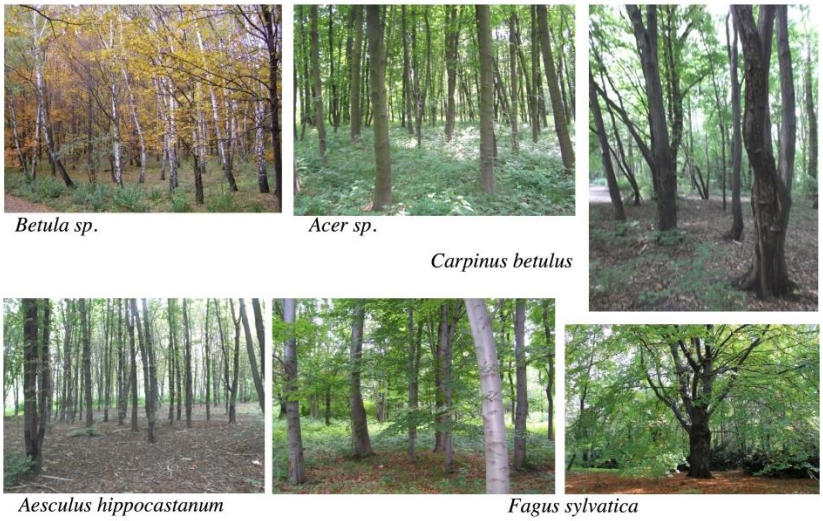

Fig. 4. Extensive area of the Silesia Park – dense woodlots.
Stand species structure - areal domination of some tree species (authors: Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz, Piotr Wiśniewski, 2013–2014)
4 pav. *Ekstensyvioji Silezijos parko zona – tankus miškas.*
Medynų rūšinė struktūra – arealinis kai kurių medžių rūšių dominavimas (autoriai: Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz, Piotr Wiśniewski, 2013–2014 m.)

The area consists mostly of mature tree-stands composed of various species, with different density and various tree habit forming origin:

- small areas with loose and properly developed tree-stand - dendrometric parameters of such trees are near optimum for park trees, with satisfactory slenderness ratio and statically stable; individual trees - large with fully developed habit characteristic for a particular species (extensive part of the park - central and western area); average tree height 22.0-25.0 m; spacing: 5.0, 7.5-10,0-17.0 m; crown closure approx. 70-80%;
- areas with a particularly thick tree-stand with overdeveloped trees and disrupted static stability (extensive part of the Park - southern and south-eastern areas); average tree height up to 30.0 m; spacing: 1.0-8.0 m (2.0-5.0 m); crown closure approx. 85-90%.

In terms of **vertical structure** the tree-stand can be divided into the following layers: **highest layer A1** and **A2** (in parts of the area); **shrub layer (layer B)** present in varying degrees - locally dense and very dense, locally thinning (among other due to maintenance

works or seasonal habitat conditions); **herb layer (C layer) -** varying cover density, depending on present vegetation of higher layers and its density.

Generally, the tree-stand covering the area has a high, however uneven density[6], nonetheless a few local (considering the scale of the area) clearly defined clearings (mini-interiors) can be found – surface area approx 400.0 - 1000.0 m^2. Often these are a result of removal of patent, large tree specimens such as dying poplars.

At the design stage of the Silesia Park it was assumed that many of the trees planted in this part of the park will upon reaching maturity - especially pioneering species - be gradually removed as fore crop for more demanding species such as beech or hornbeam. In the following period those requirements were to a large extent ignored or respected only partially. In some parts this currently results in excessive thickness and tree crown closure which is not **optimal for recreational purposes** (especially in lower layers – unfavourable composition of atmospheric air, humidity, air temperature, insolation) (Bartman, 1974; Obmiński, 1977; Krzymowska–Kostrowicka, 1997). Additionally, Park design envisaged creating and maintaining numerous and vast interiors, openings and gaps intended for recreational purposes as well as maintaining far vistas to other locations on site and outside its boundaries. Without proper park management secondary natural succession lead in many places to **diminishing of the original tree-stand composition.**

Years later Silesia Park developed a particular, dynamic ecological structure. A varied set of conditions typical to particular biotopes in the Park has developed between flora, fauna and the environment. In general the following phytocenoses can be distinguished in the Park:

- xerothermic meadows;
- meadows similar to pastures and pasture like areas – in vast Park lawns;
- wet meadows, e.g. in terrain depressions or near ponds;
- water and near water plant communities (pond shore zone);
- alder forest like, riparian forest like, oak-hornbeam forest like, oak forest like, forest border like communities – in the extensive forest area;
- communities of synanthropes or smiesynanthropes – in extensive areas or areas were secondary succession was allowed to progress.

In most of the Park area biological factors form a relatively balanced system. This balance is maintained among other due to size of the site (approx. 600 ha), which is mainly covered with rich vegetation (park tree-stand). **Destabilization** of Silesia Park environment may be caused by **inappropriate vegetation maintenance** or **lack thereof**, which may be a decisive factor in case of undesirable plant succession such as expansion of invasive plant species (both tree and other) which can be observed in the park[7].

[6] The vegetation density of this area is very differentiated – **spacing** between main tree specimens vary in different parts of the area form (1.0) 2.0 m to 8.0-10.0 m, sometimes more than that; **poplar spacing** – generally largest of the trees – approx. 12.0-18.0 m (such as in sector S4)/ **tree crown closure** – varied: (50%) 75%-90% (100%).

[7] Phytosociological assessment shows presence of **6 herbaceous plant species** and **2 tree species**, considered as **highly invasive country-wide** (Tokarska-Guzik, et al., 2012; *Rozporządzenie Ministra z dn. 9 września 2011 r.*). Identified species are expansive (such as trees: *Quercus rubra* and *Prunus serotina*) - they are highly competitive and supersede other, native plants in their respective phytocenoses.

Summary

Rehabilitation of Park area (degraded, post-industrial and low-grade habitats) has been **gradually achieved** among other by use of appropriate vegetation – including by planting trees and shrubs over a large area. This process has resulted in an advantageous transformation of soil (such as increasing soil fertility, improving structure, increasing amount of dead biomass – humus, development of soil microorganisms) which is very important in terms of plant growth.

Positive soil rehabilitation along with availability of underground water, significant decrease in dust and chemical air pollutants in Silesia in recent years **favours vegetation growth**. This is evidenced by the observed lush growth and high vitality of vegetation in Silesia Park throughout the entire growing season.

Silesia park designers intended it to be **a durable and self-regulating natural system** based on the fact that the larger the area and the longer it is maintained the greater its ecological stability and the greater its impact on surrounding area (e.g. Niemiec, 1953; Niemiec, Kuszell, 1954; Bartman, 1974).

Bibliography

1. Bartman, E. Wykorzystanie lasów do celów rekreacyjnych. [Forests as recreational areas] In: Rozprawy naukowe. Zeszyty Naukowe SGGW w Warszawie. Z 33. Zakład Graficzny Politechniki Warszawskiej, Warszawa, 1974.

2. Fortuna-Antoszkiewicz, B., Łukaszkiewicz, J., Wiśniewski, P. Inwentaryzacja ogólna drzewostanu parku. Wojewódzki Park Kultury i Wypoczynku, im. Gen. Jerzego Ziętka S.A., al. Różana 2, 41-501 Chorzów. [General park tree stand inventory. Wojewódzki Park Kultury i Wypoczynku, im. Gen. Jerzego Ziętka S.A., al. Różana 2, 41-501 Chorzów.] Maszynopis w zb. WPKiW, Chorzów, 2014a.

3. Fortuna-Antoszkiewicz, B., Łukaszkiewicz, J., Wiśniewski, P. Inwentaryzacja ogólna drzewostanu parku. Część II: Studia i analizy. Wojewódzki Park Kultury i Wypoczynku im. gen. Jerzego Ziętka s.a., Al. Różana 2, 41-501 Chorzów. [General park tree stand inventory. Part II: Research and analysis. Wojewódzki Park Kultury i Wypoczynku im. gen. Jerzego Ziętka s.a., Al. Różana 2, 41-501 Chorzów.] Maszynopis w zb. WPKiW, Chorzów, 2014b.

4. Knobelsdorf W. (Ed.). Oaza pod rudym obłokiem: Śląski Park Kultury i Wypoczynku. Wyd. 1. Wydawnictwo "Śląsk", Katowice, 1972.

5. Krzymowska–Kostrowicka, A. Geoekologia turystyki i wypoczynku. [Geoecology of tourism and recreation.] PWN, Warszawa, 1997.

6. Lazar, J. Gleby Parku Kultury i Wypoczynku w Chorzowie. [Soil of the Regional Park of Culture and Recreation in Chorzów] Instytut Uprawy, Nawożenia i Gleboznawstwa PAN-KNR. Roczniki Nauk Rolniczych - Doniesienia o pracach naukowo-badawczych, Seria A/T. 73/Z. 4, 1956.: 652-654

7. Magiera, T., Rachwał, M., Łukasik, A. Soils of urban forest and parks of the Upper Silesia region. In: P. Charzyński, P. Hulisz, R. Bednarek (ed.). Technogenic soils of Poland. Polish Society of Soli Science, Toruń, 2013: 301-319.

8. Majewska-Duriasz, I. Opinia hydrogeologiczna dotycząca oceny możliwości wykonania zabezpieczenia przeciwpowodziowego istniejącego układu hydrologicznego na terenie Parku Śląskiego w Chorzowie z wykorzystaniem możliwości retencji oraz chłon-

ności gruntów. [Hydrogeological assessment for the purpose of providing anti-flood protection of existing hydrological layout of Silesia Park in Chorzów using retention and absorptivity properties of soil.] Pracownia EKOID, Katowice. Opracowanie wykonane na zlecenie Wojewódzkiego Parku Kultury i Wypoczynku S.A. Maszynopis w zb. WPKiW, Chorzów, 2014.

9. Niemiec, W. Park Kultury i Wypoczynku w Stalinogrodzie. [Park of Culture and Recreation in Stalinogród.] In: Architektura, 1953, Nr 11 (73): 273-278.

10. Niemiec, W., Kuszell, B. Wojewódzki Park Kultury i Wypoczynku w Stalinogrodzie. [Voivodship Park of Culture and Recreation in Stalinogród.] In: Biuletyn Techniczny Centralnego Biura Studiów i Projektów Budownictwa Komunalnego. Rocznik 2 (1954), Nr 1, s. 7-11. Wyd. Centralne Biuro Studiów i Projektów Budownictwa Komunalnego [Druk] RSW „Prasa", Warszawa, 1954.

11. Niemirski W., Słotwiński K. (Ed.). Śląski Park Kultury. [Silesia Park of Culture.] Nakładem Komitetu Budowy Wojewódzkiego Parku Kultury i Wypoczynku w Katowicach. Wyd. "Śląsk", Katowice, 1963.

12. Obmiński, Z. Ekologia lasu. [Ecology of a forest.] PWN. Warszawa, 1977.

13. Rozporządzenie Ministra z dnia 9 września 2011 r. w sprawie listy roślin i zwierząt gatunków obcych, które w przypadku uwolnienia do środowiska przyrodniczego mogą zagrozić gatunkom rodzimym lub siedliskom przyrodniczym. [Resolution of the Ministry of 9 September 2011 on a list of foreign plants and animals which if released into the environment may threaten native species or habitats.] Dz. U. Nr 210, poz. 1260

14. Tokarska-Guzik, B., Dajdok, Z., Zając, M., Urbisz, A., Danielewicz, W.. Rośliny obcego pochodzenia w Polsce ze szczególnym uwzględnieniem gatunków inwazyjnych. [Foreign plants in Poland with a focus on invasive species.] Generalna Dyrekcja Ochrony Środowiska, Warszawa, 2012.

Beata Fortuna-Antoszkiewicz, Jan Łukaszkiewicz

Silezijos parkas Chorzow Lenkijoje – sėkminga pramoninio kraštovaizdžio renatūralizacija po 60 metų

Santrauka

Silezijos parkas (Gen. George Ziętek'o vaivadijos kultūros ir poilsio parkas) Chorzow Lenkijoje, kurio bendras plotas sudaro 600 ha, buvo įkurtas prastos kokybės žemėje, kuri iš dalies buvo sunaikinta dėl kasybos ir metalurgijos pramonės veiklos. Po 60 metų šio straipsnio autoriai atliko sudėtingą parko augalijos tyrimą. Šio tyrimo tikslas buvo nustatyti parko rūšinės sudėties išsaugojimo laipsnį, susijusį su pradiniais projektavimo tikslais ir bet kokiais pasikeitimais dėl daugelį metų vykusio žemės atkūrimo ir natūralios augalijos kaitos. Buvo nustatyta, kad augmenija Silezijos parke apskritai atitinka pradinį planą, tačiau po 60 metų įvyko reikšmingų pokyčių, turinčių įtakos parko funkcijoms, jo bendrai formai ir kraštovaizdžio vertybėms.

Raktažodžiai: Silezijos parkas, rūšinė sudėtis, augmenija, postindustrinės žemės atkūrimas.

THE URBANISATION PROCESSES AND FOREST LANDSCAPE ON THE EXAMPLE OF THE NORTH PART OF THE MAZOWIECKI LANDSCAPE PARK (MPK)

Emilia Janeczko[1], Joanna Budnicka – Kosior[2], Radosław Dąbrowski[3]
[1] *Warsaw University Of Life Sciences, Faculty of Forestry, Department of Forest Utilization, Poland*
[2] *Warsaw University Of Life Sciences, Faculty of Forestry, Chair of Geomatics and Land Management, Poland*
[3] *Warsaw University Of Life Sciences, Faculty of Forestry, The Team of Mazovia Landscape Parks, Poland*

The article presents the results of analyzes of the impact of urbanization on forests included in the northern part of the Mazowiecki Landscape Park (MPK). As source materials for analysis, the available topographic maps and orthophotomaps. As a result of these analyzes the following was diagnosed, the most common threat to the natural and cultural environment MPK: progressive housing development on parcels within the park and its buffer zone, resulting in the approach to the building edge of the forest and the disappearance of the ecotone zone.

Keywords: spatial planning, natural environment, nature park.

Introduction

Currently, one of the commonly occurring phenomena in the space of our country is the suburbanization, involving the spilling of the spatial structure of cities and uncontrolled suburban development centers and suburban areas. This phenomenon is referred stands. As *urban sprawl* is consequence of society's enrichment and associated with the rapid pace of the development of civilization. As is clear from the Communication of the Commission... (2004) sprawling cities, dealing with the residential building of rare objects and the commercial areas of valuable agricultural land and undeveloped is the most urgent problem of urban planning. Cities spread and occupy rural areas faster than the growth rate of the human population (20% growth over the last 20 years compared with just 6% increase in population over the same period). Suburbanization leads on the one hand to meet social needs in the context of the qualitative characteristics of the place of residence, on the other hand, is often in conflict with the needs of environmental protection and landscape. According to Przewoźniak (2005) the effects of suburbanization is a natural decline in biodiversity, transformation and disappearance of valuable ecosystems, weakness and atrophy of the natural dynamics of the environment. This phenomenon leads to an increase in environmental pollution, loss of natural recreational value, negative landscape transformation, and ultimately also to the loss of attractiveness of investment. The Concept ... (2012) calls attention to the fact that the serious problem of spontaneous suburbanization, the proliferation of development in rural areas is a violation of spatial order. Chmielewski (2005) believes that suburbanization in Warsaw has deurbanisation features, which develops outside the cities, creating layouts difficult to handle technical infrastructure, and cuts the strings of natural links, destroying local ecosystems. Mazowiecki Landscape Park (MPK), in particular, the northern part because of the links with Warsaw, and also because of the valuable, legally protected values of the natural environment and landscape is an important training ground for research, allowing to know the widest possible range of changes in the forest environment, caused by urbanization processes. This requires an interdisciplinary research to fully recognize the

problems associated with suburbanization, determines the scale of this phenomenon and identify possible ways to prevent the consequent threats to forest areas. The first stage of this research should be to recognize the dynamics of the spread of development in areas MPK. The aim of this article is to determine the direction and scale of the spread of development in selected areas within the northern part of MPK and its buffer zone and the initial recognition of the phenomena occurring in the forest environment under the influence of urbanization.

Material and methods

Mazowiecki Landscape Park was established by the Resolution of the Provincial Council in Siedlce dated 30 May 1986 and the resolutions of the National Council of the City of Warsaw dated 17 December 1987 year. Park was established to preserve existing forests that are an essential part of the structure of nature and the construction of facilities (also known as "green lungs") of Warsaw agglomeration, as well as the preservation of valuable natural plant communities, habitats and migration of animals, forms of geomorphological, cultural and landscape values and protect and development of precious landscapes of forest-meadow-fieldstone. MPK area is 15 710 ha, including forest land occupy 11 858 ha (75.5%), agricultural land of 3346 ha (21.3%), water - 80 ha (0.5%), land permanently invested - 283 ha (1.8%), wooded land in built up areas 47 ha (0.3%) and waste land 96 ha (0.6%). Park is located entirely in the Mazowieckie voivodship in the following administrative units: Wawer districtin Warsaw, district Wesoła in Warsaw, cities Otwock and Józefów, town and municipality of Karczew, municipalities Celestynów, Wiązowna, Kołbiel, Sobienie - Jeziory and Osieck.

The article presents the results of research conducted within this part of the Park, which is located within the city limits of Warsaw. Information about the directions of the spread of the building within the southern part of the MPK was based on: topographic maps at a scale of 1:10 000 (ed. 1982) and 1:25 000 (ed.1991) issued by the Head Office of Geodesy and Cartography, available orthophotomap made in 2008 and map land records, showing the current buildings at the site. All spatial analysis was carried out in the Quantum GIS (QGIS 2.14 Essen).

Results

The analysis of available cartographic studies show that from the 80s to the present share of built-up areas throughout the park, especially in its northern part has doubled (Fig.1).

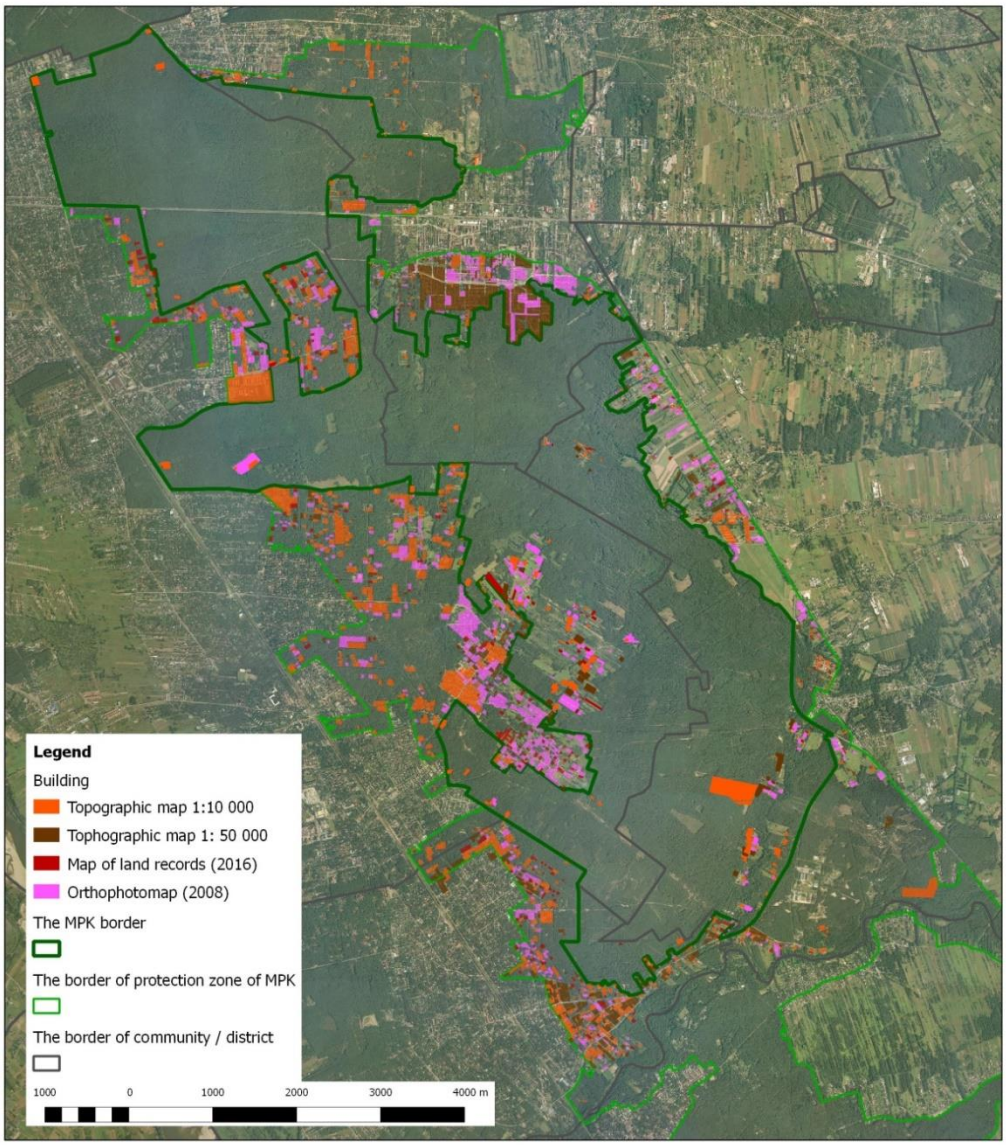

Fig. 1. Built-up areas at the border and in the buffer zone of the north part of MKP
1 pav. *Užstatytos teritorijos pasienyje ir apsauginėje šiaurinės MKP dalies zonoje*

In the 80's buildings concentrated around settlements like Aleksandrów and Macierówka. In the next decade Aleksandrów grew. In the first decade of the twenty-first century, intense urbanization processes took place within the estate of Macierówka. The rest of the northern part of the park, there are only a few buildings, which apart from a few objects exist since the 80s, more serious changes related to the suburbanization of land can be observed within lagging MPK. Much has grown between the buildings Zbójna Mountain of Joseph and compared to that of the 80s, while in the 90s formed building an extension of the existing urban structures from previous years, with many modern buildings is a typical

example of the process of *urban sprawl.* Most often develops construction in forest areas in the belt between forest complex Zbójna Mountains and of Joseph (Radość Estate and Housing Miedzeszyn). Enclosed, occupied for building plot in forest areas are not conducive to maintaining the natural links in this area. A similar intensity arrives in built-up areas between Zbójna Mountain and the route E 30 (Warsaw - Minsk Mazowiecki). Installation approaching the border of the Park in the neighborhood of estates New Anin and Wisniowa Góra. The conservation plan MPK (Regulation ... 2004), according to the findings regarding the general area land settlements to the local spatial development plans in the use of each plot of biologically active participation should be at least 70%, and the minimum proportion of forest cover - 60%. (§35. Item 10). However, this provision is not always respected by the owners of newly constructed residential buildings. Quite often there is a situation where the surface occupied by buildings with accompanying communication systems exceeds the maximum size. Not to mention the fact that the wooded area of that parcel will remain in effect only fiction.

Progressive urbanization in the northern part of the MPK increasingly lead to the separation of Sobieski Forest and cut off this part of the site from other forest areas Mazowiecki Landscape Park. The effects of such activities may be in the near future catastrophic for the functioning of the natural sequences, already disturbed in connection with the course of the E30 road.

Discussion

The Regulation ... (2004) points to such a threat to the natural environment and landscape MPK as among others.: chaotic building expansion (spontaneous settlements), styleless expansion, blemishing the landscape, housing and service sector, as well as the disappearance of the regional construction and historical systems spatial village. The study showed that the building within the MPK and its surroundings spreads with great force. It is not always at the same time creating a well thought out, coherent spatial arrangement.

In many places there are solid architectural values of the small compositional aesthetic. Analysing architectural form, not only the erected buildings, but even fo appearing in the photographs we see clear differences in style and form, color roof of the adjacent building, which clearly indicate that commonly occur in the development of architectural and spatial chaos.

The analysis of available maps and satellite images shows that in the 80 buildings in the current boundaries of the Park and its buffer zone existed both turn along the route Warsaw - Lublin, as well as in all the great scenic places, often situated far from roads and larger clusters of buildings. This is confirmed by Chmielewski (2005) - the rapid development of the private sector in the 80's resulted in the Warsaw area's increase in the number of houses and cottages, a region of the spontaneous purchase of land for building summer resort were apart from Zegrze Lake's suburban areas of forests. Urbanization of the 80's contributed significantly to the reduction of forest areas around Warsaw and the lack of technical infrastructure accelerated the opinion of Chmielewski (2005), the degradation of the natural environment. According Chmielewski (2005) in the 90s throughout the suburban area of Warsaw have launched an avalanche of requests for exemption of agricultural land from agricultural production intended for their construction purposes. The directions of the

spread of development have become areas regarded once as nonprogressive and most environmentally sensitive processes of suburbanization. It was a phenomenon is also reflected in the operating results presented in the study. For the forest environment means it is definitely more noise, the spread of invasive species and the species is not always consistent with the naturally occurring vegetation in the Park, the disappearance of the natural ecotones, cutting both local and regional strings natural links.

Summary

Suburbanization is generally identified with a disorder of spatial order. It is an undeniable source of threats to the environment, including in particular the woods, and at the same time an important element of transformation of rural areas in the direction of "village post-production", where the main method of use and factors of anthropogenic changes to the landscape is no longer production (agricultural/ forestry), but consumption of landscape values. According to KPZP one of the ways of solving the problems arising from uncontrolled process of suburbanisation it is the search for a new model of space planning, assuming "the maximum use areas already developed (brown fields), while the development of new areas (green fields) will be allowed only when exhausted resources of possible areas for redevelopment. Reducing conflicts in space, especially related to the spillage of urban centers and reduction of the same area of forest land, should be conducive to rational spatial policy of the authorities of the municipality (city). As Gawronski advocates (2003) spatial specificity of ecologically protected areas should be to limit the possibility of implementing their own local spatial concepts.

Literature

1. Chmielewski J., M. 2005. Problems distracted by building on the metropolitan area of Warsaw. Problems of suburbanization ed. P. Lorens, Library planner 7, Urban Planner, Warsaw, pp. 52-62.

2. K. Gawronski, Poplawski L. 2003. Problems spatial areas ecologically protected on the example of the Poprad Landscape Park. Acta Scientiarum Polonorum Administratio Locorum 2 (1-2), Olsztyn, pp. 45-56.

3. Przewoźniak M. 2005. Ecological aspects of suburbanization - theory and reality. Problems of suburbanization ed. P. Lorens, Library planner 7, Urban Planner, Warsaw pp. 127-134.

4. Communication of the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee for the Regions Towards a thematic strategy on the urban environment. The Commission of the European Communities COM (2004) 60, Brussels.

5. The concept of national spatial development 2030 2012 Ministry of Regional Development, Warsaw.

6. Regulation No. 13 of the Governor Mazowiecki of 16 April 2004. On the establishment of a protection plan of Mazowiecki Landscape Park of Czeslaw Łaszka for 20 years (Acts. Office. Woj. Maz. No. 87 of 16 April 2004.).

Emilia Janeczko, Joanna Budnicka – Kosior, Radosław Dąbrowski

Urbanizacijos procesai ir miško kraštovaizdis šiaurinėje Mazowiecki kraštovaizdžio parko (MKP) dalyje

Santrauka

Straipsnyje pateikiami urbanizacijos poveikio šiaurinės Mazowiecki kraštovaizdžio parko (MPK) dalies miškams analizės rezultatai. Analizė paremta turimais topografiniais žemėlapiais ir ortofotoplanais. Analizės rezultatai atskleidė, kad didžiausią grėsmę gamtinei ir kultūrinei MKP aplinkai kelia gyvenamųjų namų statybų plėtra parko teritorijoje ir jo apsauginėje zonoje, dėl ko artėjama prie miško pakraščio ir taip naikinama pereinamoji zona.

Raktažodžiai: teritorijų planavimas, natūrali aplinka, gamtos parkas.

THE APPLICABILITY OF UNMANNED AERIAL VEHICLES FOR THE EVALUATION OF WATER RESERVOIRS IN LANDSCAPE VISUAL QUALITY

Dorota Kargul-Plewa, Emilia Janeczko, Małgorzata Woźnicka
Warsaw University of Life Sciences, Faculty of Forestry
Department of Forest Use, Poland

The article reviews research methods applied in the assessment of the forest landscape and attempts to determine the possibilities of using unmanned aerial vehicles in visual quality surveys of water reservoirs in forest areas. The need to take actions on the shaping of forest landscape is the consequence of, among other things, an increasing importance of non-productive functions of forests as well as rising public expectations regarding forests. The physiognomy of forest landscape is related to the presence of certain types of vegetation, as well as the elements of engineering forest management, including water reservoirs. In the article a particular attention was given to the role of water reservoirs in forest landscape assessment and the necessity to shape them properly. Unmanned aerial vehicles can be a useful tool in the assessment of forest landscape, as well as in making decisions related to planning and designing water reservoirs.

Keywords: forest landscape, reservoirs, unmanned aerial vehicle (UAV).

Preface

Due to the influence of natural and anthropogenic factors, landscape is continually evolving, having at the same time an enormous impact on human welfare. The need to protect and consciously shape the surrounding landscape is becoming the subject of the ever more frequent discussions. According to the International Union for the Conservation of Nature and Natural Resources, landscape is a visual condition of the environment, i.e. the sum of material elements of the environment indicating its ecological condition. It constitutes a part of the Earth's surface which is the spatial unity in terms of external appearance and interrelations between its phenomena (Pietkiewicz and Żmuda, 1973). Pursuant to the European Landscape Convention drawn up in Florence on 20 October 2000 (Journal of Laws of 2006, No. 14, item 98), the landscape is an area perceived by people the nature of which results from actions of natural and anthropogenic factors and interactions between them. According to this definition, we can conclude that forest landscape is the spatial composition of natural and anthropogenic elements, and the factor determining its physiognomy is vegetation, but also the equipment or the structures associated with the so-called engineering forest management (Janeczko 2008). The change of the natural landscape structure or its dynamics is reflected in the change of its appearance and can be grasped in the process of landscape perception (Richling 2013). Different methods are used in landscape evaluation, from general natural valorisation, through ecological, urban and architectural evaluation, to the evaluation focusing on the aesthetic appearance, the degree of landscape deformation, the usefulness for tourism and recreation (Myczkowski 2013). These evaluation methods use a variety of measures, however they are not always fully objective. Therefore, in the study of the landscape visual quality not only the choice of a particular evaluation method is important, but also the proper choice of criteria determining the visual quality. There are two groups of methods for assessing the attractiveness of the landscape: classic and specialised (Śleszyński 1997). One of the classic methods for landscape evaluation is the point grading method which consists in assigning a certain score to selected properties of the land within the limits of the reference fields. The examples of the application of the point grading method to evaluate the landscape visual quality can be found in the works of Janeczko (2002), as well as Markiewicz and Szużmow (1992). The point grading method was also used by

Rutkowski (1978) in the assessment of land for the purpose of relaxation. On the other hand, specialised methods include methods based on the use of photographic material. Methods frequently used within this group include: Scenic Beauty Estimation (SBE) developed by Daniel and Boster in 1976, and VRMP (Visual Resource Management Program, 1980). The SBE method was used for the estimation of forest landscape for example by Rudis et al. (1988). In Poland it was used for the aesthetic landscape evaluation of the Elbląg Canal (Rylke and Gąsowska 2009). According to Hoffman and Palmer (1995) photographs and slides are a common tool used in the studies of preferences and landscape perception because they are more cost-effective and enable faster on-the-spot evaluations. Photographs and slides of different types of landscape were used for instance in the works of Appello and Beinaldez (1986), Bruno and Shelby (1992), Hammitt et al. (1994), Magill (1994), Paquet and Belanger (1997), Karjalainen and Komulainen (1999). Water has always occupied an important place in landscape evaluation. According to Krzymowska-Kostrowicka (1997), the evaluation of landscape amenities in tourism is based – apart from the analysis of the lay of the land, its forms, forms of land use and habitat types – also on the consideration of water resources. Brown and Reed (2000) and Dubel and Szczygielski (1982) list the following factors that affect the attractiveness of the environment: surface waters, vegetation, land relief, and the presence of open areas such as meadows, pastureland and ploughfields. The visual value of the landscape is determined by people observing the landscape. The selection of a suitable method as well as the type of research tools are important aspects in the evaluation of landscape. The aim of this article is to present the applicability of photographs taken by drones in the evaluation of landscape visual quality of forest water reservoirs.

Drones as a tool for landscape recording

Originally unmanned aerial vehicles (UAVs) were used by the military. With time, owing to the development of military technologies, they have become available for general use. For more than a decade we can observe on the Polish market the development of this technology in the civilian area in various sectors of the economy. Unmanned aerial vehicles, popularly referred to as 'drones', are used more and more frequently in the agriculture and forestry. The ability to transmit real-time video images makes UAVs a perfect tool to monitor forests, lakes, territorial waters, roads and motorways, as well as to coordinate and support emergency operations and document natural disaster-related losses [http://www.x-dron.pl/dokumenty/UAV_raport_ULC_2013.pdf]. Due to their low-altitude flights UAVs are able to take photographs below the cloud base. Further advantages include relatively low purchase and running costs, usually no requirement for the use of an airport to take off and land, and a high resolution of the products obtained, reaching single centimeters or even millimeters. UAVs are also used for photogrammetric surveys conducted mainly for non-urbanised areas, small areas (up to several thousands of hectares) or hardly accessible grounds. Photographs taken by drones can also be applied in the survey of land use and drawing-up planning documents where accuracy requirements are less stringent. In Poland, the period of 2010–2016 witnessed a very rapid development of UAV technology, making it a competitor for aerial and satellite photography. Owing to high resolution photographs of forest areas in different spectra (visible spectrum, near-infrared spectrum and infrared spectrum) it is possible to specify various parameters and find various indicators that characterise the selected areas. One of the greatest advantages of UAVs is the fact that they are able to perform aerial work in inaccessible or hardly accessible places. Drones are vehicles of different types, sizes, equipment and purpose – both military and commercial. Drones available for the commercial market are machines of small size, usually weighing 3-15 kilograms.

Their technical specification depends on the type of the tasks performed and the necessary equipment. Multirotor platforms capable of vertical takeoff and landing fall into the most frequently used UAVs category. They ensure a high level of stability of flight and hover, precise control and weight-carrying capacity to move – when necessary – professional filming or measuring equipment, as shown in the report delivered by the Civil Aviation Authority (ULC) in 2013. [http://www.x-dron.pl/dokumenty/UAV_raport_ULC_2013.pdf].

Unmanned Aerial Vehicles in the Polish legal system

Rules for the use of Polish airspace are set out in the Act of 3 July 2002 – Aviation Law (Journal of Laws of 2002, item 933, as amended) and implementing regulations enacted on its basis. Detailed rules concerning the performance of unmanned aerial flights in Poland are specified in three regulations of the Minister of Transport, Construction and Maritime Economy of 26 March 2013 on the exclusion of the application of certain provisions of the Act – Aviation Law to certain types of aircraft, and the determination of the conditions and requirements for the use of these vehicles, which partially lay down the rules for the performance of flights (Journal of Laws of 2012, item 933, as amended). Detailed rules for obtaining the said document are set out in the Regulation of the Minister of Transport, Construction and Maritime Economy of 3 June 2013 on qualification certificates which lays down the licensing rules for persons performing unmanned aerial flights (Journal of Laws item 664); and in the Regulation of 26 April 2013 on the technical and operational conditions for special category aerial vehicles which are not supervised by the European Aviation Safety Agency (Journal of Laws of 2013, item 524). The first two regulations are currently being revised. The Civil Aviation Authority also continues work on the draft regulation on the detailed flights rules for unmanned aircraft operating in the Polish air space, and on cooperation procedures for operators of these vehicles and air traffic services providers. The regulation will determine the rules for the flights out of sight of the person operating the vehicle (currently flights out of sight, for safety reasons, are allowed only in designated airspace) [source: http://www.ulc.gov.pl/].

Drones and landscape evaluation of water reservoirs

The identification of the characteristics determining the visual quality of a water reservoir and their importance in landscape evaluation requires, in each case, a pilot survey with the use of photographic material. For this purpose, both photographs taken from pedestrian perspective and the bird's eye view can be used. Drones may prove to be very useful in this field. Photographs taken by drones were used for instance in the survey of the landscape aesthetic quality of water reservoirs located on the territory of the Regional Directorate of the State Forests in Radom (Kargul-Plewa 2016). A questionnaire providing photographic material from drone flights was used for this purpose. The platform used was a vehicle with a maximum take-off mass of 13.5 kg (5 kg of lift capacity) equipped with a 4K video camera. Pictures taken during flights provided images of the coastline from the distance of 100 m, 200 m and 300 m, the altitude of 50 m, 100 m and 200 m, at the camera angle of 45° up to 90° and with the resolution of 12-24 MP. The images presented different types of water reservoirs, taking into account such aspects as their neighbourhood, the size of a water reservoir, its shape, vegetation cover of water table, the presence of infrastructure in the immediate vicinity (such as trails, paths, recreation facilities, hydraulic constructions etc.), or the type of woody plant in the vicinity of the water reservoir. Figure 1 presents the fragment of the questionnaire used in the survey on the visual quality of water reservoirs.

6.Proszę przyjrzeć się prezentowanym poniżej fotografiom i schematom obrazującym różny stopień pokrycia lustra wody roślinnością wodną. Który z wariantów uważa Pan(i) za najbardziej atrakcyjny krajobrazowo?

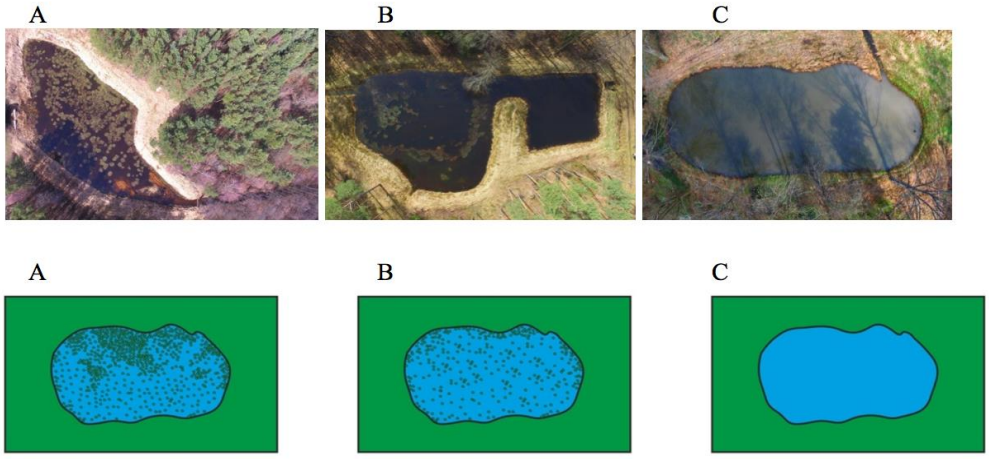

Fig. 1. The fragment of the questionnaire from the survey on the visual quality of water reservoirs
1 pav. *Vandens telkinių vizualinės kokybės vertinimo klausimyno fragmentas*

In this particular case, the question in the survey was to determine which variant of vegetation cover of water table is perceived as the most attractive to the public. Photographs presented three possible variants of vegetation cover of the water: the so-called "zero" variant – no vegetation or single groupings of water plants, the medium variant in which vegetation covers 10-50% of the water surface, and the third variant in which vegetation covers more than 50% of the water surface. In order to facilitate the task of evaluation, below each of the photographs a graphic illustration was attached which reflects the situation from the photograph. This was done in order to highlight the aspect of the degree to which the water table is covered with vegetation and to eliminate all other aspects which could influence the respondents' evaluation. A similar procedure was applied for the analysis of other above listed features conditioning the visual quality of water reservoirs. The questionnaire comprised a total of seventeen questions concerning the visual assessment of forest water reservoirs and five sociodemographic questions (sex, education, educational profile, age, place of residence). The survey was conducted via the Internet. It was distributed with the use of the social media to different groups gathering people interested in forest recreation, as well as to foresters. The results obtained on the basis of the survey are currently being subject to statistical analysis. However, it can certainly be claimed that photographs delivered by drones may prove very helpful in the assessment of the visual quality of water bodies, and the fact that they can be easily obtained ensures their widespread use. In addition, the use of images taken from the bird's eye view enables the elimination of frequent, in comparison with the photographs taken from the ground level, technical errors resulting from, among other things, landscape cropping.

Conclusion

There are multiple research methods to evaluate visual quality of the landscape. However, due to the development of new techniques and technologies, more advanced, reliable and accurate solutions in this field can still be sought. Undoubtedly, drones may be used in a

comprehensive landscape assessment. They may be also applied to the detailed landscape quality survey on one of the components of a landscape, in this case water reservoirs. Such surveys are necessary for the development of engineering landscape shaping principles.

Bibliography

1. Berg L., 1947-1952. Geografičeskie (landšaftnye) zony Sovetskogo Sojuza, Geoizdat, Moskva.
2. Europejska Konwencja Krajobrazowa, GDOŚ Warszawa 2010
3. Myczkowski Z., 2013. Materiały pokonferencyjne GDOŚ Identyfikacja i waloryzacja krajobrazów – wdrażanie Europejskiej Konwencji Krajobrazowej.
4. Nebiker S., Annen A., Scherrer M., Oesch D. 2008. A light – weight multispectral sensor for UAV- opportunities for very high resolution airborne remote sensing. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. XXXVII, Part B1.
5. Plutecki W., Zmarz A., Sanko I. 2013. A truly photogrammetric UAV. GIM International 4:Poznań
6. Przywara J., 2012: Inwazja dronów. Magazyn Geoinformacyjny Geodeta 10: 10.-15.
7. Raport ULC 2013 r., źródło: http://www.x-dron.pl/dokumenty/UAV_raport_ULC_2013.pdf
8. Richling A., 2013, Materiały pokonferencyjne GDOŚ Identyfikacja i waloryzacja krajobrazów – wdrażanie Europejskiej Konwencji Krajobrazowej.
9. Richling A., Solon J. 1996. Ekologia krajobrazu. PWN, Warszawa.
10. Sobol E. (red.), 1995, Mały słownik języka polskiego PWN, Wyd. Nauk. PWN, Warszawa.
11. Sołowiej D., 1987, Podstawy metodyki oceny środowiska przyrodniczego człowieka, Wyd. UAM, Poznań.
12. Szczęsny T., 1982, 39–41. Ochrona przyrody i krajobrazu. PWN W-wa.
13. Śleszyński P., 1996. Ocena atrakcyjności wizualnej krajobrazu okolic Pińczowa. Praca magisterska wykonana na Wydziale Geografii i Studiów Regionalnych Uniwersytetu Warszawskiego, pod kierunkiem prof. dr hab. Andrzeja Richlinga.
14. Ważyński B. 1997. Urządzanie i zagospodarowanie lasu dla potrzeb turystyki i rekreacji. AR,
15. Ważyński B., 2005: Poradnik urządzania lasu. Oficyna Edytorska Wydawnictwo Świat, Warszawa: 231-237.
16. Wojciechowski K., 1986. Problemy percepcji i oceny estetycznej krajobrazu, Wyd. UMCS, Lublin.
17. Zasady hodowli lasu, 2012, Centrum Informacyjne Lasów Państwowych, Warszawa.
18. Zmarz A. 2011. Zastosowanie bezzałogowych statków latających do pozyskania danych obrazowych o lesie. Katedra Urządzania Lasu, Geomatyki i Ekonomiki Leśnictwa, SGGW
19. Europejska Konwencja Krajobrazowa sporządzona we Florencji dnia 20 października 2000 r., Dz. U. z dnia 29 stycznia 2006 r. Nr 14 poz. 98.
20. Ustawa o ochronie przyrody z dnia 16 kwietnia 2004 r. Dz.U. 2004 nr 92, poz. 880.
21. Ustawa z dnia 3 lipca 2002 r. Prawo lotnicze Dz.U. 2013 poz. 1393 (tekst jednolity).
22. http://www.ulc.gov.pl/pl/
23. http://www.x-dron.pl/dokumenty/UAV_raport_ULC_2013.pdf

Dorota Kargul-Plewa, Emilia Janeczko

Nepilotuojamų skraidyklių panaudojimas kraštovaizdžio vandens telkinių vizualinės kokybės vertinimui

Santrauka

Straipsnyje apžvelgiami miškų kraštovaizdžio vertinimo metodai ir galimybės panaudoti nepilotuojamas skraidykles vandens telkinių miškų plotuose vizualinės kokybės tyrimams. Poreikį imtis veiksmų dėl miško kraštovaizdžio formavimo paskatino, be kitų dalykų, didėjanti negamybinių miško funkcijų svarba, o taip pat augantys visuomenės lūkesčiai. Miško kraštovaizdis yra susijęs su tam tikrų augmenijos rūšių buvimu, taip pat su inžineriniais miškotvarkos elementais įskaitant vandens telkinius. Straipsnyje ypatingas dėmesys skiriamas vandens telkinių vaidmeniui vertinant miškų kraštovaizdį ir būtinybę juos tinkamai formuoti. Nepilotuojamos skraidyklės gali būti naudinga priemonė miškų kraštovaizdžio vertinimui, o taip pat sprendimų, susijusių su vandens telkinių planavimu ir projektavimu, priėmimui.

Raktažodžiai: miško kraštovaizdis, vandens telkiniai, nepilotuojamos skraidyklės.

TRENDS OF THE LANDSCAPE FORMATION

Madara Markova
Latvia University of Agriculture, Faculty of Environment and civil Engineering, Department of Landscape Architecture and Planning

It is important to remember, that people are the first and the most important aspect in the landscape architecture. Landscape elements are important not only in the research of the existing situation, but also in its designing process. Strong associations have developed in the landscape architecture industry worldwide. These associations not only bring together landscape architects and professionals of the field of the landscape architecture, but also promote the development of the common sector, support young professionals and highlight the examples of good practice. Key words from project and activity description can be seen as elements of landscape formation trends. Although in general in the award nominees descriptions different terms are used, these two awards are united by common attention, which is focused to the cooperation of all types and levels.

Keywords: landscape elements, landscape award, indicators.

Introduction

The landscape formation is based on the scape designing for people. People are the first and the most important aspect in the landscape architecture. The second aspect that matters is a landscape scale. A scale could be understood differently – it is not only a map scale. And the last, but not the least, is the third part – landscape elements. According to Erin Tharp's thoughts, 3D modeling, innercity design, bus stops, cycling routes, historic preservation, rooftop and vertical gardens and sustainability are considered as trends of the 21st century (Tharp, 2010). Research-led perspective is still popular nowadays and design-led perspective just develops gradually (Sanders, 2006).

In this century we think a lot of the nature. In this context it is equally important to think about physical landscape and physical landscape elements and their materials. As it is mentioned in European Science Foundation newsletter "Landscape in a Changing World", there are embedded major challenges of our century in the landscape: climate change, energy needs, health and safety, food security, urbanisation and migration (European Science Foundation, 2010). The researches of landscapes are important broad-basedly because of their multidisciplinarity. Landscape multidisciplinarity also is shown throughout recent decades, by becoming subject of the research in such disciplines as archaeology, cultural geography, ecology, environmental studies, historical studies, landscape architecture, planning, psychology and sociology (European Science Foundation, 2010). In the beginning of the 21st century the scientist Terry C. Daniel noted in his research that designing ideas would be based on the ecosystem management (Terry, 2001).

Landscape elements are important not only in the research of the existing situation, but also in its designing process. Landscape elements – indicators are often used for the evaluation and description of the landscape. Elements changing – the number, type, design, applications, the aim are quantitative landscape elements used in landscape evaluation and process characterization. Valuable is not only fixation of existing situation, but also visualisation that improves the representation of the landscape to viewers (Bishop, Hull, 1991; Terry, 1992; Orland, 1993; Sheppard, 1989; Zube et al 1987; Terry, 2001). The landscape is described more as a whole in Daniel's research, but the description of details in the virtual environment of the 21st century has also become more realistic. Nowadays globalization and exploration of regional differences are seen in many areas. Regional landscapes and their

elements are the key elements of the cultural landscape, and show these differences (Wascher, 2004).

Strong associations have developed in the landscape architecture industry in several countries, which not only bring together landscape architects and professionals of the field of the landscape architecture, but also promote the development of the common sector, support young professionals and highlight the examples of good practice. One of the most influential nowadays is the American Society of Landscape Architects (ASLA). ASLA was developed in 1899, it has not only rich and long-standing history, but it is also a big and comprehensive organization nowadays. ASLA has created annual award in various categories – general design, residential design, analysis and planning, communication, landmark. The results are published on the website of ASLA, together with a description of each award winner. Project parametric is one of the landscape Quality component, that's why descriptions, which shows project value are important.

The global landscape architects organization is IFLA (International federation of landscape architects), which currently brings together 76 national associations from Africa, America, Europe Asia Pacific and Middle East. Currently, the organization has four subordinate organizations – IFLA Africa, IFLA America, IFLA Asia-Pacific, and IFLA Europe. Currently, the organization is working on implementing the award in the global and regional level for the purpose to encourage and recognize best quality landscape works in member states of IFLA; to enhance the recognition of the landscape profession and the practice of landscape architecture globally; to contribute to the design, conservation and management of the environment (Hayter, 2016). IFLA presents the IFLA Sir Geoffrey Jellicoe Award, which is the highest recognition award from IFLA, as well as the IFLA Student Landscape Architecture Design Competition is organized annually, which has been represented from 1987, but annual competition has been represented from 2003. IFLA award that could be as a comparable indicator on a global scale is still in the development process.

The Landscape Award of the Council of Europe could be considered as a comparable for the ASLA award in Europe. This award was introduced in 2008 in connection with the Landscape Convention, and the countries ratifying the Landscape Convention eventually introduce the Landscape Award of the Council of Europe, taking into account that the purpose of the award is to reward practical initiatives that could be taken as an example of consummation of the landscape quality objectives in areas of member states of the Landscape Convention. The common basis of regulations is developed, which each promoter country correspondingly has the right to review and edit (Council of Europe, 2008). Taking into account that the introduction of the award of the Landscape Convention and the Landscape Award of the Council of Europe in each country passes at different speeds, yet the winners of the award also have been evaluated separately. The information for all the award winners of 2008 till 2014 is recorded in the publication of the Council of Europe "European spatial planning and landscape, No. 102" (Council of Europe, 2014).

Method

This research presents expert made approach to the landscape research (Terry, 2001). A summary and evaluation of the results was carried out within the framework of the research. The nominees of annual award of the ASLA in different award categories and descriptions of the winning objects from 2012 till 2016 (American Society of Landscape Architects) have been studied within the framework of the research. The research examines the winners of the ASLA award of excellence, although honorary awards are put forward at each of the nominations. The summary of the Landscape Award of the Council of Europe from

2008 till 2014 (Council of Europe, 2014) was carried out within the framework of the research. On reading the descriptions of the nominees the keywords are defined. In turn, the keywords are summarized in the results interpretation if summarizing without taking into account different cases in which the word is used in the original description of the nominees.

Results and discussion

Key words from project and activity description can be seen as elements of landscape formation trends. Kew words are changing through the years and can be used as indicators for fixation of landscape formation trends.

The summary of nominees of the annual ASLA award in various award categories and descriptions of winning objects from 2012 till 2016 was carried out of 26 nominees (Table 1). Although the award categories are diverse, including categories such as general design, residential design, analysis and planning, communication, landmark, many keywords from the descriptions of nominees are similar or exactly the same. A powerful majority of the attention in nominees descriptions focuses on realized or planned cooperation in different ways describing it with words – „connection" for 6 times, „engagement" for 1 time, „collaboration" for 2 times, „bringing together" for 1 time and „bridging" for 1 time. Also the term „local" is used for 5 times, terms „public" – for 3 times and „unique", „eco" „sustainable", „liveable" and „development" – for 2 times. Many terms are used only once, such as health, popular, remediation, social, strategies, harmony, preservation and many others.

Table 1.
1 lentelė

Award category *Apdovanojimų kategorija*	**Year** *Metai*	**Winner** *Laimėtojas*	**Keywords from project description** *Projekto raktažodžiai*
General design category	2016	Underpass Park	public, connecting, unique, health
	2015	At the Hudson's Edge: Beacon's Long Dock as a Resilient Riverfront Park	popular, connections, vital part, remediation and ecological restoration,
	2014	Bill & Melinda Gates Foundation Campus	ecologically and socially sustainable, local engagement, connects
	2013	Lakewood Garden Mausoleum Lakewood Cemetery	sustainably, gracefully
	2012	A Green Sponge for a Water-Resilient City: Qulin Storm water Park	ecosystem services, urban development
Residential design category	2016	DBX Ranch: A Transformation Brings Forth a New Liveable Landscape	liveable landscape, interconnected, context-sensitive and sustainable strategies
	2015	Cedar Creek	harmony between built structure and site
	2014	Woodland Rain Gardens	preservation and enhancement
	2013	Sagaponack Residence	relocate
	2012	Drs. Julian and Raye Richardson Apartments	home, local materials, storm water management

Analysis and planning category	2016	The Copenhagen Cloudburst Formula: A Strategic Process for Planning and Designing Blue-Green Interventions	climate change mitigation solutions, flexible and universally adaptable model, liveability
	2015	Penn's Landing Redevelopment and Feasibility Study	redevelopment, mixed-use, connect
	2014	Midtown Detroit Techtown District	revitalization, collaboration
	2013	Lafitte Greenway + Revitalization Corridor/ Linking New Orleans Neighbourhoods	vibrant, multi-modal, linking
	2012	The One Ohio State Framework Plan	unique combination of principles, long-term vision
	2014	Finding Connections to the Outdoors for Youth and Families in Larimer County, Colorado	access to nature, nature connections, physical organisation
	2013	Green Roof Innovation Testing (GRIT) Laboratory	only one of its kind, optimization
Communication category	2016	What's Out There Guidebooks	collaboration with local partners
	2015	Landscape Performance Series: Demonstrating the Environmental, Social, and Economic Value of Sustainable Landscapes	transform, brings together,
	2014	The Landscape Architecture Legacy of Dan Kiley	modernist landscape
	2013	Visible/Invisible: Landscape Works of Reed Hilderbrand	photographic representations
	2012	Digital Drawing for Landscape Architecture: Contemporary Techniques and Tools for Digital Representation in Site Design	bridging
Landmark award	2016	Michigan Avenue Streetscape: 20 Years of Magnificent Mile Blooms	public space, seasonal
	2015	The Art Institute of Chicago South Garden by Dan Kiley, Nominated by the Cultural Landscape Foundation	intimately scaled garden
	2014	Norman B. Leventhal Park at Post Office Square	excellent design, revival, public-private cooperation
	2012	Village of Yorkville Park	local, revitalization

The summary of the Landscape Award of the Council of Europe from 2008 till 2014 was carried out on 40 nominees from 23 countries (Table 2). All award applicants have to fulfil the common goal oriented results, because the award is intended to reward practical initiatives that could be taken as an example in achievement of landscape quality objectives in the areas of member states of the Landscape Convention. The award winners are different types of activities and projects, therefore the descriptions of the projects are manifold. The mostly used terms in the award winners descriptions are "local" for 17 times, „sustainable" for 15 times, "eco" for 11 times, "awareness" for 9 times and „preservation" for 8 times. The winners of this award as well as ASLA award nominees paid a lot attention on a cooperation of different types, the terms used for its characterization are „involvement" – used for 6 times, "participatory" used for 3 times, "co-operation" used for 2 times and „joint-action", "relationship between", "intersectoral", "interrelated", „interaction" used for 1 time. In the context of the Landscape Convention it is quite understandable that in the descriptions of the project are used such terms as "protection", "conservation", "restoration", "unique" used for

5 times and “identity”, “traditional”, “heritage” used for 4 times. Another terms as “development”, “education”, “establishment”, “contemporary”, “increasing”, “creating”, “improvement” and other terms are used less than for 4 times.

Table 2.
2 lentelė

Year *Metai*	**Winner** *Laimėtojas*	**Country** *Šalis*	**Key phrases from project description** *Projekto raktažodžiai*
2008-2009	Parc de la Deûle	France	protection, ecological interest, identity, redeveloped, community, interaction
	Cristina Enea Park	Spain	conservation, restore and restructure, sustainable, urban
	The tourist trail marking system	Czech Republic	improve, relationship between
	The landscape management of the Hämeenkyrö National Landscape Area	Finland	traditional, cultural landscape, nature conservation, socio-economic balance, local
	Implementation of the Complex Nature Conservation and Landscape Management Programme in the Zámoly Basin	Hungary	education, awareness-raising, protection, re-establishment
	The Val di Cornia Park System	Italy	local, sustainable development, available, heritage
	Biodiversity and Natural Resources Management Project	Turkey	protection, effective, intersectoral, participatory, sustainable
	The Regional Distribution of Landscape Types in Slovenia	Slovenia	inventory, protection, contemporary
2010-2011	Carbonia: the landscape machine, Joint Committee of the Municipality of Carbonia	Italy	regenerate, preserved, developed
	Grant programmes for local communities to shape their surroundings into a place where they are happy to live	Slovakia	local, public, green, living, heritage, awareness-raising
	Education and awareness-raising: city, territory, landscape	Spain	awareness-raising, long-term, sustainable, individuals
	The Durham Heritage Coast	United Kingdom	increase, re-creation, improvement, sustainable, participation
	The Landscape Route of the Escaut Plains Natural Park	Belgium	aware, locals, co-operation, remarkable
	The hazel orchards in the village of Polystypos	Cyprus	local, diversification, involved
	The Čehovice landscape, Prostějov district in Moravia	Czech Republic	rehabilitation, restoring, ecological, local, learn
	The management of endangered traditional biotopes and the preservation of the traditional rural landscape	Finland	traditional, ecosystems, involved, aware
	The Port aux Cerises open air leisure centre, Joint Committee for Investigation	France	recovered, converted, quality of life, people
	The traditional stone culture of the Bükkalja landscape	Hungary	preserve, traditional, review, local

	The Dutch Landscape Manifesto	Nether-lands	improve, highlight, involvement, reuniting
	The Herand Landscape Park	Norway	typical, local, converted, livelihood, identity
	The landscape of Backi Monostor village	Serbia	preserve, increase, knowledge
	We are making our landscape	Slovenia	disseminate, education, sustainable
2012-2013	Preserving ecological value in the landscape of the Szprotawa river valley	Poland	conservation, implementation, re-establishment, long-term
	The rebirth of the Alto Belice Corleonese region through the recovery of lands confiscated from the mafia organisations	Italy	recover, local, sustainably, identity, heritage
	U-parks, U-turns we love	Lithuania	living, preserving, ecologically, restoration, public, unique
	The Gate of Gornje Podunavlje	Serbia	sustainable, local, connection, partnership
	Hoge Kempen National Park	Belgium	involved, unification, local, sustainable
	Environmental education in the town of Strakonice year by year or Pilgrimage through the Contemplative Landscape	Czech Republic	interrelated, uniqueness, sustainable, awareness
	The Landscape Projects of Hyyppä Valley, City of Kauhajoki, Hyyppä village association	Finland	long-term, preservation, local
	Grand Pré Park	France	contemporary, public, diversity, exchanges
	Complex landscape rehabilitation and development programme in the Gerecse Mountains and the Által Creek Valley	Hungary	preservation, sustainable, ecological, joint action, local
	Bere Island Conservation Plan	Ireland	sustainable, conservation, involvement
	Dzintari Forest Park	Latvia	unique, preserved, public, incorporate
	Planning policy for conservation and sustainable development of 20 national landscapes in the Netherlands	Nether-lands	local, regional, protect, sustainable, improving, awareness, co-operation
	Furnas Landscape Laboratory (Furnas LandLab)	Portugal	restore, multifunctional, first of its type, ecological, involvement
	Agricultural Development and Environmental Protection in Transylvania	Romania	conservation, traditional, increasing, local, ecosystems
	Salvage, Revival and Operation of the Forest Railway in the Landscape of Cierny Balog	Slovak Republic	restoring, identity, sustainable
	Landscape and water-management restoration of Škocjanski Zatok nature reserve	Slovenia	typical, ecosystem, remedied, awareness, local
	The sustainable revitalisation of the protected landscape of Geria	Spain	heritage, sustainability, participants, awareness, preserving
	South Pennines Watershed Landscape Project	United Kingdom	unique, climate change, engaging, local

Conclusion

There are many different awards and associations, the aim of which remains the same through the time, to unite and to learn from good examples. Awards can be seen as trends of best practise in landscape formation. The summary of ASLA Award and the Landscape Award of the Council of Europe was carried out within the framework of the research. Although in general in the award nominees descriptions different terms are used, these two awards are united by common attention, which is focused to the cooperation of all types and levels, that are described with such words as – connection, engagement, collaboration, bringing together, participatory, relationship between and other. The study should continue in the future, by making a comparison of the characterizations of available projects and activities with the competition regulations in greater details.

References

1. American Society of Landscape Architects. https://www.asla.org/HonorsAwards.aspx
2. Bishop, I.D., Hull, R.B. Integrating technologies for visual resource management. Journal of Environmental Management, Volume 32, Issue 4, June 1991, p. 295-312.
3. Council of Europe. The Resolution of the Council of Europe CM/Res. 3 on The Landscape award of the Council of Europe contest rules. 2008.
4. http://www.varam.gov.lv/lat/darbibas_veidi/tap/ain_pol/eiropas_padomes_ainavu_balva/?doc=18320
5. Council of Europe. European Landscape Convention. The Landscape award alliance of the Council of Europe. European spatial planning and landscape, No. 102. 2014, 130 p.
6. https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=09000016802f2998
7. European Science Foundation. Landscape in a Changing World – Bridging Divides, Integrating Disciplines, Serving Society. COST-ESF Science Policy Briefing 41, 2010. http://archives.esf.org/fileadmin/Public_documents/Publications/SPB41_Landscape_ChangingWorld.pdf
8. Hayter J. IFLA News issue 17. 2016. http://iflaonline.org/wp-content/uploads/2016/12/IFLA-News-Issue-17.pdf
9. Orland, B. Synthetic landscapes: a review of video-imaging applications in environmental perception research, planning and design. In: Marans, R., Stokols, D., Environmental Simulation: Research and Policy Issues. Plenum Press, New York, 1993, p. 213-251.
10. Sanders, E.B.-N. Design Research in 2006. Design research Quaterly, V.1:1. Design Research Society, 2006, 25 p.
11. Sheppard, S.R.J. Visual Simulation: A Users Guide for Architects, Engineers and Planners. Van Nostrand Reinhold, New York, 1989.
12. Terry C. Daniel. Data visualization for decision support in environmental management. Landscape Urban Planning 21, 1992, p. 261-263.
13. Terry C. Daniel. Whither Scenic Beauty? Visual Landscape Quality Assessment in the 21st Century. Landscape and Urban Planning 54(1), 2001, p. 267-281. https://www.researchgate.net/publication/223248778_Whither_Scenic_Beauty_Visual_Landscape_Quality_Assessment_in_the_21st_Century
14. Tharp E. 7 Top Landscape Architecture Trends of the 21st Century. 2015. http://landarchs.com/7-top-landscape-architecture-trends-21st-century/

15. Wascher, D.M. Landscape-indicator development: steps towards a European approach. The new dimensions of the European landscape: Frontis Workshop on the future of the European cultural landscape, Wageningen, The Netherlands, Jongman, R.G.H. (ed.). Dordrecht: Springer, 2004, p. 237–252.

16. Zube, E.H., Simcox, D.E., Law, C.S. Perceptual landscape simulations: history and prospect. Landscape Journal, 6, 1987, p. 62-80.

Markova Madara

Kraštovaizdžio formavimo tendencijos

Santrauka

Svarbu atsiminti, kad kraštovaizdžio architektūroje žmonės yra pirmasis ir svarbiausias aspektas. Kraštovaizdžio elementai yra svarbūs ne tik esamos padėties tyrimams, bet taip pat ir jos projektavimo procesui. Kraštovaizdžio architektūros srityje visame pasaulyje yra susikūrusios stiprios asociacijos. Šios asociacijos ne tik suburia kraštovaizdžio architektus ir specialistus, bet taip pat skatina bendrą sektoriaus plėtrą, remia jaunus specialistus ir išryškina gerosios praktikos pavyzdžius. Projekto ir veiklos aprašyme pateikti raktažodžiai gali būti vertinami kaip kraštovaizdžio formavimo tendencijų elementai. Nors apskritai apdovanojimų nominantų aprašymuose naudojami skirtingi terminai, šiuos apdovanojimus vienija bendras dėmesys visų tipų ir lygių bendradarbiavimui.

Raktažodžiai: kraštovaizdžio elementai, kraštovaizdžio apdovanojimas, rodikliai.

THE IMPACT OF SELECTED LEISURE ACTIVITIES ON SHAPING NEW URBAN SPACES

Lidia Ozimkowska, Jerzy Wojtatowicz, Tomasz Wojtatowicz
University of Ecology and Management, Poland

Introduction

Objects of the architecture of landscape are shaped both by powers of nature and human activity. Depending on character of the objects and their surrounding participation of these two elements might differ. Some of the objects posses vast natural resources and development of these objects in the area could impel to conserve and enrich values of nature taking the opportunity to adopt in the broadest possible way the processes of natural succession. Other objects developed by human activity in greater extend evolve towards proliferation of anthropogenic resources.

These days with accelerated pace of life people have substantially less time for different forms of recreation activity, especially these exercised in the open air. Urban density is successively expanding and feeling the open areas of the city. City squares and green areas retained merely a communication function. Decreasing number of trees in city plazas became a sad fact. They are being replaced with the objects called ''small'' architecture, city furniture, spacial forms, water ponds, etc. gardens are reduced to the solely decorative function for their surrounding architecture, in this way being deprived of its own sense of existence as individual objects thought to serve a certain purpose.

People tend to spend increasingly more time indoors whether at home, office, school or shopping mall. Spare time is spent in closed objects like city swimming pools, tennis courts, gym halls, concert halls, clubs or galleries. Despite this rich offer of indoor activities there are some forms of recreation that could be performed only in the designed open areas.

The author is present issue to create new places conceived as islanded areas within the structure of parks or existing as separate objects with recreation function, often with educational purposes. Places of such character could be established equally in the densely urban areas as well as in the open landscape.

New objects for scientific education as the basis for innovative forms of designing regarded in the open areas or recreation objects.

Designing focused on modernization as well as developing of the objects of architecture is to recon the variations of recreation activities in the way they:

a) do not collide with each other
b) fulfill the new recreation needs
c) avoid extinction of natural and cultural values of the place

At the stage of planning and defining functional and special structure in the multifunctional object one must consider universality and the needs of potential users. However, too universal approach in the course of programming process might lead to schematism and monotony of the projects, in the result to decrease the value and attractiveness for the users.

Also the administration shows a little interest to implement innovative forms of recreation what brings many of the projects to fail. Consequently, innovative forms of recreation appear spontaneously in the places that are not appropriate, often sparking conflicts and pose risk for health and life. From the very beginnings leisure time spent in parka, gardens and other objects of landscape architecture used to create opportunities for observation of nature. In the last decades constantly awareness in the field of ecology is exerting on-growing pressure to design and arrange selected places, often equipped with different facilities, thus opening a chance for scientific education about nature.

Bird feeders and nesting sites are deployed in the areas, as well as the paths and places that bring nature closer to people. Often this places are arranged withe the considerable effort and cost. These are among the others building and structures that provide information appliances, sometimes with supportive base used for observations, with gangways hanged up in the trees and underwater passes.

Recently, designing such observation sites of paths seems to become insufficient. This idea is being replaced with a new one, where areas are arranged either with the already existing objects of landscape architecture or become independent recreation objects with precisely defined educational purpose. However, the conditions such as public, dement, geographical environment and financial possibilities will influence the substantive cope of a place or an object. Carefully planned designing projects of recreation or function in the given area must become a priority. A design could encompass individual components and features of the landscape and its elements. The aim of recreational area with education mission could become a biotype, a biocoenotic or an ecosystem. New recreation areas could put on educational accent on biodiversity, ecology, present and forecasted ways of protection of nature, environment or landscape.

New recreational gardens with educational function

Increasingly, it became prominent in the public debate to adopt already existing parks to the new forms of recreation were close encounter with nature should be equipped with educational novelty value. In the year 2013 the Administration of Center District of Warsaw made an effort to rearrange the urban space on this territory to conserve natural resources in particular to satisfy needs of animals and create conditions for their direct observation. In the same year, 2013, the authors began their conceptional work over the ’nature areas’ in the Park Krasińskich, in Warsaw. In the course of extensive studies over the issue on theoretical principles of this land use, the problem combining both functions of recreation and education became especially pronounced.

In the process of public discourse it became clear that the discrepancies and public protests on the solution how to combine educational values of the place with the recreation, would not be easy to solve. Some strived to preserve the existing status quo, others pushed for intensive recreational changes. Similarly, such divergencies have split the scientific community. Some preferred to dress education for bird protection, others preferred to preserve spontaneous vegetation in this historical garden.

To meet a variety of expectations, differed kinds of areas were presented to which of them provided the priority functions in recreation in nature. However, enriched with educational element. Eventually, the following projects were forwarded.

Ecological garden - recreational benefits should derived from their circulation of matter and energy especially in urban areas where energy is supplied from the outside and the products of metabolism are removed also outside the city, for example mowed grass or fallen leaves. This selected area especially during the first years of functioning should be supplied with natural matter, in the same way as it is done to the urban ecosystem. Yet, with the time, the very specific system of maintenance would decrease the amount of supplied organic matter. Nevertheless, the supportive system to provide the area with organic matter, should continue, otherwise, in the case the process ceased, it could disturbed the balance of the existing condition and in the consequence brought to changes of formative character. This would result in destruction of many organisms and desolation of the special character of the area.

Biocenotic garden - recreational character of the place should provide with the possibility to observe the relations and bonds among the living organisms. Brought scope of biocenosis issues would be confined only to presentation of these binding dependencies the floral enrichment opens new opportunities for growth, animas and fungi both in quantity and quality. Implementations of such character to the area would make it possible to compare and observe the on going changes not only with animals and fungi but also in the functional relationships in-between different organisms existing in this particular place. A perfect example could be a tree hollow left after a broken branch destroyed by fungi or pecked by nuthatch that has become inhabited by a different bird or insects. The place would increasingly evolve due to human activity implementing new plants, nesting boxes, feeders, waterholes and other technical appliances influencing the quantity and quality of species in the field of flora and fauna.

Biocenosis shaped by a human hand would become visible in comparison in the renaming parts of the park. Most favorable conditions for biocenic areas are found in old unattended parks or their parts. Holding special values, thus attractive for future inhabitants. There we can find old hollow or dead trees with wildlife habitats giving shelter to rare animal species. Biocenic areas could be also settled on the territories that are much different from the surrounding. This could be a pond or woodlet in the fields of willfully arranged piece of land with trees and shrubs that would be intensively treated for maintenance, for example all four corners of allotment area that are usually of extensive usage.

Garden of biodiversity - it has been already established that recreational area should provide the possibility for observations of living organisms. The location in the park make it possible to introduce cultivated plants of high decorative and biocenic values. In the process of selection of the plants, attention must be paid on the continuity of flowering for the entire vegetation period. When apposing the poor biocenic values of a park lawn against a blooming meadow in a biocenic garden, this comparison would show how the garden outnumbers lawn in the amount of living organisms. Thus the plants should be carefully selected choosing those that fruit early and those that fruit late. Also plant species should be carefully chosen to build multileveled tree stands of different age and undergrowth. The location of the garden within the park, the structure of the space of the park and the programme of development of the area would depend on the function of the object including specific function of a biocenic garden.

The function of the place determines the selected area within the park. Every consecutive example of the above mentioned parks could become only a part of a bigger space, as it has been already implemented in playgrounds for children, water parks, illusive gardens, vegetable or monoculture grounds with collections of variety of roses, dahlias, heathers and many other plant species. Such a garden thought as an integral part of bigger entity of landscape architecture could be located in any part of its area. Naturally, these kinds of gardens might exist independently, what would special merit when being located on vast areas. It has been also noted that it is much easier to present species (biodiversity) when they grow in number rather then the interactive influence of the organisms on each other (biocenosis). Having this in mind the garden Park Krasińskich in Warsaw, was appointed to adopt the name of biodiversity garden. Eventually, after a discourse in the scientific circles a decision has been taken to put into life a project of Nature Zones.

Biodiverse Garden - Nature Zone in Park Krasińskich[8] in Warsaw

Nature Zones in Park Krasińskich [Phot.1, 2] is an experimental project that became a great success. Yet, it has been only possible with all the effort to compile a design, work out the procedures, apply proper care and maintenance, conservation works and exploitation.

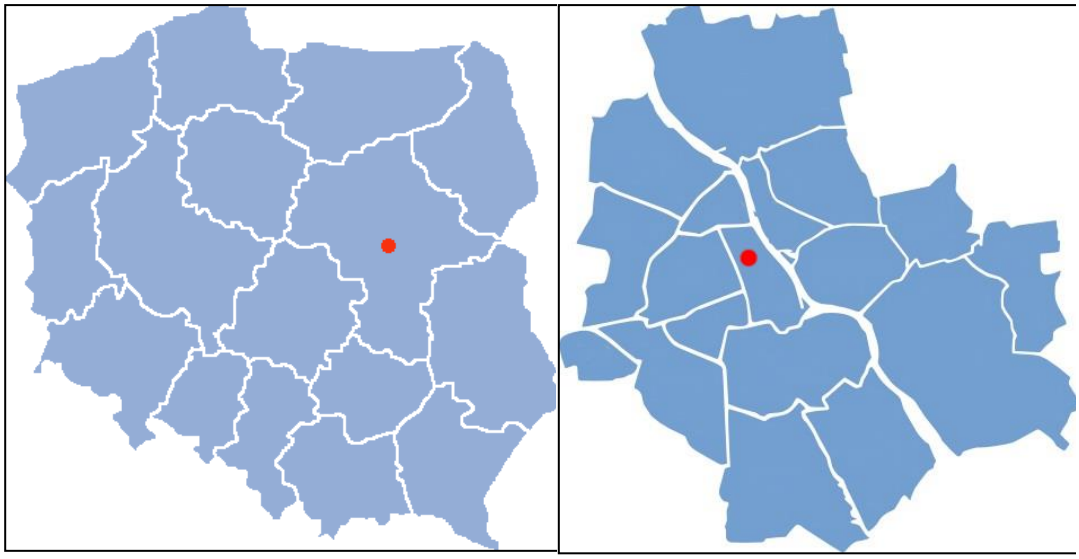

Fig. 1, 2. Location of the area in Poland and in Warsaw
1, 2 pav. *Vietovė Lenkijoje ir Varšuvoje*

[8] Park Krasińskich was established in 1676 in a Baroque style and designed for recreation. I principle this is its basic function. Other functions like protection of environment are only supportive. In the year 1766 the garden was open to the public. Since that time the park has underwent several transformations and rearrangements. However, the author of characteristic landscape style of the park was Franciszek Szaniora, the Head Gardener of the City of Warsaw. Until today, this style has been carefully preserved.

Fig. 3. Location of the area in Park Krasińskich
3 pav. *Vietovė Krasińskich parke*

In this case the designed area with the its structure and destination would create a protective area of multitude of plant species to serve recreation and educational purposes. This piece of land will develop and become biodiversity distinguished in its biodiversity.Due to not only versatility of vegetation but technical appliances and different methods of maintenance. In this way the relevant conditions would be fulfilled for observation of wildlife with animals, plants, fungi and other natural phenomena.

Two basic objectives have been agreed as necessary to ensure biodiversity and to make it open for visitors. However, making the area available to explore must not influence in a negative way the biodiversity of the place. Equally, the development of biodiversity should not disturb the observation. It has been proposed that it would be advisable to arrange both the Nature Zone and the rest of the park area to make them the place where the visitors could observe animals, plants an fungi and watch the relationships between living organisms in this environment of duality, shaped both by nature and by a men. There would be also essential to select a species that are characteristic due to their silhouette, color, abundance of flowering a fruiting, emitted sounds taking, characteristic pose during mating time or while feeding. These measure would make it easier for visitors to recognize and admire the place especially for those who are amateurs.

Conceptual Project for biodiverse garden

Conclusions from the analysis to the conceptual project

In the process of work over the project for renovation of the park several guidelines suggested by the investor had to be considered, in line with the designer assumptions, what eventually led to the conclusions listed here below:

-> In order to preserve close relationship between the historical character of the Park Krasińskich with the Nature Zone, there would be necessary to select area adjacent to the path in the park, where all the elements of the project will be retained and the elements of the Nature Zone will not introduced.

-> In order to enrich the Nature Zone with additional elements some intensive planting must be carried out along the bordering fence; while the remaining part of the area should be equipped with both vegetative and non-vegetative elements propitious for life and development of plenty of species of animals, plants and fungi.

-> In order to secure proper balance with all the functions: protective, ecological, educational and promotional within the Nature Zone, the areas should be chosen where the particular function will become of top priority.

-> Educational function should be implemented on the entire area of the Park Krasińskich. Nevertheless, precautions should be also taken to minimize unfavorable influence of visitors in the park, so only the guided groups of tourists will be admitted. The Nature Zone should be carefully protected since the capacity of this territory is limited.

-> In order to ensure more isolation against the destructive external agents it has been suggested to widen the protective space of the Nature Zone by planting shielding greenery belt along the external part of the bordering fence.

-> In order to keep views of the park to be admired pedestrians some free spaces should be provided in between the vegetation.

Functional Parts of Biodiverse Garden

The entire territory of the Nature Zone has been divided into five areas that differ in their functions.

SECTOR A - The area most valuable from the point of view of nature-internal part of the Nature Zone with the elements of the programme.

SECTOR B - The area of great significants to become harmonized with the interior of the historical park-the part adjacent to the already existing path in the park, that is also the bordering line of the park from the southern and easter sides.

SECTOR C - The area of interfusion of sectors A and B -The internal part of the Nature Zone, where the implementation of the elements of the program is possible only under the condition of harmonious merge with the historical park.

SECTOR D - External protective belt of vegetation form the Andersa Street and Świętojerska Street-The part adjacent to the bordering line from the northern and western sides.

SECTOR E - The area where the park is bleeding in with its surrounding.

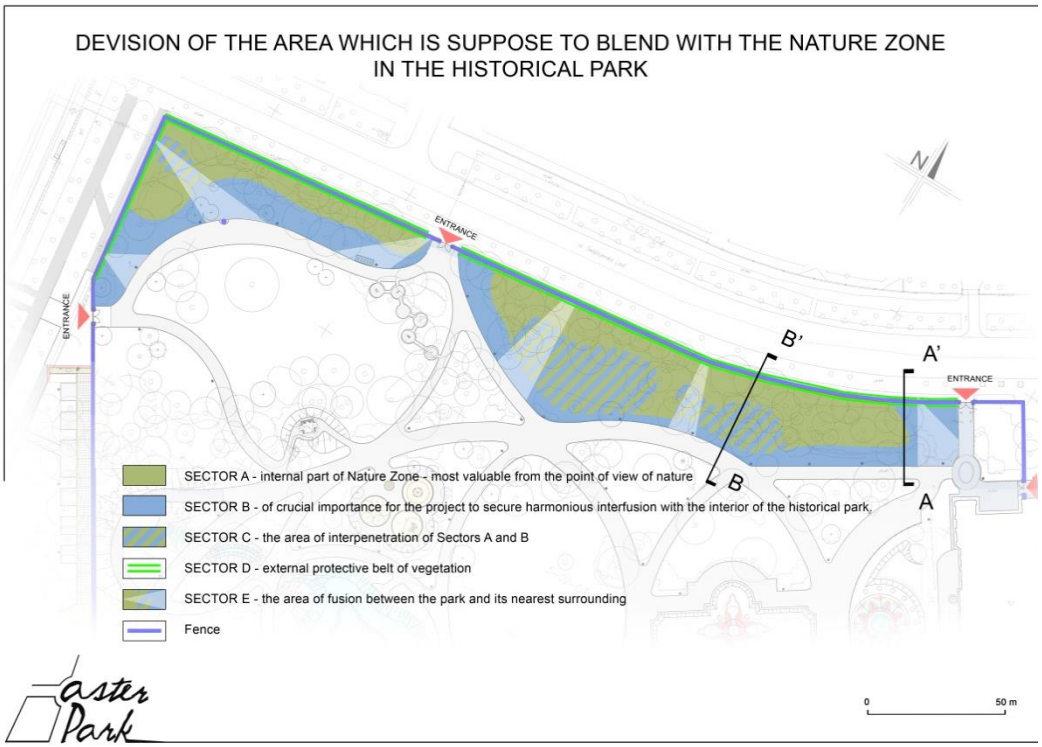

Fig. 4. Division of the area which is suppose to blend with the Nature Zone in the historical park; perimeter

4 pav. *Vietovės suskirstymas siekiant darnaus susiliejimo su istorinio parko gamtine zona; perimetras*

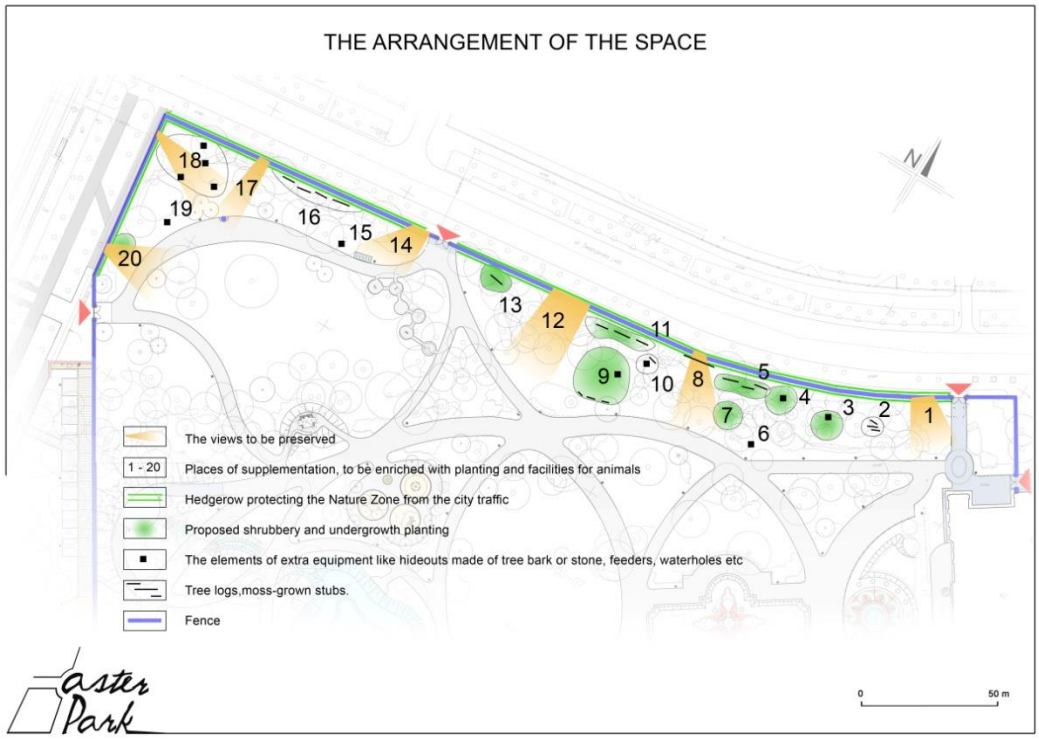

Fig. 5. The arrangement of the space
5 pav. *Erdvių išsidėstymas*

Fig. 6. View/Section A-A'
6 pav. *Vaizdas/ A-A'dalis*

Fig. 7. View/Section B-B'
7 pav. *Vaizdas/ B-B' dalis*

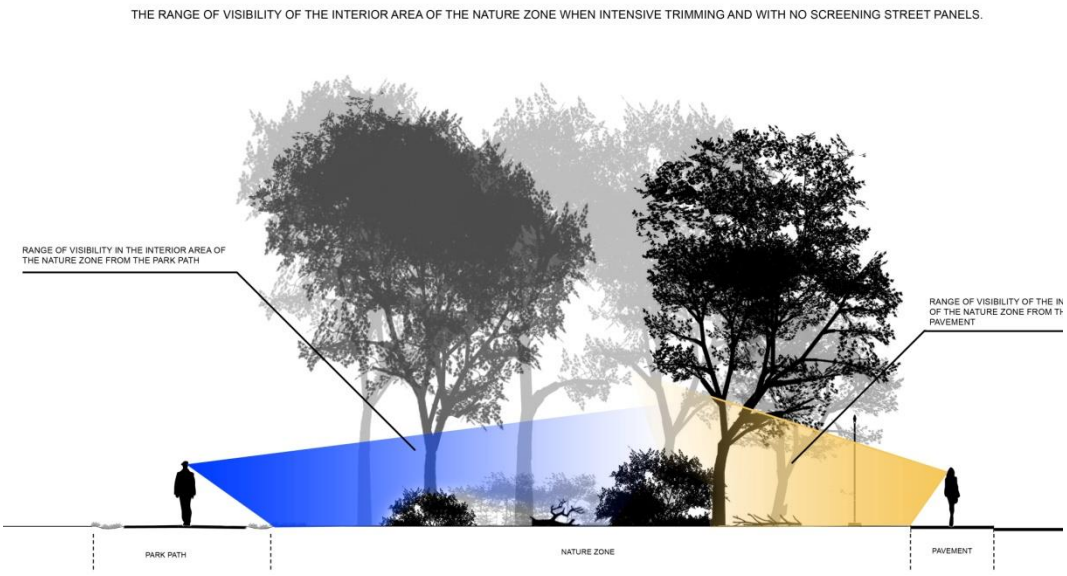

Fig. 8. The range of visibility of the interior area of the Nature Zone when intensive trimming and with no screening street panels.
8 pav. *Gamtinės zonos vidinės dalies matomumas, atlikus intensyvų genėjimą ir neužstačius plokštėmis nuo gatvės.*

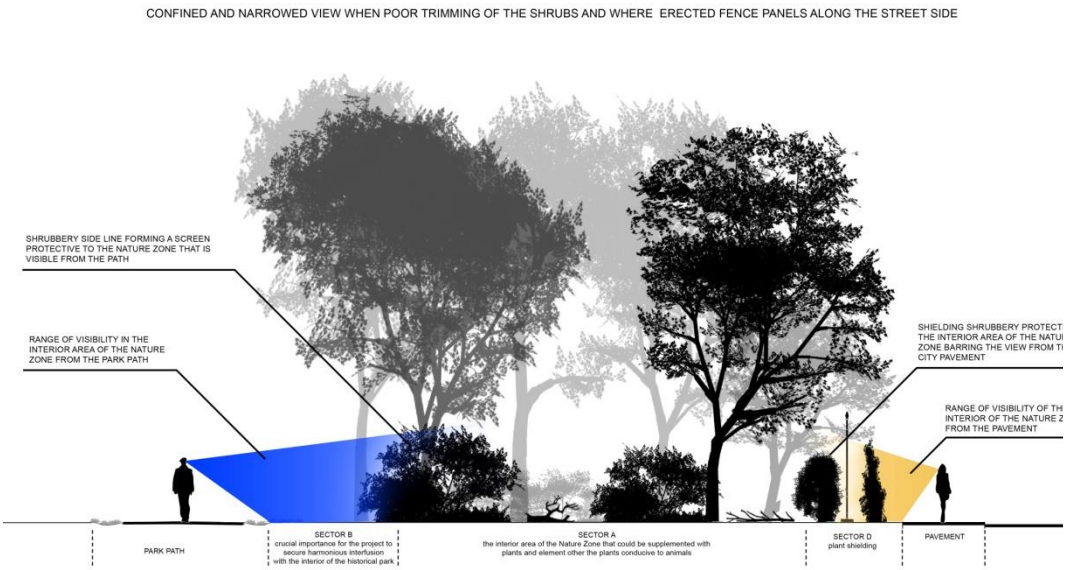

Fig. 9. Confined and narrowed view when poor trimming of the shrubs and where erected fence panels along the street side.

9 pav. *Apribotas ir susiaurėjęs matomumo laukas, kai krūmai yra nepakankamai nugenėti ir pastatyti atitvarai nuo gatvės.*

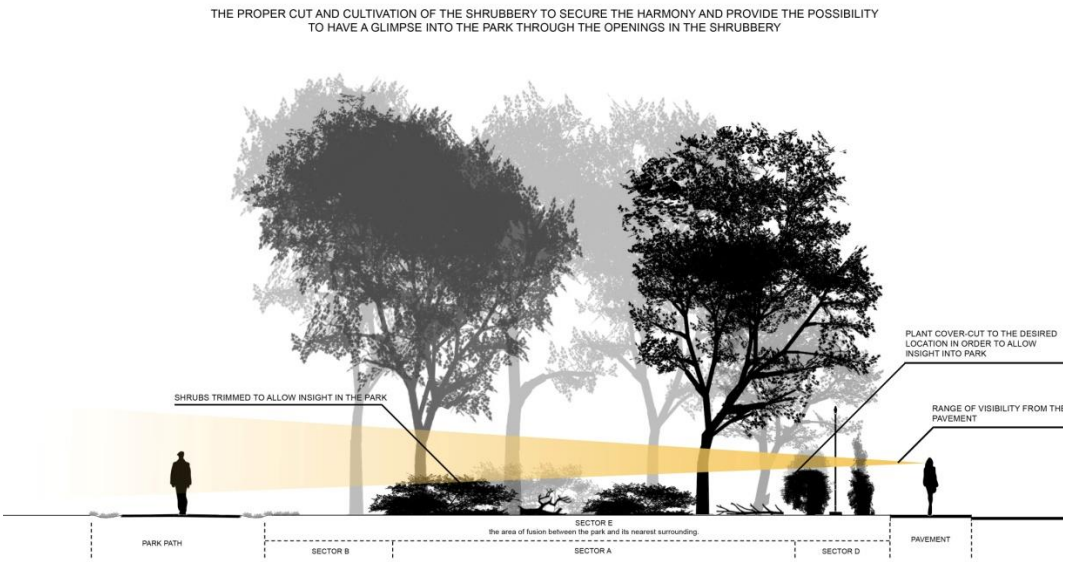

Fig. 10. The proper cut and cultivation of the shrubbery to secure the harmony and provide the possibility to have a glimpse into the park through the openings in the shrubbery.

10 pav. *Tinkamas krūmų iškarpymas ir auginimas užtikrinant harmoniją ir suteikiant galimybę pažvelgti į parką pro atsivėrusius tarpus.*

Educational and Promotional Guidelines

Board of Experts

It is of top priority to constitute a system of conditional and the activity of the observes with the service personnel responsible for the maintenance of the park. The project would become a success only when the activity of all the employed personnel is well coordinated with the work of zoologists, especially entomologists, ornithologists, botanists, phytosociologists, mycologists, architects of the landscape, ecologist, guides and pedagogists specializing in nature conservation and finally journalists, and all those people engaged in social media and marketing.

The newest means of technology could also support the project by creating a virtual educational and informative platform.

Virtual, Educational-Informative Platform

The concept of the project called the Nature Zone was meant to create a harmonious blend with the surrounding areas, however the careful and precise composition of the Park Krasińskich cannot provide for extra observation area for educational purposes since that would derange the entire arrangement plan of the park.

Nevertheless, it is necessary to introduce an educational-informative programme that would meet the expectations of contemporary society. The promotion of Park Krasińskcch with the help of special internet platform is a necessity of modern times. It should contain database and applications for tablets and smartphones to link them with the already existing internet site for the Park Krasińskich. This database would contain all plants growing in the area inhabiting animals, fungi and lichens and other observed phenomena. The access to this application should be easy and widely advertised, so that not only available for the specialists but also for average user. This modern facility would make it easier to monitor and analyze the changing surrounding in the time span of months, years and seasons.

Opening such a possibility for people to participate of life of the park and supplement a database would not only attract wider circles of visitors to the park but could also become affluent source of information for conservation personnel coordinating and supervising the programme, the Nature Zone.

In some cases information coming from the amateur source could become valuable even for the scientists. Naturally, all incoming information needs to be carefully verified. Sometimes a magnetizing information that attracts visitors and fans to the park, would be for example the news about a news species of a bird that appeared in the park or about a blooming plant. So the need for creating a new application for the park is necessary and well grounded, especially that there is the growing consciousness of environmental protection and conservation within the society.

The user would be able to send images and comments not only to the fellow admirers but also to the database. The next step forward on the way to make the idea of the Park Krasińskich popular, is the issue of free wireless internet (WiFi), that would cover the entire area of the park or at least some places in the close vicinity to the Nature Zone. These could be information tables deployed in various places in the park. Such a facility would enhance the activity, making a discussion more vivid, sharing the images more easy and additionally

proliferate the knowledge and information about the park. Such internet application should help to understand what is the purpose of the Nature Zone, what philosophy is involved with this project and provide with characteristics of the plants and most popular animals on this area including small mammals, birds or insects.

This application being focused mainly for the Nature Zone could be considerably enlarged and cover the entire area of the Park Krasińskich. The administration should put proper care to advertise information about opening hours the history of The Palace and the park. There must be precise information about the location of the park on the city map with means of transport and with the gallery of contemporary and historical images of the place.

The visitors could be also provided with an audio-guide that would be much of aid to appreciate the natural and historical value of the park. Audio-guide would operate within the scanning QR photocopy system, accessible on the tables in the park. Similar system has been already installed in The Royal Residence in Wilanów. The access to information could be possible by clicking a chosen place on a map-the convenience that has already been opened in Chopin Museum in Żelazowa Wola. The stream of information could go also via GPS system for the visitors where the information could be sent directly down to the individual mobile phone.

The array of possibilities in still growing internet devices bring the opportunity to use push note devices also sent directly to the mobile phone with the already installed application, and inform a visitor about the current and future events in the Park Krasińskich. Such applications would be of much help to learn about the events organized by people, for example meetings or presentations.

This applications are suppose to be available for computers, tablets and smartphones operating within the different systems like Android and iOS and Windows Phone and both on and offline, also coordinated with Global Positioning System. In the case of this function is switched off, the application should provide the possibility to log in to the system to enjoy the publication of the images transferred to the database or attached to social media accounts via Facebook or Twitter.

Summary

- Self-education in nature becomes more and more popular among the users of recreational grounds located in urban areas.
- Territories, understood most general as the areas with educational value, could be designed in a form of gardens within the already arranged landscape, or as the separate objects for recreational purposes.
- The territories of recreational and educational values located within the already existing and arranged landscapes are designed to attain basically one goal that could be fulfilled, for example as it is in a biocenic garden.
- The separate or isolated recreational objects of educational value are the areas where the purposes to achieve are more complex in their nature.

References

1. Bell, S. Elements of Visual Design In the landscape, E&FN SPON, London 1993.
2. Bogdanowski, J. Kompozycja i planowanie w architekturze krajobrazu (Composition and Planning in Landscape Architecture). Kraków: Ossolineum, 1976.
3. Forman, R.T.T., Godron, M. Landscape ecology. Wiley and Sons Ed., New York, 1986.
4. Jakubowski, K. Edukacja w miastach [w]Zieleń miejska 10(102):.34-36, 2015.
5. Luniak, M. Wstępna propozycja urządzania i programowania strefy przyrody w ogrodzie Krasińskich, 2013-05-31.
6. Ozimkowska L. „Analiza granic Zespołu przyrodniczo-krajobrazowego ‚Arkadia' pod kątem ich funkcji reprezentacyjnej" ('An Analysis of Boundaries at the *Arkadia* Landscape-Nature Protected Complex in Respect of their Representative Function'). [In:] Problemy współczesnej architektury i budownictwa (Problems of the Contemporary Architecture and Construction), Proceedings from the 3rd ARCHBUD Scientific Conference, Zakopane, 2010, pp. 209-216.
7. Ozimkowska, L. „Wpływ zmiany formy granicy na zmianę charakteru obiektu architektury krajobrazu" ('The Influence of the Boundary Form Change on the Character Change of a Landscape Architectural Object'). [In:] Problemy współczesnej architektury i budownictwa (Problems of the Contemporary Architecture and Construction), Proceedings from the 3rd ARCHBUD Scientific Conference, Zakopane, 2010, pp. 217-223.
8. Ozimkowska, L. et Wojtatowicz, J. „Problemy ochrony wartości przyrodniczych, kulturowych oraz walorów estetyczno - widokowych projektowanego obiektu architektury krajobrazu na etapie formułowania umowy" ('Problems Concerning the Protection of Natural and Cultural Values as well as Aesthetic and Viewing Advantages of the Landscape Architectural Object under Design at the Stage of Formulating the Contract'). [In:] Problemy współczesnej architektury i budownictwa (Problems of the Contemporary Architecture and Construction), Proceedings from the ARCHBUD Scientific Conference, Zakopane. Warszawa: BEL Studio, 2008, pp. 103-114.
9. Patoczka, P. „Ściany" i „Bramy" w krajobrazie ('Walls' and 'Gates' in the Landscape). Kraków: Politechnika Krakowska, 2000.
10. Szokalski, M., Wojtatowicz, J. Ptaki w ogrodzie. PWRiL, Warszawa, 1989.
11. Wojtatowicz, J. Pielęgnacja układu kompozycyjnego i gospodarka w przestrzeni parku. [W:] Przyroda i miasto, t. 2. Wydawnictwo SGGW, Warszawa, 1999.
12. Wojtatowicz, J. Teoretyczne podstawy kształtowania układu biocenotycznego parku. Warszawa, 30.05.2006, mscr.
13. Wojtatowicz, J. Ocena drzew szczególnych w krajobrazie. [W:] Horyzonty architektury krajobrazu. Metoda architektury krajobrazu. Wydawnictwo „Wieś Jutra", Warszawa, 2010.
14. Wojtatowicz, J. Theorical Basis for the Biocenotical Park System. [w:] Старовинні паркі і ботанічні бади-науқові центри збереження біорізноманіття та охорона історико-культурної спадщини. 40-46. Національна академія наук України. Національний дендрологічний парк„Софіївка" - НДІ НАН України. Матеріали

міжнародної науқової конференції присвивяченої 210- річчю Національного дендрологічнодо парку „Софіївка”- НДІ НАН України. 52-28.09.2006.

15. Wojtatowicz, J. Predominating tree species at selected parks in the Wielkopolska macroregion. Ann. Warsaw Agricult. Univ. - SGGW, Hoticulture, (Lanscape Architecture). 23. Warsaw Agricult. Univ. Press, 2002.

Lidia Ozimkowska, Jerzy Wojtatowicz, Tomasz Wojtatowicz

Pasirinktos laisvalaikio veiklos įtaka formuojant naujas miesto erdves

Santrauka

Kraštovaizdžio architektūros objektai yra formuojami tiek gamtos galių dėka, tiek ir žmogaus veiklos dėka. Atsižvelgiant į objektų prigimtį ir jų aplinką, šių dviejų elementų pasireiškimas gali skirtis. Kai kurie objektai turi didžiulius gamtinius išteklius, ir jų plėtojimas gali reikalauti saugoti ir turtinti gamtos vertybes pasitelkiant plačiąja prasme natūralios kaitos procesus. Kiti žmogaus veiklos sukurti objektai didina antropogeninius išteklius.

Šiomis dienomis esant greitesniam gyvenimo tempui, žmonės turi žymiai mažiau laiko įvairių formų poilsio veiklai, ypač vykdomai po atviru dangumi. Miestų tankumas palaipsniui didėja ir juntamas poreikis atviroms erdvėms mieste. Miestų aikštės ir žalieji plotai yra išlaikę tik komunikacinę funkciją. Mažėjantis medžių skaičius miesto aikštėse yra liūdnas faktas. Jie yra pakeičiami objektais, vadinamais "mažoji" architektūra, miesto baldai, erdvinės formos, tvenkiniai ir pan. Želdynai dabar atlieka vien tik dekoratyvinę funkciją aplinkinei architektūrai. Tokiu būdu iš jų buvo atimta teisė egzistuoti, kaip atskiriems objektams, kurie turi tarnauti tam tikram tikslui.

Žmonės linkę praleisti vis daugiau laiko patalpose: namuose, biure, mokykloje ar prekybos centre. Laisvalaikis taip pat praleidžiamas uždarose erdvėse, tokiose, kaip miesto baseinai, teniso kortai, sporto salės, koncertų salės, klubai ar galerijos. Nepaisant šios turtingos pasiūlos vidaus veiklai, yra keletas poilsio formų, kurios gali būti atliekamos tik suprojektuotose atvirose erdvėse.

Autorė pasiūlė įrengti naujas vietas, tokias, kaip saleles parkų teritorijose ar kaip atskirus objektus, atliekančius poilsinę funkciją, o neretai ir turinčius edukacinį tikslą. Tokio pobūdžio erdvės gali būti įrengtos tiek tankiai apgyvendintuose miestuose, tiek ir atvirame kraštovaizdyje.

Raktažodžiai: miesto erdvė, laisvalaikis, kraštovaizddžio architektūra, želdynai.

CORRELATIONS BETWEEN BIRDS, PLANTS AND PEOPLE IN URBAN LANDSCAPING

Lidia Ozimkowska, Jerzy Wojtatowicz
University of Ecology and Management, Poland

This paper focuses on connections and dependencies between birds and vegetation on the one hand and birds and people on the other. Both positive and negative interactions between these groups have been analysed and illustrated with examples accompanied with references to relevant bird and plant species. The authors also provide a number of suggestions for planting vegetation which is particularly beneficial for birds living in cities. It is strongly proposed that the process of designing public space should evolve to take into account the needs of local resident birds as a distinct animal group.

Keywords: landscaping, urban avifauna, vegetation.

Introduction

While it is commonly recognized that a modern architect should be equipped with interdisciplinary knowledge in (among others) construction, law, and social sciences, not to mention a grasp of aesthetics, not many people pay attention to the fact that architects, urban planners and landscape architects alike should also bear in mind the issues related to the animal world. Unfortunately, the complex and problematic aspects of wildlife living in landscaped sites remain obscure to most people involved in their design, development and maintenance. Even if noticed, these problems are often inadequately addressed with little more than putting up nest boxes, feeding birds and taking steps to contain rooks or city pigeons. The curricula of high schools and colleges for technical and management staff of green areas lack any subjects or courses that would cover the question of fauna in a comprehensive and up-to-date manner. As a result, case studies and project studies for the landscaping of open urban spaces contain virtually no documents concerning fauna. When present (in isolated cases), avifauna inventories are included only in appendices and not used for preparing conceptual and technical designs or preservation plans. The sites that are designed in this way force wildlife to occupy random recesses out of the designers' control, which sometimes may result in deadly traps for animals or a direct threat to human residents (Wojtatowicz 2006). It is therefore important to remember that, while designing and maintaining green areas, one can exert a conscious influence on the population composition of birds and other animals in terms of species and numbers (see e.g. Sokołowski 1923, 1932, Szokalski et al. 1987, Luniak 1988).

The objective of this paper is to answer the question of how we can adapt urbanized space in order to facilitate closer contact between people and animals. The discussion is based on connections and dependencies between people and birds as well as their living environment.

This relationship can be discussed in the context of the component interactions it encompasses, including the ones between:

- plants and birds;
- birds and people;
- plants and people.

What is more, the above interdependence patterns work both ways: the mutual impact may be either positive or negative (Fig. 1).

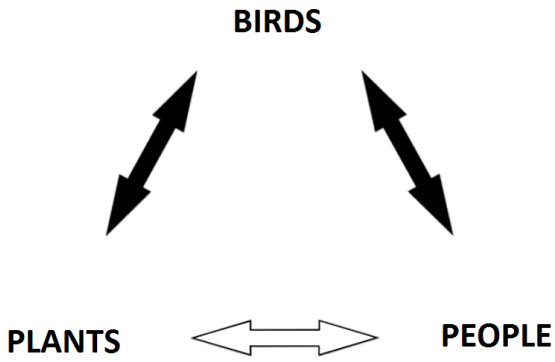

Fig. 1. Correlations between birds, plants and human residents.
1 pav. Koreliacija tarp paukščių, augalų ir žmonių.

The authors of this paper have studied the correlations between birds and vegetation as well as birds and city dwellers.[9] Their findings may contribute to increasing the potential for protection and observation of birds. The bottom line is to ensure that the animal world is not in any way threatened by random, ill-judged planting and inadequate cultivation of flora.

In this paper, the Latin names of ligneous plants are cited after Seneta et al. (2012), and the Latin names of birds – after Tomiałojć et al. (2003). For the sake of clarity, Latin terms are used only where particular names are mentioned for the first time and in all the footnotes.

1. Connections and dependencies between birds and plants

1.1. Positive impact of plants on bird life

Vegetation provides birds with day- and night-time roosting places. It is also their source of animal food as well as fruit, seeds, sap, and even water.[10] Vegetation is where birds can hatch (treetops, trunks, fallen logs), clean themselves, observe the surroundings from hides, produce songs and other vocalizations from singing platforms, duet and fight at lekking arenas; this is also where they collect materials for building nests. However, for most bird residents – or even bird visitors – of a park or a housing estate, plants serve first and foremost as shelter against people and predators.[11] Since birds take shelter in vegetation as a threat arises, in a random way, it is not possible to accommodate this particular consideration when designing greenery in human settlements. By contrast, a landscape architect is able to purposefully introduce the plants in which birds can perch for hours. House sparrows

[9] This paper draws on the lecture entitled *The Correlations Between Ornithology and Dendrology: A Landscape Architect's Perspective*, delivered by Jerzy Wojtatowicz, PhD (Eng) on 18 March 2015 at the Polish Dendrology Society in Warsaw (Poland).
[10] See e.g. Bartkowiak 1970, Cramp (ed.) 1994, Desselberger et al. 1999, Glutz von Blotzheim 1988, Taczanowski 1882.
[11] Birds may use plants to hide themselves at the moment of danger, e.g. when a sparrowhawk (*Accipiter nisus* L.,1758) suddenly appears by their feeder.

(*Passer domesticus* L.,1758) tend to choose lush shrubs, trees and creepers with dense branches, growing in sunny, wind-shielded areas, such as the sweet mock-orange (*Philadelphus coronarius*), the columnar European hornbeam (*Carpinus betulus 'Columnaris'*), the Virginia creeper (*Parthenocissus* spp.), and the Oriental bittersweet (*Celastrus orbiculatus*). Many small birds prefer briar patches and plants with long thorns, e.g. the Duke of Argyll's tea-tree (*Lycium* **halimifolium*),*** the barberry (*Berberis* spp.), the cherry plum (*Prunus cerasifera*), and the hawthorn (*Crataegus* spp.). We can also plant species that are of little use to nature, but, when skilfully clipped, may become dense enough to house a whole population of a particular bird species. Tying branches into desired positions or constraining the tops of trees and bushes may lead to the degree of densification that ensures good hiding places for birds. Refuge can also be found in hollows, nooks and crannies of old trees, which is why it is recommended not to remove them unless they pose a threat to public safety. The above-described types of vegetation are selected by birds to sleep and rest as well. Some individuals may even continue to perch for the night in precisely the same spot of a chosen branch for a longer period of time.[12]

Birds can feed on seeds, fruit, nectar, sap, buds and other green parts of plants. The best place for observing them is by the feeders filled with nuts, sunflower seeds and crop plants grown in the fields. Large numbers of birds usually occur wherever there are many fructifying trees of one species, for instance house sparrows are attracted to the common knotgrass (*Polygonum aviculare* L.) while European goldfinches (*Carduelis chloris* L.,1758) prefer the burdock (*Arctium* L.). It is also not uncommon to see different species feeding on fruit of one and the same plant.[13] Moreover, a number of bird species are highly specialized in feeding on one type or species of plants, and in many cases a connection between the shape of the beak and the type of food can be observed on closer inspection.[14] Some birds, such as the great spotted woodpecker (*Dendrocopos major* L.,1758), are capable of tapping through the bark in the springtime to lick the sap. Many small birds find food on the surface of leaves, plant shoots and boughs, as well as cracks in tree bark.

Vegetation in general, and trees in particular, provide birds with lookouts for the observation of the surroundings and hideouts for making timely attacks on insects,[15] other birds[16] or small mammals.[17] Avifauna may also inspect the area from tree crowns to choose the best moment

[12] Such roosting places of, e.g., the Eurasian collared dove (*Streptopelia decaocto*), may be sometimes found in the branches of the blue spruce (*Picea pungens* Engelm.). In winter, a whole flock of tits or chickadees (**Paridae**) can all rest at night in just one tree hollow.

[13] For instance, rowan trees (*Sorbus aucuparia* L.) can nourish fieldfares (*Turdus pilaris* L.,1758), common blackbirds (*Turdus merula* L.,1758), hawfinches (*Coccothraustes coccothraustes* L.,1758), bullfinches (*Pyrrhula pyrrhula* L.,1758) and Bohemian waxwings (*Bombycilla garrulus* L.,1758).

[14] Examples include the hawfinch (*Coccothraustes coccothraustes* L.,1758), which cracks kernels of stone fruit (*Prunus*) with its beak; the European goldfinch (*Carduelis chloris* L.,1758), using its slender bill to extract seeds from the puff of the common dandelion (*Taraxacum officinale, Weber, T. Densleonis, Desf; Leontodon taraxacum, Linn.*), plumeless thistles (*Carduus* L.) and plume thistles (*Cirsium* Mill).

[15] As done by the spotted flycatcher (*Muscicapa striata* Pall.,1764), among others.

[16] As done by the Eurasian sparrowhawk (*Accipiter nisus* L.,1758) and the tawny owl (*Strix aluco* L.,1758), among others.

[17] As done by the northern goshawk (*Accipiter gentilis* L.,1758), among others.

and fly down in flock to feed on fruit.[18] Tree crevices and hollows or cup-like formation of leaves in plants such as the wild teasel (*Dipsacus silvester* Hudson) is where water can be found; also dew is often used by birds to drink and bathe. Some species, for example common blackbirds (*Turdus merula* L.,1758) and song thrushes (*Turdus philomelos* [C. L. Brehm, 1831]), tend to perch on the top branches and mark their territories with song to attract females and scare off enemies. Other birds, for example warblers (*Sylviidae*), choose the middle parts of shrub crowns. Woodpeckers (*Picidae*) usually select dry branches and tops of tree trunks to drum on. Duetting and fighting take place on thicker branches and boughs; these lekking arenas are usually surrounded by smaller roosts so that the female can perch and watch the duel. For laying and hatching eggs, different species choose different places (Gotzman et al. 1972). Some birds build nests among the crown branches of trees or bushes, others select sites closer to the trunk, still others nest in tree hollows. Bird nests can also be found in herbaceous plants, or even on the ground, among stalks, leaves and grass blades, if tree shoots reach down to the ground level or bush branches spread low. Most birds make and line nests with plant materials, such as branches, roots, mosses, leaves, grass blades and pieces of bark.[19]

1.2. Negative impact of plants on bird life

The negative influence of plants on birds should be analysed in its many aspects, especially if we focus on one particular bird species. Many plants of foreign origin are not a favourable environment for local birds. Some tree and shrub species take up a lot of space but are of little use to birds: they do not produce bird food since they do not set seeds (for example, double-flowered plants), they do not provide adequate shelter, and their thin sparse crowns, frail slender shoots and branches cannot support nests (as in most *Spiraea* plants). Most bird species which are permanent residents of towns and cities naturally inhabit the areas on the edge of the forest and the field or meadow. For those that populate the heart of the forest, in turn, grasslands and barren lands are an insurmountable obstacle, therefore they will never settle in housing estate environments. Grounds with scanty trees or even larger shrubs drive away birds that are used to open spaces (such as grasslands and fields) and cannot survive in the city due to problems with finding food, hiding from predators and selecting suitable breeding grounds.

1.3. Positive impact of birds on plants

Birds have a positive effect on urban vegetation: they control pests, distribute seeds, fertilize the soil with their droppings, and sometimes pollinate plants. Avifauna renders a considerable service to humans by eating an immense number of harmful insects in all stages of their life cycle, including their eggs, caterpillars and other larvae, pupae, and adult insects such as small beetles (Nowak 1961, Sokołowski 1932, Zając 1978). Birds who feed on fruit, seeds and green parts of unwanted plants contribute to the area's protection both directly and indirectly. Seeking food here and there, they considerably reduce the number of fruit and seeds

[18] As done by the Bohemian waxwing (*Bombycilla garrulus* L.,1758), the song thrush (*Turdus philomelos* C. L. Brehm, 1831) and the fieldfare (*Turdus pilaris* L.,1758), among others.
[19] See e.g. Gotzman et al. 1972, Brown et al. 2006, Cramp (ed.) 1994, Desselberger et al. 1999, Glutz von Blotzheim 1988, Taczanowski 1882.

of many weeds which could invade the cultivated green areas. In some cases, the dispersal of seeds by animals may be beneficial since it increases the biodiversity of plant communities. Moreover, the role of birds in plant nutrition is often undeservedly underestimated. It should be remembered that even small birds pass a large amount of food through their digestive system, which provides plants with many vital nutrients and facilitates germination.

1.4. Negative impact of birds on plants

Sometimes, birds may affect vegetation in a negative way when they eat fruit, seeds and buds. They also pluck shoots and smaller branches to build nests. Trying to get to sap, they damage the bark layer, which impairs plant health and allows pathogens to penetrate deeper. Moreover, making holes in the bark and boring hollows accelerates wood decay.

2. Connections and dependencies between birds and people

2.1. Positive impact of people on birds

People's beneficial effect on birds' life can be seen, first and foremost, in providing food, roosting places for the night, and nest boxes (Szokalski et al. 1987). Bird feeding can be done deliberately by scattering edibles on the ground, window sills, and in feeders. Avifauna can also live on seeds and fruit of urban plants, not to mention leftovers we dispose of into rubbish bins and skips. Furthermore, city dwellers more and more often take steps to protect birds by putting up nest boxes, feeders and waterers, or even adapting ponds to serve as bird baths.

2.2. Negative impact of people on birds

High density of human population in urban areas often means that they are not inhabited by certain avifauna species, even in spite of potentially favourable conditions. Deterred by people and city noise, many birds never occur in the urban environment. We can often observe people and their pets scare birds away, either intentionally or unintentionally. Some species have got used to the presence of humans and frequently ingest food incompatible with their natural diet, which may result in disease or even death. Feeding the same type of food to birds (for example, pork fat to chickadees) in the long run can lead to beak deformations. Another major threat is posed by improper maintenance of green areas. Gardening works are not scheduled with due consideration for life processes of birds, and it is often the case that whole clutches are destroyed as a result of watering or cutting plants.

2.3. Positive impact of birds on town and city dwellers

Watching bird behaviours in urban areas, especially at different times of the year or even in the course of many years, enriches our knowledge of not only the winged fauna but also the world of nature in general. Birds evoke a wealth of aesthetic experiences, both visual

and aural, with their different sizes,[20] shapes,[21] colours,[22] sounds[23] and their movement.[24] They have been depicted in many photographs, poetical works, paintings and sculptures; their vocalizations have inspired many famous composers. Whenever they move, the static monotony of the cityscape is broken. Furthermore, birds feed on mice, ticks, mosquitoes and other species that are a nuisance to human residents.

2.4. Negative impact of birds on town and city dwellers

Notwithstanding the above-mentioned advantages of the animal-human cohabitation, many people do not appreciate to have birds around, focusing mostly on the resulting noise, mess, possible contagion, fruit and seed depletion. Certainly, it is possible to list some more features that town and city dwellers may not like about birds; for example, people interested in insects usually observe that areas that are home to many different bird species are low in insects. Birds can substantially reduce the number of mammals and other animals as well.

3. Suggestions for planting bird-friendly vegetation in urban environment

Many factors need to be taken into consideration as early as plant selection, which is an initial stage of the process of landscaping. The choice should be determined first and foremost in accordance with the area's natural, functional and aesthetic resources. At present, landscaping designs practically do not accommodate the needs of animals, including birds. Both field research and scientific data show that the greater the diversity of plants in terms of their number and density, the height of trees and shrubs, the presence of the underbrush and the expanse of lawns as well as the variety of species, the greater the wealth of the local avifauna (Luniak 1988, Sokołowski 1923, Szokalski et al. 1989). That is the reason why we propose that the following bird-friendly vegetation should be selected in landscaping designs:

- tree lines and hedges (especially clipped ones);
- herbaceous perennials with parts that are edible for birds;[25]

[20] They can range from ten to twenty centimetres (e.g. the long lesser whitethroat, *Sylvia curruca* L.,1758), to several dozen centimetres (e.g. the common wood pigeon, *Columba palumbus* L.,1758).
[21] From small stocky birds, such as the house sparrow (*Passer domesticus* L.,1758), the European greenfinch (*Carduelis chloris* L.,1758) and the hawfinch (*Coccothraustes coccothraustes* L.,1758) to slender ones, e.g. the common swift (*Apus apus* L.,1758), the barn swallow (*Hirundo rustica* L.,1758) and the white wagtail (*Motacilla alba* L.,1758), among others.
[22] From the one-colour male of the common blackbird (*Turdus merula* L.,1758) to the many-hued great tit (*Parus major* L.,1758), the Eurasian blue tit (*Parus caeruleus* L.,1758), and the common redstart (*Phoenicurus phoenicurus* L.,1758), among others.
[23] E.g. the common blackbird (*Turdus merula* L.,1758) and the Eurasian blackcap (*Sylvia atricapilla* L.,1758).
[24] E.g. the rook (*Corvus frugilegus* L.,1758) and the common blackbird (*Turdus merula* L.,1758).
[25] *Examples include the sneezeweed (*Helenium*), the garden pansy (*Viola *L.), the carnation (*Dianthus *L.), the self-heal (*Prunella*), the buttercup (*Ranunculus *L.), the starwort (*Stellaria *L.), the goldenrod (*Solidago*), the knotgrass (*Polygonum*), the primrose (*Primula *L.), the speedwell (*Veronica*), the coneflower (**Rudbeckia**), the Star-of-Bethlehem (*Ornithogalum*), the dock (*Rumex*), and the sea pink (*Armeria*).*

- annual plants with parts that are edible for birds;[26]
- grasses with parts that are edible for birds;[27]
- plants that provide adequate roosting and nesting places.[28]

a

Conclusions

There is no doubt that analysing the connections and dependencies between plants, animals and people within one coherent system of organisms living together in urban environment is definitely a much more complex process than, for example, designing irrigation and lighting. It is also evident that our constant search for enhancing the comforts of modern life will result in introducing more and more new technologies and technical systems. The solution we would like to put forward is that deliberate methodical consideration is given and applied to living creatures on a par with other systems included in any comprehensive landscaping project for a given housing area or urban agglomeration. We believe that a modern approach to landscaping should involve not only the necessary cooperation of city architects and planners on the one hand with landscape architects and urban ecologists on the other, but also the expertise of specialists concerned with a particular animal species or group of species.

Bibliography

1. Bartkowiak S. Ornitochoria rodzimych i obcych gatunków drzew i krzewów. Arboretum Kórnickie 15, 1970. Pp. 237-261.

2. Brown R., Ferguson J., Lawrence M., Lees D. Tropy i ślady ptaków. Muza SA, Warszawa, 2006.

3. Cramp S. (ed.). Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Crows to Finches. Oxford University Press, Oxford, 1994.

4. Desselberger J., Kruszewicz A. (trans.). Wielka Encyklopedia Przyrody. Ptaki. (Die große farbige Enzyklopädie Urania Tierreich – Vögel). Muza SA, Warszawa, 1999.

[26] Examples include the aster (*Aster*), the knapweed (*Centaurea*), the devil-in-a-bush (*Nigella*), the common zinnia (*Zinnia elegans* Jacq.), the sweet pea (*Lathyrus* L.), the goatsbeard (*Tragopogon* L.), the flax (*Linum* L.), the stock (*Matthiola* R. Br.), the milk thistle (*Silybum*), the common sunflower (*Helianthus annuus* L.), the common daisy (*Bellis perennis* L.), and the amaranth (*Amaranthus*).

[27] Examples include the common oat (*Avena sativa* L.), the common millet (*Panicum miliaceum* L.), the fescue (*Festuca* L.), the fountaingrass (*Pennisetum*), the meadow-grass (*Poa* L.), the foxtail (*Setaria* P. Beauv.), and the English ryegrass (*Lolium perenne* L.).

[28] Examples include the gooseberry (*Ribes uva-crispa* L.), the black chokeberry (*Photinia melanocarpa*), the barberry (*Berberis* L.), the common ivy (**Hedera helix** L.), the box (*Buxus* L.), the yew (*Taxus* L.), the hawthorn (*Crataegus* L.), the apple tree (*Malus* Mill.), the mountain ash (*Sorbus* L.), the mock-orange (*Philadelphus* L.), the viburnum (*Viburnum* L.), the globe Norway maple (*Acer platanoides 'Globosum'*), the hazel (*Corylus*), the wild privet (*Ligustrum vulgare* L.)**,** the scarlet firethorn (*Pyracantha coccinea* M.Roem.), the currant (*Ribes* L.), the clematis (*Clematis* L.), the globe black locust (*Robinia pseudoacacia 'Umbraculifera'*), the rose (*Rosa*), the common snowberry (*Symphoricarpos albus* L.) with the S. F. Blake species (*S. racemosus* Michx.), the spruce (*Picea*), the honeysuckle (*Lonicera* L.), the Virginia creeper (*Parthenocissus*), the grapevine (*Vitis*), the deutzia (*Deutzia*), and the arborvitae (*Thuja*).

5. Glutz von Blotzheim Urs N. Handbuch der Vogel Mitteleuropas. Aula Verlag, Wiesbaden, 1988.

6. Gotzman J., Jabłoński B. Gniazda naszych ptaków. PZWSz, Warszawa, 1972.

7. Luniak M. Informacje i sugestie ornitologa dla konserwatorów drzew parkowych [in:] Komunikaty dendrologiczne 8, ZOiKZP-O, Warszawa, 1988. Pp. 1-12.

8. Luniak M. Zasiedlanie przez ptaki nowych osiedli mieszkaniowych w Warszawie [in:] Problemy ochrony i kształtowania środowiska przyrodniczego na obszarach zurbanizowanych 2. SGGW-AR, Warszawa, 1990. Pp. 156-169.

9. Nowak E. Ptaki sprzymierzeńcami rolnika. LSW, Warszawa, 1961.

10. Seneta W., Dolatowski J. Dendrologia. PWN, Warszawa, 2012.

11. Sokołowski J. Ochrona ptaków. PROP, Kraków, 1923.

12. Sokołowski J. Ochrona ptaków [in:] Skarby Przyrody (ed. by Wł. Szafer). PROP, Warszawa, 1932. Pp. 162-184.

13. Szokalski M., Wojtatowicz J. Ptaki w ogrodzie. PWRiL, Warszawa, 1989.

14. Taczanowski W. Ptaki krajowe, Vol. 1, 2. Wyd. Akad. Umiejętności w Krakowie, Kraków, 1882.

15. Tomiałojć L., Stawarczyk T. Awifauna Polski. Rozmieszczenie, liczebność i zmiany. Vol. I, II. PTPP „pro Natura", Wrocław, 2003.

16. Wojtatowicz J. Theoretical Basis for the Biocenotical Park System [in:] Старовинні паркі і ботанічні бади-науқові центри збереження біорізноманіття та охорона історико-культурної спадщини. 40-46. Національна академія наук України. Національний дендрологічний парк„Софіївка"- НДІ НАН України. Матеріали міжнародної науқової конференції присвивяченої 210- річчю Національного дендрологічнодо парку „Софіївка"- НДІ НАН України. 52-28.09.2006. 2006.

17. Zając R. Rola owadożernych ptaków [in:] Biologiczne metody walki ze szkodnikami roślin (ed. by J. Boczek, J.J. Lipa). PWN, Warszawa, 1978.

About the Authors

Jerzy Wojtatowicz, PhD (Eng) graduated from the Department of Landscape Architecture at the Faculty of Horticulture at the Warsaw University of Life Sciences (SGGW), where he also worked for many years as a member of academic staff. Between 2000 and 2014, he acted as the Dean of the Faculty of Architecture at the University of Ecology and Management (WSEiZ) in Warsaw. Co-manager of a landscape design studio (Aster-Park S.C. L Ozimkowska J Wojtatowicz) since 1995. His main scientific interests are focused on the issues of tree species domination in Polish historic parks as well as nature and landscape conservation in protected areas and their surroundings. Co-author of a book devoted to birds, his other major interest (*Ptaki w ogrodzie,* 1987). Science editor of two book publications: *Warszawska Przyroda. Obszary i obiekty chronione* (2005) and *Przyroda Warszawy* (2010).

Lidia Ozimkowska, PhD (Eng), landscape architect and former staff member at the Botanical Garden of the Polish Academy of Sciences (PAN) in Powsin, presently a lecturer at the University of Ecology and Management (WSEiZ) in Warsaw. Co-manager of a landscape design studio (Aster-Park S.C. L Ozimkgvowska J Wojtatowicz) since 1995. Member of a number of professional associations, including the Polish Association of Architects

(SARP), the Polish Federation of Engineering Associations (NOT), the Polish Association of Landscape Architects (SPAK), the Polish Dendrology Society (PTD). Received the NOT-SITO expert title in design, development and maintenance of green spaces.

Jerzy Wojtatowicz, Lidia Ozimkowska

Koreliacija tarp paukščių, augalų ir žmonių formuojant miesto kraštovaizdį

Santrauka

Šiame straipsnyje aptariami ryšiai ir priklausomybės tarp paukščių ir augmenijos iš vienos pusės, ir paukščių bei žmonių - iš kitos. Tiek teigiama, tiek neigiama sąveika tarp šių grupių buvo išanalizuota ir iliustruota pavyzdžiais kartu pateikiant nuorodas į atitinkamas paukščių ir augalų rūšis. Autoriai taip pat pateikia pasiūlymus, kokią augaliją sodinti miestuose, kuri būtų ypač naudinga paukščiams. Siūloma projektuojant viešąją erdvę atsižvelgti į vietos paukščių, kaip ypatingos gyvūnų grupės, poreikius.

Raktažodžiai: *kraštovaizdžio formavimas, miesto paukščių rūšys, augalija.*

FOREST LANDSCAPE AND THE RECREATIONAL NEEDS OF PEOPLE WITH DISABILITIES - POLISH STATE FOREST CASE STUDY

Małgorzata Woźnicka, Dorota Kargul-Plewa
Warsaw University of Life Sciences, Faculty of Forestry,
Department of Forest Utilization, Poland

More than 12% of the Polish population are people with disabilities. In the life of people with disabilities a very important role in tourism and recreation. The advantage of the forest environment is the fact that most of them have healing properties and health promoting regeneration. However, it must be prepared tourist and recreation infrastructure. After 2000, in the Polish forests began formed facilities for people with disabilities - without architectural barriers. However, there is an important landscape. It is subject to perception usually multisensory. In recent years, popular are soundscapes, and for years, people are fascinated by scents of plants. It is these elements of the landscape should be exposed to persons with disabilities.

Keywords: disabled people, landscape, soundscape, forest.

Introduction

Due to their surface area and distribution, forests in Poland are seen as the country's major asset in terms of recreational spaces. They are seen both as tourist destinations in themselves and as a factor enhancing the attractiveness of other sites, e.g. mountain or lakeside areas. Forest areas offer one of the cheapest forms of leisure, and most Polish forests are open to the public, which creates increasing pressure of recreational use. Proper recreational infrastructure in forest areas helps protect the landscape and the environment, but must also consider the needs and expectations of the society.

In recent years, attention is increasingly paid in Poland to making the environment, including forest infrastructure, more accessible to people with disabilities. The needs of this social group must be considered in all land development projects pursuant to the Polish Act on Area Planning and Development of March 27, 2003 (Journal of Laws: Dz.U. 2003, no. 80, item 717), and the Charter of Rights for People with Disabilities adopted by the lower chamber of the Polish parliament on August 1, 1997. In projects aiming at making forests more accessible to people with disabilities, the main focus is placed on providing leisure and recreational infrastructure and avoiding or eliminating architectural barriers. It seems, however, that the specific needs of this group related to the landscape are being overlooked. Therefore, the purpose of the present paper is to provide examples of recreational infrastructure adapted to the needs of people with disabilities, and to emphasize the aspect of perception of the surroundings by the disabled, specifically including visually impaired people.

Accessibility of forest infrastructure for people with disabilities

As stated in the 2011 "World report on disability", there are more than 1 billion people with disabilities globally, including 110–190 million with severe difficulties in functioning in the modern world. Sadly, the numbers are growing, as WHO estimates put the percentage of disabled people at 10% in the 1970s, and 15% now. In the 2011 Polish National Census, the number of people with disabilities in Poland was 4,697.5 thousand, accounting for 12.2% of total population (Population and households 2011). Many authors analyzing social preferences emphasize that these preferences include factors such as sex, age, residence, and in the case of people with disabilities – the type and severity of the disability.

The disabled group is predominantly female, as the number of women with disabilities was 2,530.4 thousand (13.5% of all women), while the number of men with disabilities was 2,167.1 thousand (12.3% of all men). Most people with disabilities live in urban areas – 3018.0 thousand versus 1,679.0 thousand in rural areas. Nearly one in two people with disabilities (1.8) reports moderate limitations in functioning, one in four (4.3) – severe limitations, one in eight (8.3) – total disability, and one in ten report no limitations. Another important characteristic is age. In Poland, the highest age group (60 and above) comprises 53% of people with disabilities, with significantly more disabled women (59%) than men (47%). One in three people with disabilities are aged between 40 and 49, one in 11 – between 20 and 39, one in 28 – between 0 and 14, and one in 59 – between 15 and 19.

Most (64.8%) have a single disability, while 28% have two or more (two – 18.7%, and three – 9.9%). Nearly 7% of respondents declined to answer. In the group of people with a single disability, the most common causes were musculoskeletal disorders or injuries (40%), cardiovascular or neurological disorders (14% each), eye disorders or injuries (6%), hearing disorders or damage (4 %); other causes were reported by 22% of respondents. Regardless of sex, most people with disabilities have lasting limitations in functioning, which is mainly due to their more advanced age. The largest group (48.7%) are individuals whose disability has lasted more than 10 years; in the second-largest group the time is between 5 and 10 years. As few as 5% have experienced the limitations for less than 1 year, and 22% – between 1 and 5 years. Approximately 3% of respondents declined to answer.

Tourism and recreation play an extremely important role in the life of people with disabilities. This includes recreational activities in natural surroundings such as forests. One significant advantage of forest areas is the fact that they typically have therapeutic and regenerative properties and are thus conducive to better health. In Poland, this aspect has been studied more extensively by Moszyńska B. (2000) and Krzymowska-Kostrowicka A. (1997). But the recovery of psychophysical capabilities through tourism, as emphasized by Łobożewicz and Bieńczyk (2011), requires a well-developed and accessible tourist and leisure infrastructure, which also entails the removal of psychological and architectural barriers to full participation of people with disabilities in tourism. Forests provide a number of opportunities for tourism and recreation. Studies on recreational preferences of forest visitors (Gołos, Janeczko 2002, Woźnicka 2006) indicate that the most common form of recreational activities they engage in, regardless of physical and geographical variables, are walks and hikes. The recreational use of forest areas by people with disabilities is mainly contingent upon the accessibility of tourist and leisure routes, including footpaths and educational trails. Such linear objects allow visitors to fully benefit from the forest environment, including points of natural or cultural interest.

Most investments associated with making forests accessible for recreational use by people with disabilities in Poland were carried out quite recently, after the year 2000. The most interesting examples of forest accessibility projects in Poland include the "Royal Springs" (Królewskie Źródła) educational trail, the "Polish and Lithuanian Royal Oaks" (Szlak Dębów Królewskich i Książąt Litewskich) educational trail, the Pułtusk Forest Division educational trails, the hiking trail in the Biała Woda nature reserve, the educational trail leading to the "Jedlinki" forest station, the trail in the Rudawy Landscape Park (Śnieżka Forest Division), and the Bucharzewo sensory garden.

The “Royal Springs” educational trail was created in 2003 in the Kozienice Forest Division (Radom Regional Forest Directorate). It has been named after the “Royal Spring” (Źródło królewskie) forest area, which is also a nature reserve. A long section of the trail runs along the banks of Zagożdżonka river, which is fed from a number of sources located in its many meanders. The modernized infrastructure is accessible to wheelchair users. A total of 700 meters of wheelchair ramps have been built in the river valley. Another trail adjusted to the needs of people with disabilities is the “Polish and Lithuanian Royal Oaks” educational trail, six kilometers north of Białowieża (Stara Białowieża forest area, Białowieża Forest Division). It is approximately 500 meters long, and features several dozen of magnificent oaks aged 150–500 years. Visitors have the opportunity to learn about the history of the Białowieża Forest, Poland, and Lithuania from the 12th until the 18th century. Each oak along the trail has been named after a Polish king or a Lithuanian prince, including Gediminas (Giedymin), Vytautas (Witold), Sigismund the Old (Zygmunt Stary), Stephen Bathory (Stefan Batory), Sigismund Augustus (Zygmunt August), Barbara Radziwiłłówna etc. The trail was created as early as 1978, but the redevelopment completed in 2008 made it accessible both for wheelchair users and for the visually impaired. Two other educational trails made at least partially accessible for people with disabilities can be found in the Pułtusk Forest Division. One was opened in the year 2008 (Głuch 2010). It is 5.5 km long, and features 30 stations. The first 800 meter section with 12 stations is accessible for persons with reduced mobility. In 2014, another nature trail was opened in the Pułtusk Forest Division. It comprises two sections: a shorter paved section (1.4 km long) accessible for visitors with disabilities and a longer unpaved section (4.3 km long). The shorter section features 7 stations, and the longer one – 15 stations, all with information boards. Mountain forests are also being made more accessible for the disabled. In 2007, an accessible trail was opened in the Biała Woda nature reserve in the Pieniny Mountains (Krościenko Forest Division). The 2.4 km long trail runs through the picturesque Biała Woda stream valley. Its surface has been leveled and hardened, and four overpasses between 9 and 12 m in length have been built that allow wheelchair users to cross the stream running through a limestone gorge. What makes the trail exceptional is that some of its sections closely resemble the higher parts of the Pieniny National Park that would be much more difficult to reach for people with reduced mobility (http://naukawpolsce.pap.pl/aktualnosci/news,64411,w-pieninach-otwarto-trase-turystycznadla- niepelnosprawnych.html). Several years earlier, in 2005, a new educational trail to the “Jedlinki” forest station and a new trail in the Rudawy Landscape Part were opened. Both trails were created as part of a joint project of the Kowary Town Hall and the Śnieżka Forest Division. The trail to Jedlinki is 3.4 km long and has a paved surface. Along the route, 19 educational boards are displayed, featuring information on the flora and fauna of the forest and on issues related to forest management. Benches and shelters have also been installed. The route leads to a clearing upon which stands the former Tannenbaude lodge, now known as the “Jedlinki” forest station. It is the crossing point of a number of tourist trails. The Rudawy Landscape Park trail is 1.9 km long and can be accessed by vehicles carrying disabled passengers upon approval from the Śnieżka Forest Division authorities. The trail runs from the Średnica pass to the so-called Stone Ledge – a space specially arranged as a picnic and meeting spot for visitors with disabilities (http://www.niepelnosprawni.pl/ledge/x/14679). Another accessible site can be found in Bucharzewo

(Sieraków Forest Division) in western Poland. It is called the "Forest Adventure" Accessible Educational Garden (Integracyjny Leśny Ogród Edukacyjny "Leśna Przygoda"). It is the first free-admission educational garden for visually impaired people in Poland, opened in 2009. The 1.98 ha site near the Forest Division office now features a network of pathways and "fields" with over 30 educational stations. The form and distribution of all exhibits have been planned with the needs of visually impaired visitors in mind. All aspects of the layout and the learning materials have been developed in a way that enables people with other disabilities to use all the facilities in an unrestricted manner. Thanks to the use of adaptive technology, all exhibits can be fully explored using touch (Ogonowska-Chrobrowska and Jakubowski 2010), as well as with other senses. Each station is equipped with an information board featuring printed text overlaid with transparent plastic Braille labels. The garden is divided into a number of themed sections, covering areas such as hunting, forestry and forestry education, fire prevention, forest conservation, or dendrology. The garden also features a "sensory path".

Recreational infrastructure development and accessibility projects for forest areas should ensure optimum conditions for recreation, while avoiding degradation of the forest environment.

Landscape and its perception

The European Landscape Convention (ELC) describes landscape as an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors, which is also a key element of individual and social well-being and quality of life, and its protection and planning involve every individual. The convention obliged its signatories to define landscape quality objectives and to develop national policies for landscape protection and planning. Landscape planning is understood as actions aiming at improving landscape quality by enhancing, preserving, restoring or creating landscapes. The convention also emphasized the role of human perception of the landscape, which is typically multi-sensory, with a dominant visual aspect, though under certain conditions the dominant role can be played by another sense (e.g. hearing – in the presence of excess noise, smell – in the presence of intense odors, etc.) (Bernat S. 2011). Importantly, the perception of space reveals processes taking place in the consciousness – a complex process of perceiving the reality, and specifically, the surroundings, that is, the space within the reach of human senses: sight, hearing, smell, taste, and touch.

As stated by Szczepańska M. and Wilkaniec A. (2015), full rest can be achieved in an attractive multi-sensory landscape, i.e. one perceived using other senses beside the sight. Sensory stimuli reaching the observer through a variety of channels are not isolated – they interact and blend in the subconscious, giving rise to individual and comprehensive perception (Piechota 2006). Krzymowska-Kostrowicka (1997) defines perception as a set of stimuli (information) reaching the brain and processed there into sensations, ideas, and associations that determine the behavior of the individual. People receive information from their surroundings using the different senses, and consciously or subconsciously identify, compare, classify, assess and evaluate them, undertaking various actions. Sight is the dominant sense in humans. According to Kowalczyk (1992), approximately 85% of sensory stimuli are per-

ceived using this sense. Vision loss or impairment results in a number of limitations in various aspects of life. The visual perception of landscape is complemented by auditory, olfactory, tactile and gustatory stimuli. Apart from tactile sensations, the skin also allows people to perceive pressure, temperature differences (warmth and cold), pain, and vibration. The amount of information reaching the human consciousness through the different senses cannot be measured exactly, but the role of these senses in the perception of landscape is known to be different and varying (Szczepańska M. and Wilkaniec A. 2015). The subjectively formed image of the landscape based on sensory perception of stimuli or signals received from the surroundings is termed the "multi-sensory landscape". The latter has also been defined by Bartkowski T. (1985) as a perceptive reflection of sensory signals received from the natural landscape.

Recently, forms of tourism are being developed that involve travel to places with unique acoustic properties or unique auditory landscapes ("soundscapes"), understood as the auditory layer of the landscape, or landscape that can be experienced through hearing (e.g. Bernat 2008). Related activities include "soundwalks" or "aural safaris". Soundscapes are created by a combination and interaction of a number of various acoustic fields, each with a single, specific source. These landscapes, perceived as acoustic events, are a component of the information system of the geographic environment. They reflect socio-economic, cultural, and natural processes, form a valuable part of natural and cultural heritage, and are highly susceptible to changes associated with civilization development. For landscape planning purposes, acoustic units called sonotopes are defined (as one of information layers taking into account differences in geology, hydrology, land use, sound propagation and perception) (Hedfors 2003).

In the past 10 years, multiple websites have been created to increase awareness of the aural characteristics of places. Lists such as "the World's Quietest Places 2012" are being published. The role of sounds is also being recognized in studies on the attractiveness of tourist trails (e.g. Rogowski 2012). The best-known Polish soundscape is the Kraków Market Square with the St. Mary's Church trumpet call. The melody dates back to the late 14th century, and is played in the highest tower of the St. Mary's Church, in the four cardinal directions. When the trumpeter starts playing, the gathered crowds fall silent. Afterwards, the listeners applaud and wave towards the player. They participate in the creation of a unique soundscape, with the music eliciting a reaction from the listeners (silent concentration followed by the applause and cheers) (Bernat 2014). Soundscapes offer enormous potential for the development of tourism, as they can enhance the attractiveness of both valuable natural spots (silent areas, landscape parks) and culturally unique areas (old town centers). This is especially important in the context of unequal distribution of tourist traffic.

As mentioned above, soundscapes can also be experienced in forest areas. The forest landscape is often perceived as a combination of forest type and land formation. The physical variation of forest areas is also related to the age and species composition of the trees, as well as types of human activity (Janeczko 2011). Pietrzak M. (1998) distinguishes such aspects of non-visual experience of the landscape and environment as: the potential use of the landscape (e.g. children's games, fishing), touching and moving various objects (e.g. tree bark, flowers), smells (e.g. herbs, hay), sounds (e.g. bird songs, rustling leaves), body temperature regulation (e.g. sunbathing, cooling in the water), and the role of factors interfering

with the perception (e.g. noise, unpleasant odors). Forest landscapes can be shaped to promote the above-mentioned aspects, e.g. using the distinctive smell of specific plants such as Allium ursinum L. or Ledum palustre, or the atmosphere of forested wetlands, such as alder swamps.

Conclusions

When considering the needs and requirements of people with reduced mobility, using wheelchairs, crutches, walking frames etc., the primary area of focus are architectural and land barriers. The relevant regulations include a number of guidelines for increasing accessibility for people with disabilities. Visually impaired individuals also encounter specific barriers that have a minimum impact on people with intellectual disabilities (though these are often individuals with multiple disabilities) or the deaf and hard-of-hearing. Considering the needs of people with disabilities in forest development projects includes not only infrastructure accessibility, but also engaging senses such as the smell or touch to allow visitors to experience the forest environment or to enhance this experience.

Bibliography

1. Bartkowski T. 1985. Nowy etap dyskusji nad pojęciem krajobrazu. Czasopismo Geograficzne 56, 1, 73-79.
2. Bernat S. 2008. Dźwięk w krajobrazie jako przedmiot badań interdyscyplinarnych. Prace Komisji Krajobrazu Kulturowego PTG, nr 11, INoZ UMCS Lublin.
3. Bernat S. 2011 Percepcja i ocena jakości krajobrazów dźwiękowych w polskich parkach narodowych, Problemy Ekologii Krajobrazu, T. XXXIII. 175-184.
4. Bernat S. 2014. Potencjał turystyki dźwiękowej. W: Turystyka Kulturowa, www.turystykakulturowa.org Nr 6/2014 (czerwiec 2014)
5. Europejska Konwencja Krajobrazowa, 2000 (Dz.U. z dnia 29 stycznia 2006 r., nr 14, poz.98)
6. Gołos P., Janeczko E. 2002. Las i jego funkcje w opinii Polaków. Badania opinii publicznej OBOP. W: Modelowe zagospodarowanie lasu dla rekreacji i wypoczynku w wybranych LKP−badania opinii publicznej. Dokumentacja naukowa IBL, Warszawa.
7. Hedfors P. 2003. Landscape architecture in the light of sound. Doctor thesis. Swedish University of Agriculture Sciences. Uppsala. Acta Iniv.Agric.Suecia Agraria 407.
8. http://isap.sejm.gov.pl/DetailsServlet?id=WDU20060140098
9. Janeczko E., 2011. Waloryzacja krajobrazu leśnego, Wyd.SGGW, Warszawa
10. Janeczko E. 2002. Środowiskowe i społeczne uwarunkowania funkcji rekreacyjnej lasów Mazowieckiego Parku Krajobrazowego (MPK). praca doktorska.
11. Kowalczyk A. 1992. Badanie spostrzegania krajobrazu multisensorycznego – podstawą kształtowania obszarów rekreacyjnych. WSP Bydgoszcz.
12. Krzymowska-Kostrowicka A. 1997. Geoekologia turystyki i wypoczynku, Warszawa, PWN.
13. Ludność i gospodarstwa domowe 2011. GUS 2012
14. Łobożewicz T., Bieńczyk G. 2001. Podstawy turystyki. Wyższa Szkoła Ekonomiczna w Warszawie.

15. Moszyńska B. 2000. Walory zdrowotne zbiorowisk leśnych w turystyce i rekreacji w strefie podmiejskiej Warszawy. W: K. Pieńkos (red.) Problemy Turystyki i rekreacji w lasach Polski. Warszawa, p. 73–82.

16. Ogonowska-Chrobrowska H., Jakubowski M. 2010. Las widziany dotykiem – integracyjny leśny ogród.

17. Edukacyjny w Nadleśnictwie Sieraków. Stud. i Mat. CEPL, Rogów 1 (24): 165-172.

18. Piechota S. 2006. Percepcja krajobrazu rekreacyjnego Pszczewskiego Parku Krajobrazowego. Bogucki Wyd. Nauk., Poznań.

19. Pietrzak M. 1998. Syntezy krajobrazowe. Założenia, problemy, zastosowania. Bogucki Wyd. Nauk., Poznań.

20. Rogowski M., 2012, Ocena atrakcyjności turystycznej szlaków pieszych na wybranych przykładach z Dolnego Śląska. Bogucki Wyd. Nauk. Poznań.

21. Szczepańska M., i Wilkaniec A. 2015. Atrakcyjny multisensorycznie krajobraz miasta jako potencjalna przestrzeń turystyczno-rekreacyjna. W Turystyka i rekreacja w aglomeracjach. Studia Periegetica nr 1(13)/2015. Red. Joanna Łuczak. Wydawnictwo Wyższej Szkoły Bankowej w Poznaniu Poznań 2015.

22. Światowy Raport o Niepełnosprawności/World Report on Disability www.pfron.org.pl/kn/poprzednie-numery/168,Swiatowy-raport-o-niepelnosprawnosci-podsumowanie.html

23. Uchwała Sejmu Rzeczypospolitej Polskiej z dnia 1 sierpnia 1997 r. - Karta Praw Osób Niepełnosprawnych.

24. Ustawa o planowaniu i zagospodarowaniu przestrzennym z 27 marca 2003 r. (Dz.U. 2003 Nr 80, poz.717)

25. Woźnicka M., 2006 - Inżynieryjne zagospodarowanie lasów miejskich Warszawy – uwarunkowania ergonomiczne. Praca doktorska wykonana w Katedrze Użytkowania Lasu SGGW w Warszawie.

Małgorzata Woźnicka, Dorota Kargul-Plewa

Miško kraštovaizdis ir žmonių su negalia poilsio poreikiai – Lenkijos valstybinių miškų tyrimas

Summary

Daugiau nei 12 % Lenkijos gyventojų yra žmonės su negalia. Žmonių su negalia gyvenime labai svarbų vaidmenį vaidina turizmas ir rekreacija. Miško aplinkos privalumas yra tas, kad ji turi gydomųjų savybių ir gerina sveikatą. Tačiau tam turi būti įrengta turizmo ir poilsio infrastruktūra. Nuo 2000-ųjų metų Lenkijos miškuose pradėta įrenginėti infrastruktūra žmonėms su negalia be architektūrinių kliūčių, tačiau svarbus yra ir kraštovaizdis. Jis yra suvokiamas įvairiais pojūčiais. Pastaraisiais metais išpopuliarėjo garsovaizdis, o augalų kvapai žavi žmones daugybę metų. Būtent šie kraštovaizdžio elementai turėtų būti atverti asmenims su negalia.

Raktažodžiai: *žmonės su negalia, gamtovaizdis, garsovaizdis, miškas*

TREE PROTECTION ON THE TERRITORY OF NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES (NULES) OF UKRAINE (KYIV)

Anatoliy Kushnir, Olena Kolesnichenko, Oleksandra Leshchenko, Olha Suhanova
National University of Life and Environmental Sciences of Ukraine

Centuries-old protected trees are the pride of National University of Life and Environmental Sciences of Ukraine, which serve the objects of cultural heritage of the Ukrainian nation. They perform the function of research objects for specialists of landscape management, plant protection and arboriculture. This paper examined the inventory of protected trees, biometric indicators, characteristics of their vitality, proposals of the implementation their habitat territory. Based on these findings, specified the recommendations for their protection and preservation. Database of the memorial trees has been started to create.

Keywords: arboriculture, preservation, tomography, Quercus robur L.

The National University of Life and Environmental Sciences of Ukraine (NULES of Ukraine) is one of the leading agricultural higher education institutions in Ukraine which provided 32 specialties with an enrolment of about 35 000 students (Figure 1).

Fig. 1. The academic building №3 of NULES of Ukraine [4]
1 pav. *Ukrainos NULES universiteto III rūmai*

The history and development of NULES of Ukraine dates back nearly 200 years. Since 1840 one of the first basic divisions of modern University has been forest department of Marymontsk Institute of Agriculture and Forestry (Poland) (Figure 2).

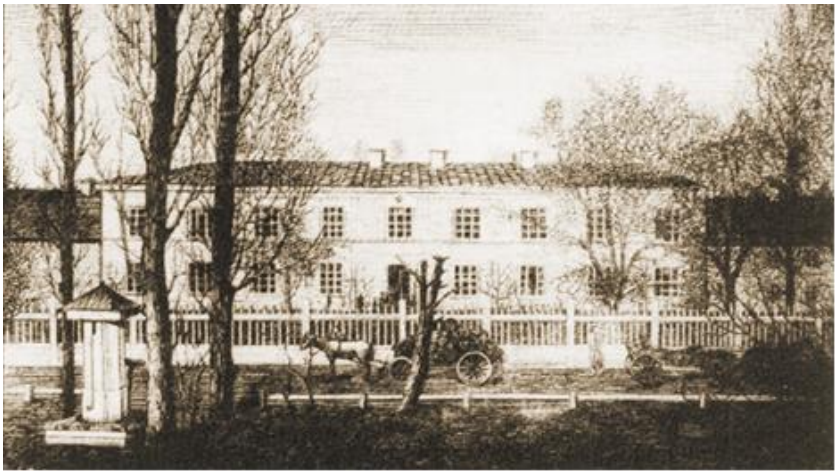

Fig. 2. The building of Marymontsk Institute of Agriculture and Forestry [4]
2 pav. *Marymonto Žemės ūkio ir miškininkystės instituto pastatas*

Later this Department was transformed into Kyiv Forestry Institute (until 1954). Nowadays it is Education and Research Institute of Forestry and Park Gardening. Its training base and laboratories are concentrated around Golosiivo forest in the south-western part of ancient Kyiv (educational building № 1, Figure 3), the Botanical gardens of NULES (educational building № 1a) and Boyarsky forest research station of the University.

Fig. 3. The academic building № 1 with its glory "Oak of Professor Alexeev"
3 pav. *Universiteto I rūmai ir jų pasididžiavimas – „Profesoriaus Aleksejevo ąžuolas“*

In the past few centuries enormous forest Golosiivo belonged to the Kyiv Lavra. Remains of a decorative garden in Golosiivo wilderness have survived until now which was created by order of the Kyiv Metropolitan Petro Mohyla in 1631 as a powerful 300–400-year-old giant oak trees, centuries-old lindens, old ruins of artificial terraces. According to data of famous dendrologist and park-scientist Lypa O. L this garden is the first of authentically known ornamental gardens in Ukraine [2].

During the 1926–1930 years in Golosiivo were built five academic buildings, workshops, three student dormitories and two houses. In September 1930 the Agricultural Institute relocated to Golosiivo and Forestry Institute placed in the present educational building № 1 of NULES of Ukraine [6, 2].

In 30–40th years XX century began to create green plantations on the territory of basic institutions of NULES of Ukraine. They improve the architectural decoration of the territory of the University, protect pedestrians from harmful gases, noise, dust and high temperatures in the summer, serve as a barrier to strong winds, perform educational and cognitive function. Basic elements of landscaping on the territory of NULES are linear plantings along the roadway and sidewalks, green strips near buildings, dormitories and apartment buildings.

Since the 90th XX century and now the founding "commemorative plantings" in honor of famous scientists and anniversaries has been an important stage in the formation of decorative plantings on the areas of NULES of Ukraine. Most widespread genera of plants of the memorial and "commemorative plantings" on the areas of University are *Quercus* L., *Sorbus* L., *Siringa* L., *Fagus* L., *Thuja* L., *Ulmus* L., *Ginkgo* L.

The centuries-old plants that adorn the territory of Kiev Center of NULES representatives exclusively by the genus *Quercus* L. [3]. Scientists and students of the Institute of Forestry and Park-Gardening conducted an inventory of green spaces of University to preserve the centuries-old trees of *Q. robur* with the status of nature monument of local importance [9]. The biometric parameters of old-growth trees are shown in Table 1.

By decision of the Kyiv City Council dated by November 27 2009 № 713/2782 24 trees of *Q. robur* which older than 400 years are declared like natural monuments of local importance in the city Kyiv (Fig. 4), [8].

Table 1. Biometric parameters of protected old-growth trees *Quercus robur* L.
1 lentelė. *Quercus robur* L. *saugomų medžių-senolių biometriniai parametrai*

Name and Location *Pavadinimas ir vieta*	**Tree height** **Bole height, m** *Medžio aukštis, m*	**Measure** **circumference at 1.3 m** **Trunk diameter, cm** *Kamieno apimtis 1.3 m aukštyje* *Kamieno skersmuo, cm*	**Notes** *Pastabos*
Oak Vetrova Str. E. Blakytnogo, 8	18.0 5.0	488.0 155.0	Named in honor of Lt. G. K Vetrova who commanded the garrison of pillbox № 205 during the defense of Kyiv in 1941.
Oak Kyrponosa Str. Generala Rodimceva, 1A	20.0 6.0	395.0 126.0	Named in honor Colonel-General M. P. Kyrponos of commander of the Southwestern Front.
Oak Yakunina Str. Generala Rodimceva, 1A	20.0 9.0	446.0 142.0	Named in honor of the hero of Kyiv defense in 1941 Lt. V. P Yakunin, commander of the garrison of pillbox № 205.
Oaks Rylskogo (2 pcs.) Str. Generala Rodimceva, 9	1. 19.0 3.0 2. 17.0 5.0	435.0 139.0 306.0 97.5	Named in honor of the famous Ukrainian writer and public figure M. T Rylskyy who lived in Golosiivo.
Oak Vitovta Str. Geroiv Oborony, 13	21.0 8.0	412.0 131.0	Named in honor of the Great Lithuanian Prince Vitovt, defender of the Russian land.
Oaks Petra Mohyly (2 pcs.) Str. Generala Rodimceva, 19	1. 23.0 7.5 2. 22,5 7.5	427.0 136.0 359.0 114.3	Named in honor of a prominent ecclesiastical and cultural leader of Kyiv Metropolitan Petro Mohyla.
Oaks Ekzyuperi (6 pcs.) Str. Generala Rodimceva, 19	1. 21.5 3.0 2. 27.0 7,0 3. 23,5 9.0 4. 24.0	374.0 119.1 410.0 130.6 304.0 96.8 321.0	Named in honor of the famous French writer Antoine de Saint-Exupery.

	7.0 5. 22.5 4.0 6. 28.0 6.5	102.2 355.0 113.1 412.0 131.2	
Oaks General Tarnavskyy (10 pcs.) Str. Generala Rodimceva, 2-4	1. 24,0 4.5 2. 26.0 6.5 3. 26.0 10.5 4. 25.5 9.5 5. 25.0 10.0 6. 22.5 6.5 7. 24.0 7.0 8. 31.5 6.0 9. 26.0 7.5 10.23.0 3.0	410.0 130.5 340.0 108.3 324.0 103.2 416.0 132.5 423.0 134.7 380.0 121.0 345.0 109.9 552.0 175.8 378.0 120.4 384.0 122.0	Named in honor of Ukrainian commander General Cetara of Ukrainian Galician Army Myron Tarnavskyy.
Oak Sichovyh Strilciv Str. Generala Rodimceva,11	23.0 8.0	467.0 149.0	Ukrainian Sich Riflemen - representatives of a single Ukrainian national military formation (established in August 1914) as part of the Austro-Hungarian army.

Fig. 4. Natural monuments of *Quercus robur* L. of local importance: 1–400-years-old, 2–500-years-old

4 pav. *Vietinės reikšmės Quercus robur* L. *gamtos paminklai: 1 – 400 metų amžiaus, 2 – 500 metų amžiaus*

In the botanical garden of NULES of Ukraine grows 112 *Q. robur* aged by 200 years and more [7]. The Figure 5 shows that 21 specimens of protected oaks on the territory of the University are in the age of 250 years and amounts 18.8% of total quantity of old-growth trees; the age category of 251–300 years – 51 specimens or 45.5%; the age category of 301–350 years – 31, instance or 27.7%; in the age category of 351–400 years – 7 specimens or 6.2%; and the least amount represented by the age categories in 401–500 years – 2 specimens or 1.8%.

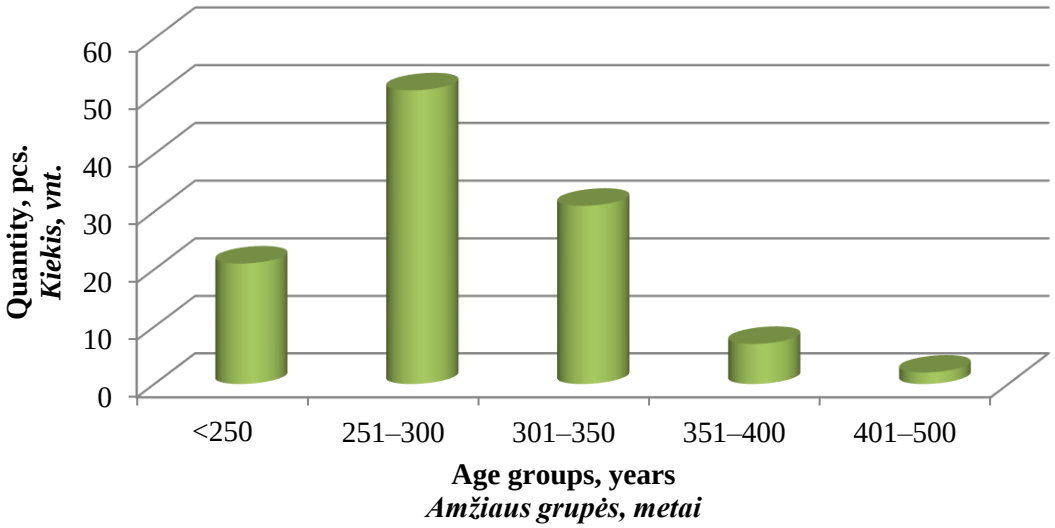

Fig. 5. Distribution of mature oak trees by the age of groups
5 pav. *Brandžių ąžuolų pasiskirstymas amžiaus grupėmis*

Protected trees of these categories are distributed by the condition as follows (Table. 2), [5].

Table 2. Distribution of oaks by age and condition**.**
2 lentelė. *Ąžuolų pasiskirstymas pagal amžių ir būklę*

Tree age, years	Condition			Quantity, pcs.
	Good	Satisfactory	Unsatisfactory	
<250	4	14	3	21
251–300	6	25	20	51
301–350	7	14	10	31
351–400	-	6	1	7
401–500	-	2	-	2
Total	17	61	34	112

In 2015, by the decision of the Second International scientific-practical conference "Historical, legal and environmental aspects of the conservation of memorable centuries-old trees" which was held in the University, considering the modern technologies of preservation and treatment of age-old trees demonstrated results of Tomograph PICUS 3 for tree assessment (Fig. 6).

Fig. 6. Assessment of memorable trees on the territory of NULES
by Tomograph PICUS 3
6 pav. *Atmintinų medžių vertinimas Tomograph PICUS 3 prietaiso pagalba NULES teritorijoje*

Based on the results of a comprehensive survey of oak Vitovta identified range of activities for its treatment and maintenance for preserving (Fig. 7).

Fig. 7. General view of *Quercus robur* L. Vitovta
7 pav. *Bendras Quercus robur* L. *"Vitovta" vaizdas*

Considering that the sanitary condition of 78 inspected old-growth trees of *Q. robur* is good or satisfactory they are promising for further selection in order to preserving [1]. Among them especially perspective are trees of three age categories – from 300 to 500 years. Assessment of the general condition of trees revealed that the main problems are (Fig. 8):

- damaged and broken tops by lightning;
- dry branches (up from 25% of the crown volume);
- presence of tumors and fruit bodies of tree destroying fungi;
- diverse frost bark damages and frost cracks;
- size of tree hollows as 290 x 70 cm and trunk inclination to 80 degrees.

Fig. 8. Main types of damaging of mature trees *Quercus robur* L.
8 pav. *Pagrindiniai Quercus robur* L. *brandžių medžių pažeidimų tipai*

Conclusions

Old-growth trees on the territory of NULES of Ukraine perform important cultural, educational, recreational and environmental functions.

Current status of these trees requires the individual development of conceptual approaches to conservation and caring, including further organization an areas around places of growth, cleansing and balancing crowns, installing information boards.

Modern technology of studying and preservation of old-growth trees as objects of cultural and natural heritage providing continuous monitoring of their growth conditions with modern equipment (resistographs, tomographs) and using the methods of arboriculture for inspection, recovery and treatment of such rarities of nature.

Literature

1. Kushnir, A.I., Sukhanova, O.A. (2009). Tehnolohichni osoblyvosti likuvannia i osdorovlennia vikovych ta istorychnych derev [Technological features of treatment and rehabilitation age and historic trees]. Kyiv : NUBiP Ukrainy, 48.

2. Kushnir, A.I., Sukhanova, O.A. (2012). Zahalnouniversytetskii skver Natsionalnoho universytetu bioresursiv i pryrodokorystuvannia Ukrainy – landshafnyi obiekt suchasnoho typu. University park National Agriculture University of Ukraine – landscape modern object type. Proceding international Conference. International Readings devoted to the 110th

anniversary of Doctor of Biological Sciences, Professor Leonid Ivanovich Rubtsov. Moliak S.V., 162–167.

3. Kushnir, A.I., Sukhanova, O.A. (2015). Etapy formyvannia ta suchasnyi stan «pamiatnych posadok» na terytorii pershoho korpusu NUBiP Ukrainy u m. Kyievi [Stages of formation and modern state «memorable landings» on the territory of the first building of NUBIP of Ukraine in Kiev]. Nakovyy Journal NULES Ukraine, 219, 230–241.

4. Official Site NULES of Ukraine. Mode of access: https://nubip.edu.ua/

5. Sukhanova, O.A., Kushnir, A.I. (2016). Stan vikovych derev-pamiatok pryrody na terytorii Natsionalnoho universytetu bioresursiv i pryrodokorystuvannia Ukrainy [State of old trees – nature monuments at the National University of Life and Environmental Sciences of Ukraine]. Proceding international Conference. Kyiv, 145.

6. Svyrydenko, V. Ye. (2005). Kuznia lisihospodarskykh kadriv [Forge forestry staff]. Aristei, 128.

7. The list of territories and objects of nature reserve fund national and local importance (as of 01.01.2015). Available at: https://wikimediaukraine.wordpress.com/2014/03/19/

8. Zakon Ukrainy vid 16 chervnia 1992 r. № 34 «Pro pryrodno-zapovidnyi fond» [in Ukrainian].

9. Zakon Ukrainy vid 8 chervnia 2000 r. № 39 «Pro okhoronu kulturnoi spadshchyny» [in Ukrainian].

Anatoliy Kushnir, Olena Kolesnichenko, Oleksandra Leshchenko, Olha Suhanova

Medžių apsauga Ukrainos nacionalinio gyvybės ir aplinkos mokslų universiteto teritorijoje

Santrauka

Šimtamečiai saugomi medžiai yra Ukrainos nacionalinio gyvybės ir aplinkos mokslų universiteto pasididžiavimas. Jie taip pat laikomi ukrainiečių tautos kultūriniu paveldu. Be to, šie medžiai atlieka tyrimo objektų funkciją, mokant kraštovaizdžio tvarkymo, augalų apsaugos ir arboristikos specialistus. Šiame straipsnyje analizuojami saugomų medžių inventorizacijos duomenys, jų biometrinės charakteristikos, gyvybingumo rodikliai ir pateikiami pasiūlymai dėl jų augaviečių. Šių pasiūlymų pagrindu pateikiamos medžių apsaugos rekomendacijos. Yra pradėta kurta atmintinų medžių duomenų bazė.

REIKALAVIMAI MOKSLINIAMS STRAIPSNIAMS RENGTI

1. Bendrieji reikalavimai:

1. Moksliniai straipsniai turi būti tokios struktūros:

- straipsnio pavadinimas;
- autoriaus vardas, pavardė;
- darbovietė;
- straipsnio anotacija originalo kalba (ne mažiau kaip 600 spaudos ženklų), jos pabaigoje - ne daugiau kaip 5 straipsnio turinio esmę nusakantys prasminiai žodžiai;
- įvadas (nurodant tyrimų objektą ir tikslą);
- tyrimų metodika (metodai);
- rezultatai;
- aptarimas;
- išvados;
- literatūra;
- santrauka – jeigu straipsnis rašomas lietuvių kalba, santrauka turi būti anglų kalba.

2. Mokslinio straipsnio apimtis – 3–4 puslapiai. Paskutinis puslapis turi būti užpildytas ne mažiau kaip dviem trečdaliais puslapio.

2. Reikalavimai straipsniui rengti kompiuteriu

Šie reikalavimai parengti, laikantis Lietuvos mokslo tarybos kolegijos 2000 m. vasario 23 d. nutarimo Nr. V-3 priedo papildant jame išdėstytus reikalavimus straipsnio teksto tvarkymo nuorodomis (>xx pt – tarpo tarp pastraipų dydis).

Reikalavimai programinei įrangai

Straipsniai turi būti parengti Microsoft Windows operacinės sistemos ne vėlesne kaip Microsoft Word' 97-2003 versija.

STRAIPSNIO PAVADINIMAS (Cambria, 11 pt, Bold)

>11pt

Vardas Pavardė (Cambria, 11 pt, Bold)

Kauno miškų ir aplinkos inžinerijos kolegija (Cambria, 11 pt, Italic)

>10 pt

Anotacijos tekstas per visą puslapio plotį (Times New Roman, 10 pt, Normal, First line 1,2 cm).

Raktažodžiai (Times New Roman, 10 pt, Italic, First line 1,2 cm).

>5 pt

Įvadas (11 pt, Bold, lygiuojama kairėje puslapio pusėje)

>5 pt

Puslapio formatas

Straipsnis (tekstas, formulės, lentelės, paveikslai) maketuojamas AB5 JIS (182 x 257 mm) formato lapuose su tokiomis paraštėmis: viršuje – 20 mm; apačioje – 20 mm; kairėje ir dešinėje – 20 mm.

Straipsnio informacijos išdėstymas ir tvarkymas

Straipsnio pradžioje atskiromis pastraipomis pateikiami: pavadinimas; straipsnių autorių nesutrumpinti vardai ir pavardės; darbovietė ir anotacija. Straipsnio pagrindinis tekstas 1 intervalo eilėtarpiu spausdinamas Times New Roman, 11 pt, Normal šriftu ir išdėstomas viena skiltimi, pirma eilutė atitraukiama 1,2 cm.

Visų struktūrinių dalių (skyrių) pavadinimai (išskyrus"*Summary"*) rašomi 11 pt, Bold. Lygiuojama prie kairiojo skilties krašto. Skyrių pavadinimai nuo teksto atskiriami 1 eilutės intervalu. Poskyrių pavadinimai rašomi iš naujos eilutės 11 pt, Italic Bold tekstą tęsiant toje pačioje eilutėje. Formulių pagrindiniai simboliai rašomi 11 pt, Italic, o jų indeksai – 11 pt. Formulės centruojamos ir numeruojamos arabiškais skaitmenimis lenktiniuose skliaustuose dešinėje kraštinėje skilties dalyje. Parašius formulę, rašomas taškas, jei joje naudojami dydžiai neaiškinami, jei aiškinami – kablelis ir naujoje eilutėje be įtraukos rašomas žodelis "čia", kiekvienas dydis paaiškinamas.

Lentelės ir paveikslai turi būti įterpti tekste po nuorodų į juos, pasibaigus pastraipai, tačiau negali būti spausdinami po išvadų. Didesnio formato paveikslai ir lentelės gali būti spausdinami per visą puslapio plotį. Grafikai ir brėžiniai braižomi kompiuteriu. Nuotraukos turi būti tik geros kokybės, tinkamos reprodukuoti. Parašai po paveikslais, lentelių pavadinimai ir pastabos po jų rašomi centruotai 11 pt šriftu lietuviškai ir santraukos kalba. Lentelėse lietuviškas tekstas rašomas – 11 pt, Bold ir santraukos kalba 11 pt, Italic. Paveikslai ir lentelės nuo teksto atskiriami 1 eilutės intervalu.

Šaltinių nuorodos tekste pateikiamos skliausteliuose nurodant autoriaus pavardę (be vardo raidės) ar šaltinio pavadinimo pirmą žodį (kai autorius – institucija) ir šaltinio publikavimo metus, pvz., (Petraitis, 2001), (Peterson, 1988), (Valstybės…, 2004, (Кресникова, 2005). Jei literatūros šaltinis parašytas daugiau kaip vieno autoriaus, nurodoma tik pirmojo autoriaus pavardė, o po jos rašoma tekste lietuvių kalba „ir kt.", o anglų kalba "et al", pvz., (Jonaitis ir kt., 1999), (Johanson et al., 2003). Skliausteliuose galima nurodyti tik publikavimo metus; naudojamos citatos rašomos su kabutėmis papildomai nurodant šaltinio, iš kurio paimta citata, puslapio numerį, pvz., Kadangi Peterson (1988) įrodė, kad …, „tai atitiko vėliau gautus rezultatus" (Kramer, 2003, p.15).

Literatūros sąrašas sudaromas abėcėlės seka – pagal autorių pavardes ar šaltinio pavadinimo pirmą žodį. Pirmiausiai dėstomi bibliografiniai aprašai lotyniškais rašmenimis, po to kitais (pvz., kirilica).

Keletas to paties autoriaus darbų surašomi chronologiškai. Kai vieno autoriaus leidiniai išleisti tais pačiais metais, rašoma taip: 2003a, 2003b ir t.t.

Sąraše sutrumpinimai nenaudojami – čia pateikiamos visų šaltinio bendraautorių pavardės ir visas pavadinimas. Visi įrašai sužymimi arabiškais skaitmenimis ir numeruojami iš eilės.

Po literatūros sąrašo per visą puslapio plotį spausdinama santrauka, duomenys apie autorių originalo ir anglų kalbomis (žr. pavyzdį).

>5 pt

Literatūra (11pt, Bold)

> 5 pt

1. Čekanavičius, A. Pastatų išorės sienų, apšiltintų iš vidaus, drėgminė būsena. Daktaro disertacijos santrauka. KTU, 2003.

2. Čekanavičius, A., Stankevičius, V., Montvilas E. Pastatų išorinių sienų, apšiltintų iš vidaus, drėgminė būklė. Kaunas, Technologija, 2004.

3. Rapcevičienė, D. Daugiabučių namų renovacijos efektyvumo vertinimas. Mokslas – Lietuvos ateitis, 2010, 2 tomas, Nr. 2, 33 p.

>10 pt

Vardas Pavardė (11 pt, Bold)

>5pt

How to prepare a manuscript for the scientific journal (11 pt , Bold)

>5pt

Summary (11 pt, Italic)

>5pt

This document contains instruction for the preparation of manuscripts for the scientific journal (11 pt, Normal, First line 1,2 cm).

Keywords: (11 pt, Italic, First line 1,2 cm).

KAUNO MIŠKŲ IR APLINKOS INŽINERIJOS KOLEGIJA
KAUNAS FORESTRY AND ENVIRONMENTAL ENGINEERING UNIVERSITY OF APPLIED SCIENCES

MIŠKININKYSTĖ IR KRAŠTOTVARKA
FORESTRY AND LANSDCAPE MANAGEMENT

2017 1(12)

Redagavo Zita Petraitytė (lietuvių k.),
Ina Janulaitienė (anglų k.),
Maketavo Alma Gustienė

SL 399. 2017 04 25. Sp. l. 13,0. Tiražas 55 egz. Užsakymo Nr. 4.
Spausdino Aleksandro Stulginskio universiteto Leidybos centras.
Studentų g. 11, LT-53361 Akademija, Kauno r.