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QUALITIES OF URBAN GREEN SYSTEMS AND THE ISSUE OF MULTI-FUNCTIONALITY

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Summary. The work presented here focuses on the issue of quality and natural values in urban green areas systems. Considering a variety of themes, the author aims at describing crucial parts of green networks in towns: urban fringes, wildlife corridors, parks and gardens. That is accompanied by a brief analysis of the theoretical basis of functions and qualities of green systems. The notion of multi-functionality, acquiring great importance in contemporary landscape management, is employed. In consequence, interconnections between ecological and socio-cultural roles of urban greenery are thoroughly discussed. Apart from describing the main ecological services of the structures, the work concentrates on the growing need to integrate the socio-cultural domain into activities leading to the establishment and development of urban ecological systems. Examples of research on urban natural systems from Poland and abroad are provided. The article highlights possibilities of fulfilment of both ecological and aesthetic needs by green infrastructure. Building on literature review and author's investigations, the paper suggests a necessity of undertaking a different approach to the organisation of green infrastructure in the country. It argues that 'mass greenery' direction should be replaced by practice targeted at quality reinforcement. Focus on the achievements of landscape ecology and landscape architecture would bring positive results.

Key words: landscape values, urban green systems, landscape quality, multifunctional use

INTRODUCTION

Urban systems are systems predominantly ruled by the human factor and they simultaneously are a striking example of multifunctional areas. Multi-functionality of landscapes [Naveh 2000] includes close relations between bio-ecological, socio-economic, socio-ecological and cultural functions and is a specific feature of man-made landscapes. This notion emphasis heterogeneity as a leading characteristic of the landscape and in consequence it means that landscapes

support various functions simultaneously [see Mander *et al.* 2007]. Urban green areas comprising the effects of coordination between human thought and natural components demonstrate multifunctional character of uses, different types of values and purposes of existence. Considering the Polish experience, it should be emphasized that theoretical models of urban green systems have been widely recognized as intrinsic elements of urban natural systems. This higher level of organization became a theme of many researches and has been illustrated by universal models of urban natural systems identified by Stala [1986], Biernacki [1990], Przewoźniak [2002], Szulczewska and Kaliszuk [2005] and others.

The issue of quality is strictly connected with the subject for the purpose of which the quality is analysed. The central position of humans in geo-ecosystems causes the necessity of regarding man's needs and the quality of his life. According to Wojciechowski [2004], who cites numerous works, e.g. of Cutter [1985] and Broadbent [1973], among many indices linked to environmental and landscape features that are used to describe life quality, two groups should be highlighted. The first one demands research on the objective state of the environment, whereas the second embraces subjective factors such as emotions and feelings. The role of natural elements is very important not only for the former, but also for the latter, since they fulfil physiological and mental human tasks. Noteworthy, several recent studies on green systems in Poland have demonstrated that life quality is beginning to acquire rising importance during the systems' designation [e.g. Szulczewska 2002, Szulczewska and Kaliszuk 2005].

Increasing demands for high quality life accompany the need to live in landscapes presenting desirable aesthetic values. This process is commonly seen in urban areas. Research conducted in Great Britain [Robertson and Walford 2000] allows better understanding of the differences in perception between rural and urban areas. The work has shown that contrary to inhabitants of cities, who expressed willingness to live in cleaner and more diverse areas with a larger amount of greenery, country residents demonstrated a higher level of appreciation of local environment conditions. In respondents' view, green areas were the second element among the most appreciated parts of the landscape. Employing the categories of aesthetic appraisal, three landscape features were seen in particularly positive sense, they were elicited by the following adjective descriptors: calm, silent, varied. Noise, monotony of the landscape and heavy odours gained negative opinions.

Interestingly, rising expectations for the state of the environment and landscape can serve as a basis for effective activities involved in establishing high quality urban ecological system and engaged in protection of the whole range of its values: ecological, aesthetic, tourist and nature-conservation oriented.

METHODS

This paper aims at integrating crucial issues regarding the role of urban greenery in the context of its quality and multifunctional use. The scope of the review is broad, ranging from a brief analysis of works concerning environmental services [e.g. Chmielewski 1992, Szulczewska 2002, Szulczewska and Kaliszuk 2005] to those analysing the quality of life [e.g. Wojciechowski 2000, Chiesura 2004]. Therefore, the study applies the methods of meta-analysis and literature studies addressing a wide range of themes. The review has synthesized outputs carried out in many works which have explored the role of green areas, but special emphasis was put on interconnections between ecological and socio-economic domains. As a result, new research areas are revealed.

REFOCUSING ECOLOGICAL FUNCTIONS OF URBAN GREEN AREAS

As far as green areas are concerned in the context of the ecological system, its quality should be connected with the degree of naturalness and the level of plant cover transformation. Sukopp and Weiler [1988, after Richling and Solon 1996] assumed that even relatively small patches of sub-natural vegetation play an important role in the functional system of a city, mainly owing to possibilities of nature conservation (they serve the purpose of refuges, reproduction places and ecological corridors) and owing to possibilities to perform social functions (particularly as a factor responsible for creating place identity and for providing leisure areas). Vegetation as the fundamental part of ecological systems cannot be divided from other structural elements of urban units since it forms varied landscapes together with built-up areas. Matuszkiewicz [1990, 1992, after Richling and Solon 1996] identifies three characteristic complexes of units composed both of vegetation and invested areas:

– complexes whose physiognomies have been predominantly shaped by vegetation,
– complexes showing a mosaic of vegetation and built-up areas,
– complexes demonstrating a slight influence of vegetation.

The presence of natural assets in urban areas contributes to the quality of life in several aspects. The most general influence belongs to environmental services such as air and water purification, wind and noise filtering, microclimate stabilisation. The relationship between urban form, biodiversity potential and ecosystem services are nowadays starting to be examined in a large extent [Tratalos *et al.* 2007]. Regarding socio-cultural and psychological benefits, the restorative function is of great importance [Chiesura 2004]. An ecological system of urban areas interlinks environmental and cultural functions and this constitutes one of its main features. Noteworthy, during most of the phases of evolution of historic green areas the tendency of domination of non-ecological functions over ecological is recognized [Siewniak and Mitkowska 1998].

Owing to ecological presumptions, high natural quality of green areas system should be connected with: 1) maintenance of proper relations between a habitat and vegetation cover, 2) focus on native species and native systems resembling potential natural vegetation, and 3) introducing proper or at least better environmental conditions. However, geo-ecosystems are dominated by human impact; therefore ecological services are interconnected with aesthetic and leisure functions. In some countries green areas management is governed by the notion of native character. This is the case of the Netherlands, where trees, and specifically bushes, are selected to adjust local predispositions and in consequence indigenous species are extremely important [Waźbińska 2001]. Similar rules are often found in the United Kingdom.

Urban green areas consist of many forms, the most important being gardens, parks, forests, tree alleys, sport and leisure areas, cemeteries. Parks usually cover an abundant part of the total area of green infrastructure. In consequence, their importance cannot be underestimated as they possess a rich set of values.

ECOLOGICAL VALUES OF PARKS AND GARDENS

The ecological value of a garden is shaped by natural potential of all garden elements and it is mostly influenced by genetic resources of organisms and potential of their biotopes [Siewniak and Mitkowska 1998]. Parks and gardens usually serve as 'a connector' in a green areas system and usually bring beneficial influences on abiotic components, mainly soil and climate. Furthermore, legally protected natural objects and species are found there. The biocenotic function belongs to the most considerable – in many situations parks fulfil the role of shelters for numerous organisms, they are responsible for continuity of ecological corridors.

Natural values of gardens are well pronounced in the idea of a natural garden. According to Siewniak and Mitkowska [1998] main features of this type of a garden include:

– domination of natural vegetation structures,
– low expenses on maintenance and growing plants,
– creating refuges for endangered species,
– improvement of natural conditions of a given area and improvement of life standards in built areas.

Ecological roles of gardens depend on their location in ecological networks; gardens can be links of ecological chains in green corridors, but they can also be a structure resembling an ecological island. The latest research conducted in Belgium [Cornelis and Hermy 2004] have demonstrated a profound role of urban and sub-urban parks for biodiversity conservation. The Shannon-Weaver index in analysed parks reached between 2.64 and 3.45, the lowest number of habitats in the parks amounted to 16, whereas the highest to 38.

Linking the issue of nature conservation with the art of gardening is reflected in the idea of 'wild gardens'. Though associations with natural parks and gardens are found, wild gardens cannot be identified with natural gardens. The difference lies in the expected effects. 'Wild gardens' are frequently parts of landscape gardens and can be seen as the expression of wilderness, dense, primeval greenery, low access to its area is stressed, not the nature conservation needs alone. However, it seems that biocenotic services of wild gardens become more popular nowadays. For example, The Royal Horticultural Society recommends planting both native and foreign species, those which are able to attract and supply with food local animals. The needs of bees and bumblebees are highly valued, useful plants include *Melissa officinalis, Buddleja davidii, and Pulmonaria saccharata*. Birds would benefit from *Sorbus commixta, Rosa rugosa, Stipa tenuissima* and many others. Small ponds featuring gentle slopes are recommended as a source of water to be consumed or serve for baths for various animals, as well as wood piles used for winter hibernation [RHS Plants…, 2001].

The general remark that green urban networks should be organized with a respect to the ecological and aesthetic values has not always been followed in Poland. Bogdanowski [e.g. 2000] criticized mistakes made in the 2nd half of 20th century. According to him, forms of greenery degradation occurring in the area of the country are numerous, the most frequent constitute: monotonous tree planting along roads; unreasonable afforested areas contrasting with the local character; improper activities within historical objects. Actions aimed at developing 'mass greenery' in many cases resulted in depreciation of not only selected elements, but also entire landscapes. In consequence, improvements of greenery should be directed at building up its quality. It is argued that both experiences of art of gardening expressed in historic parks and gardens and achievements of landscape ecology stressing the role of multi-functionality in cultural landscapes [see for instance Haines-Young and Potschin 2000] are here of much help. World-wide tendency to employ rules of landscape ecology in designation of urban greenery brought with it many interesting projects, Berlin or London may be mentioned as examples [Drapella-Hermansdorfer 2005].

THE URBAN FRINGE AS A CONFLICT ZONE

The urban fringe is sometimes defined as 'the last planning frontier' [Gallent *et al.* 2004]. Being a marginal belt between urban and country domain, the transformation zone and the area of strong economic activity, it presents itself as an unusually dynamic spatial unit. Ecological values of this zone are interlinked with the diversity of land use. Objects demonstrating great ecological values (frequently legally protected) in many cases are in close contact with deteriorated areas. The diversity of present functions may lead to many conflicts and numerous environmental hazards.

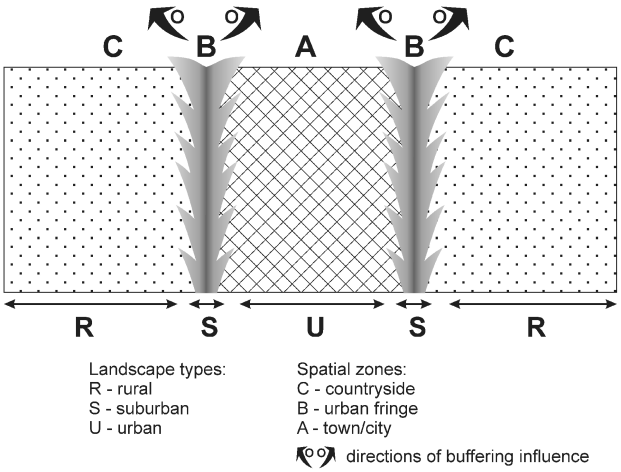

Fig. 1. The urban fringe in relation to rural, urban and suburban landscapes – a scheme

Tourist function, which is one of the most noticeable here, demands biologically active areas to be present in towns' vicinities. Therefore the matter of 'naturalization' if not 'renaturalization' of urban fringes is more highlighted now owing to leisure services. The urban fringe can also be seen as a buffer zone. Being vulnerable to anthropogenic impact, it plays protective roles. 'Buffer function' acts in two directions: large biologically active areas protect a town against harmful influences of its own environment and simultaneously are a protective zone for a neighbouring rural system (Fig. 1).

Urban fringes cover different landscape types. This obliged researchers and designers to apply proper methodological premises in the process of landscape management. Cited before Gallent *et al.* [2004] stress the advantages of multifunctionality for planning purposes when urban fringes are examined in any spatial context.

ECOLOGICAL CORRIDORS

Urban ecological systems often consist of elements which, owing to their spatial arrangement and biocenotic functions, should be identified as wildlife corridors.

Designing wildlife corridors is a difficult task and it needs an individual, trans-disciplinary approach. Distinguishing the targets of a given corridor should be the first step of the project. Fleury and Brown [1997] gave a useful description for the procedure for south-western Ontario and selected the main attributes of the corridors: a matrix, patch, networks of connections, barriers, length, width, shape, edge, structure and composition. The authors have additionally eli-

cited a universal scheme of wildlife corridors design. Noteworthy, particular functions of the corridor depend on its inner structure and on the scale of works.

Parks and gardens can be corridors themselves, or serve as a link between other valuable areas. The selection of species obviously influences the migration phenomena. Young [2005] provides a spectacular example of relations between garden structures and migration routes of butterflies. Corridor parameters can also be used as landscape structure indicators to evaluate urban ecological networks. Cook [2002] analyses corridor content paying attention at the type, size, interior/upland ratios, matrix utility factors, connectivity and the degree of naturalness.

The success of idea of nature conservation partly depends on incorporating human needs – this assumption is evident as far as towns or cities are concerned. Leisure needs in urban or peri-urban areas are very strong; therefore wildlife corridors are in continuous conflicts with other land uses. That is the reason of Fleury and Brown's [1997] opinion, who wrote that wildlife corridors are currently a kind of 'an experimental field'.

CONCLUSIONS

Questions of quality and ecological values of urban green systems can be seen as a challenging concern for the analysis of 'man-nature' relations. Abovementioned relations became the basis of construction of numerous ecological models, e.g. zone-strip-knot (*model strefowo-pasmowo-węzłowy*) which was formulated by Chmielewski [1992]. A system view, with a premise that each element is necessary for the entity is the main foundation for this model as well as for those elicited for urban nature (see *Introduction)*.

The urban ecological system interlinks ecological and cultural values, its quality depends both on ecological and aesthetic features. What emerges from this perspective is a point that ecological function cannot be explored without the reference to a value system [Haines-Young and Potchin 2000]. Landscape harmony understood as adjusting the way of land use and land management to the character and potential of the area with the need to maintain high aesthetic values [Siewniak and Mitkowska 1998] does not allow treating ecological systems only in the categories of demand for any green structures. Constituting visual values of the landscape forms one of general purposes of revitalization processes and is connected with the negation of tendencies leading to uniformity. It is rather the native character and the individual features that should be appreciated. Furthermore, it is possible that negative consequences of applying 'mass greenery' concept will have to be improved by revalorisation of the whole system, in a short time. Urban ecological systems should reflect good traditions of landscape architecture, which strictly ties landscaping with ecological values. The examples of such works can be found in Poland. Unfortunately, the post-war practice of landscape architecture is abundant with non-constructive projects, seen nowadays

in most Polish large towns. The importance of the problem was often underlined by Bogdanowski [2000] and his co-workers, who appreciated the potential of historic gardens and the heritage of gardening in which they would like to see the desirable tool for organizing a proper arrangement of urban greenery.

Quality and values of green systems are closely related to the theme of public participation, with the respect for needs and customs of local societies. On the other hand, factors influencing the possibilities of effective landscape protection show co-dependency with perception, aesthetic preference and obviously with ecological functions. Such opinion was stressed by Fry and Sarlöv-Herlin [1997] in works on the assessment of forest ecotones. Incorporating so many plots in the planning and management of urban ecological structures is difficult, but highly-needed, especially when multi-functionality is taken into account.

REFERENCES

Biernacki Z., 1990. Koncepcja kształtowania trzonu przyrodniczego oraz osłony ekologicznej miasta w modyfikowanych planach zagospodarowania przestrzennego [in:] Problemy ochrony i kształtowania środowiska przyrodniczego na obszarach zurbanizowanych, p. II. Wydawnictwo SGGW-AR, Warszawa, 192–201.

Bogdanowski J., 2000. Polskie ogrody ozdobne. Historia i problemy rewaloryzacji. Wyd. Arkady, Warszawa.

Chiesura A, 2004. The role of urban parks for the sustainable city, Landscape and Urban Planning 68 (1), 129–138.

Chmielewski T.J., 1992. Ekologiczne podstawy projektowania parków krajobrazowych [in:] Wybrane problemy ekologii krajobrazu, Ryszkowski L., Bałazy S. (eds). Zakład Badań Środowiska Rolniczego i Leśnego PAN, Poznań.

Cook E.A., 2002. Landscape structure indices for assessing urban ecological networks. Landscape and Urban Planning, 58, 269–280.

Cornelis J., Hermy M., 2004. Biodiversity relationships in urban and suburban parks in Flanders. Landscape and Urban Planning, 69 (4), 385–401.

Drapella-Hermansdorfer A., 2005. Zielone osie i zielone pierścienie Berlina. Teka Kom. Arch. Urb. Stud. Krajobr. PAN Lublin, 1, 76–82.

Fleury A.M., Brown R.D., 1997. A framework for the design of wildlife conservation corridors with specific application to southwestern Ontario. Landscape and Urban Planning 37 (3–4), 163–186.

Fry G., Sarlőv-Herlin I., 1997. The ecological and amenity functions of woodland edges in the agricultural landscape; a basis for design and management. Landscape and Urban Planning 37 (1–2), 45–55.

Gallent N., Shoard M., Anderson J., Oades R., Tudor C., 2004. England's urban fringes: multifunctionality and planning. Local Environment 9 (3), 217–233.

Haines-Young R.H., Potschin M.B., 2000: Multifunctionality and Value [in:] Brandt J., Tress B., Tress G., (eds), Multifunctional Landscapes: Interdisciplinary Approaches to Landscape Research and Management. Centre for Landscape Research, Roskilde, 111–118.

Mander Ű., Helming U., Wiggering H., 2007. Multifunctional land use: meeting future demands for landscape goods and services [in:] Mander Ű., Helming U., Wiggering H., (eds), Multi-

functional land use: meeting future demands for landscape goods and services. Springer, Berlin, Heidelberg, 1–13.

Naveh Z., 2000. Introduction to the Theoretical Foundations of Multifunctional Landscapes in Transdisciplinary Landscape Ecology [in:] Brandt J., Tress B., Tress G., (eds), Multifunctional Landscapes: Interdisciplinary Approaches to Landscape Research and Management Centre for Landscape Research, Roskilde, 27–43.

Przewoźniak M., 2002. Kształtowanie środowiska przyrodniczego miast, przykłady z regionu gdańskiego. Wydawnictwo Politechniki Gdańskiej, Wydział Architektury, Gdańsk.

RHS Plants for places, 2001, Royal Horticultural Society, Dorling Kindersley, London, Johannesburg.

Richling A, Solon J., 1996. Ekologia krajobrazu. Wydawnictwo Naukowe PWN, Warszawa.

Robertson M., Walford R., 2000. Views and visions of land use in the United Kingdom. Geographic. J. 166 (3), 239–254.

Siewniak M., Mitkowska A, 1998. Tezaurus sztuki ogrodowej. Oficyna Wydawnicza Rytm, Warszawa.

Stala Z., 1986. Przyrodniczy model struktury przestrzennej miasta. Człowiek i Środowisko 10, 4, 547–565.

Szulczewska B., 2002. Teoria ekosystemu w koncepcji rozwoju miast. Wydawnictwo SGGW, Warszawa.

Szulczewska B., Kaliszuk E, 2005. Koncepcja systemu przyrodniczego miasta: geneza, ewolucja i znaczenie praktyczne. Teka Kom. Arch., Urb. Stud. Krajob., PAN Lublin, 1, 7–24.

Tratalos J., Fuller R.A, Warren P.H., Davies R.G., Gaston K.J., 2007. Urban form, biodiversity potential and ecosystem services. Landscape and Urban Planning, 83 (4), 308–317.

Ważbińska J., 2001. Krzewy ozdobne w architekturze krajobrazu holenderskiego w zależności od siedliska. Inż. Ekol. 5.

Wojciechowski K.H., 2004. Miejsce postrzeganego krajobrazu w całościowym ujęciu jakości życia. Annales UMCS, LIX, sec. B, 213–229.

Young C.H., 2005. Garden structure and small-scale corridors [in:] Planning, People and Practice. The landscape ecology of sustainable landscapes. Proceedings of annual conference IALE (UK) 2005, D. Mc Colin, J.I. Jackson (eds), Northampton, 115–122.

JAKOŚĆ SYSTEMÓW ZIELENI MIEJSKIEJ W ASPEKCIE WIELOFUNKCYJNOŚCI

Streszczenie. Artykuł koncentruje się na zagadnieniu jakości i wartości przyrodniczych systemu zieleni miejskiej. Tematyka ta została zanalizowana w odniesieniu do koncepcji wielofunkcyjności, mającej współcześnie duże znaczenie praktyczne i teoretyczne dla kształtowania krajobrazów. Duża rozpiętość problemu powoduje, że autorka zajmuje się jedynie niektórymi aspektami zagadnienia, skupiając się na walorach przyrodniczych tzw. strefy brzeżnej miasta (‘urban fringe’), korytarzach ekologicznych oraz parkach i ogrodach. Poza wskazaniem zasadniczych zadań ekologicznych wymienionych elementów, w opracowaniu podkreśla się konieczność integracji funkcji ekologicznych i społeczno-kulturowych w działaniach zmierzających do stanowienia i kształtowania systemu przyrodniczego miasta. Autorka krytycznie odnosi się do chaotycznego, pozbawionego wartości estetycznych „zazieleniania miasta”, przeciwstawiając mu ład przestrzenny reprezentowany przez wiele historycznych założeń krajobrazowych. W opracowaniu wskazuje się na możliwość łączenia wysokiej jakości walorów przyrodniczych i estetycznych z zasadami ekologii i architektury krajobrazu. Podkreśla się ponadto konieczność uwzględniania potrzeb człowieka w planowaniu i zarządzaniu krajobrazem, procesach organizacji systemów zieleni miejskiej i usprawniania ich działania.

Słowa kluczowe: walory krajobrazu, system zieleni miejskiej, jakość krajobrazu, wielofunkcyjność