

## Wielofunkcyjna mozaika terenów zieleni w kontekście zrównoważonego rozwoju Dolnego Śląska (południowa Polska)

### A Multifunctional Mosaic of Green Spaces in the Context of the Lower Silesia Region (Southern Poland) Sustainable Development

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#### **Streszczenie**

W artykule prezentowany jest model 'Zielonej Sieci', którą tworzy mozaika terenów zieleni - elementów powierzchniowych i liniowych w mieście i strefie podmiejskiej, zaplanowana dla różnych celów: ekologicznych, rekreacyjnych, kulturowych, estetycznych i innych zgodnych z zasadami zrównoważonego rozwoju policentrycznych miast-regionów. Elastyczny model „Zielonej Sieci” składa się z węzłowych obszarów zieleni, powiązanych ze sobą za pomocą systemu greenways (korytarzy zieleni wzdłuż naturalnych i sztucznych ciągów) oraz strefy buforowej terenów rolniczych w strefie podmiejskiej, które mogą być adaptowane na różne potrzeby zagospodarowania przestrzennego. Koncepcją jest stworzenie dynamicznego systemu pomagającego w zagospodarowaniu przestrzeni urbanistycznej, chroniącego jednak wartościowe pod względem rekreacji i środowiska tereny zieleni.

**Słowa kluczowe:** 'Zielona Sieć', ochrona krajobrazu, greenways, zrównoważony rozwój

#### **Abstract**

The aim of the paper is to present the core of the "Green Grid" - an environmentally functioning web of linear and surface elements in the city and its urban fringe that have been planned for multiple purposes, including ecological, recreational, cultural, aesthetic and other uses in the sustainable development of polycentric city-regions. The idea is to introduce a flexible model of the 'Green Grid' consisting of green core areas, linear spaces along natural or human-made features (greenways) and buffer zones of agricultural land which could be applied in different spatial settings. The concept is to create a system which is flexible in accommodating new urban development but at the same time constant in protecting valuable terrain for recreation and the environment.

**key words:** "Green Grid", landscape protection, greenways, sustainable development

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#### **1. Introduction**

The management of green areas within reach of the general public is usually a problematic question. The high cost of land within the bounds of a city centre and the congestion of building areas influence the location of recreation spaces and force

them to be moved outside the city borders. The extent of a city grows, which is connected with increasing congestion in joined suburbs. Further from the city centre we see the division between rural and urban areas being blurred. The transitory zone between the city area and the neighboring terrain could constitute recreation spaces with vari-

ous functions: sporting, recreational or for exhibition. The urban fringe also creates vast opportunities for continuous natural and semi-natural habitats.

The issue of the formation of green spaces in cities creates a spectrum of possibilities for future development connected, first of all, with various urban schemes, different traditions and local conditions. The system of communication joins inner communities (housing estates) through roads and pedestrian paths. The development is a consequence of local needs and spatial potentiality for management in a recreation terrain.

The landscape of the city-region has traditionally been one of intensive urban land on the one hand, and agricultural land on the other, separated by a visually incoherent and under-utilised fringe zone. This functional and visual division is now becoming more fluid. The green network is, ideally, interconnected and performs a variety of functions, such as recreation and sustainable drainage. It becomes an infrastructure delivering a range of interdependent functions. This represents a key shift in the move towards sustainable development. The city's expansion results in urban sprawl, a rapid disappearance and fragmentation of green areas and the disruption of ecological balance. The worst case scenario of urban sprawl could precipitate irreversible changes in ecological and hydrological systems.

It is important for the future development of accessible green areas that they are integrated within a connected green infrastructure, rather than existing as isolated and fragmented sites. The 'Multifunctional green space' model focuses on the emergence of a green infrastructure within the transformation of city-regions.

## 2. Materials

The system of correlation between a "patchwork" of urban parks, regional parks, community forests and greenways has not been well identified. The 'green web' concept of Patrick Abercrombie for Greater London (Abercrombie, 1944) provides an example of an attempted correlation. His idea that *all forms of open space need to be considered as a whole, and to be co-ordinated into a closely linked park system, with parkways along existing and new roads forming the links between the larger parks* could be easily transmitted into a larger scale of the mutual connection between the city and its surroundings (Abercrombie, 1945). The concept of a 'Green Grid' is endorsed in the Milton Keynes and South Midlands Sub-Regional Strategy and The Northamptonshire Green Infrastructure Project (River Nene Regional Park, 2005). Some research has been provided to create an East London Green Grid, which will contribute to the environmental enhancement of East London. The main task is to deliver new public open space and, more specifi-

cally, it is to provide public access along the river tributaries and green areas.

Research on green spaces show that the spatial structure of multifunctional urban green areas may significantly contribute to sustainable economic and ecological development and the quality of urban life. Analyses performed within the research enable to combine modern urban achievements in the studies of green and other open spaces in the urban structure.

The 'Green Grid' system takes a new approach at framing the role of green spaces within a multifunctional infrastructure, and to developing a planning model which promotes spatial integration, sustainable transport, health and accessibility. Until now, planning models have tended to rely on simple rules of provision, which may be relatively insensitive to local needs and which may have little regard for other social and environmental functions. Despite the policy importance of this issue, very little has been published in the literature about the multifunctional role of the 'Green Grid' in sustainable development, and there has been very little cross-European comparative work.

## 3. The 'Green Grid' System

The growing city demands more green space to protect it from the negative effects of urbanization. The 'Multifunctional mosaic of green spaces' develops a concept for regional planning - to create a sustainable system of green spaces - the 'Green Grid'. The idea is to introduce a flexible model of the 'Green Grid' consisting of green core areas, linear spaces along natural or human-made features (greenways) and buffer zones of agricultural land which could be applied in different spatial settings. The central task is to form a green network which will contribute to improving biodiversity, leisure and recreation, tidal and fluvial flood risk management, grey water treatment and the quality of life. The 'Green Grid' is a network of new and improved parks and woodlands linked to the town and country by continuous green corridors (greenways) and a 'blue infrastructure' (river valleys, waterways, floodplains) (Turner, 1995).

### 3.1 Post-industrial area usage

The basic assumptions of the 'Green Grid' model are based on the belief that post-industrial brownfields in some EU regions constitute the key nexus around which a green grid can cohere to. One of the aims of the research is to prove the role of brownfields in maintaining ecosystem integrity. Brownfield sites can support a wide range of habitats and species. In Germany, some of the brownfields, such as the current Emscher Landscape Park, are recognised as some of the city's most ecologically diverse areas. Building the 'Green Grid' will

present a range of possibilities for the creation of new public spaces in correlation with post-industrial sites. The EU Draft Work programme for 2007 for framework research – Theme 8: Socio-economic sciences and Humanities – draws attention to the importance of increased globalisation, demographic change, migration and ecological challenges. It notes that these are important for social and regional cohesion within an enlarged EU. Within the EU policy context, these issues are strongly expressed in the post-industrial landscapes of polycentric city-regions.

### 3.2 Ecological integrity

The hierarchical structure ('Green Grid') and extent of vegetation in urban areas have an impact on temperature, humidity and surface run-off. Groundwater levels are gradually falling across all EU countries. Green roofs in cities can reduce storm water attenuation and the urban heat island effect. The aim of the project is to introduce the 'Green Grid' model, which would play an important role in air conditioning, improving the microclimate and an overall softening of the urban heat island effect. New housing developments influence the fragmentation of habitat and species isolation. An integration of the green patchwork and building the 'Green Grid' model could only be achieved by joining ecologically coherent networks and corridors – greenways. Following Ahern's definition: 'Greenways are networks of land containing linear elements that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use' (Ahern, 1995). Greenways exist in regional planning as multi-objective corridors, which have a key meaning in urban flood damage reduction, enhancing water quality and wildlife protection. One of the project objectives is to use different functions of greenways including: water resource protection, riparian habitat enhancement, flood hazard reduction, reduction of bank erosion, biodiversity improvement and recreation and environmental education (Platt, 1991) into building the 'Green Grid' functional green areas system.

### 3.3 Biodiversity

Enhancement and improvement of biodiversity is the basis for successful sustainable development. Sustainable management of natural and man-made resources and biodiversity is one of the fundamental issues of successful regional planning. The Strategic Plan for the Convention on Biological Diversity, introduced in 2002, focused attention on sustainable use of biodiversity, maintaining and enhancing ecosystem integrity and reducing the rate of loss of the components of biodiversity. The key

2010 Biodiversity Target is focused on significant reduction of the current rate of biodiversity and its components. The main foundation of the convention is that maintaining ecosystem integrity helps in the provision of goods and services provided by biodiversity in support of human well-being. The idea of the 'Multifunctional mosaic of green spaces' project is to introduce a model of ecological integrity which will protect the river-floodplain system and which could help in the regeneration of the environment and reclamation of derelict landscape.

The concept is to create a system which is flexible in accommodating new urban development but at the same time constant in protecting valuable terrain for recreation and the environment. The basic task introduced in the 'Green Grid' concept is to link existing and new parks within and between built up areas. Such planning allows for the creation of high quality multi-functional spaces and gives opportunities for the improvement of the quality of life. Community forests provide large areas of habitat on the urban fringe and create a source of biodiversity for a city and its neighbourhood.

### 3.4 Social integrity

The 'Green Grid' system is an environmentally functioning web of linear and surface elements that are planned for multiple purposes, including ecology, recreational, culture, aesthetics and other activities compatible with the concept of sustainable land use. An easily accessible green space creates a spectrum of possibilities to practise sport, increase children's creative play and improve social relationships. The EU Draft Work programme for 2007 for framework research – Theme 8: Socio-economic sciences and Humanities – draws attention to the importance of improving health and the quality of life, and decreasing social exclusion and discrimination. A natural green space can encourage social interaction and can contribute to making higher density housing more attractive and safe. Widely accessible green spaces favour human interactions and, in this way, help in decreasing social exclusion and strengthening the links between urban and rural communities. The 'Green Grid' model provides new opportunities for the educational use of the area and ensures a mosaic of habitats in the forest which can be used for a full range of environmental education needs of surrounding schools. The green network contributes to improving biodiversity, leisure and recreation, tidal and fluvial flood risk management, grey water treatment and the quality of life.

### 3.5 Accessibility

One of the 'Green Grid' project objectives is to explore a network of green spaces that would be easily accessible. *The Transport Act 2000* put attention on investment in public infrastructure through the promotion of Light Rapid Transport. The greenway network allows new space in order to create sustainable urban development, which could be environmentally favourable. It softens the impact of transport on climate change and opens up possibilities for clean and safe regional transport. Positive environmental improvements enhance land value. The main task in building the 'green web' is a correct analysis of the hierarchy of greenways in terms of their function, size and levels. The ESDP (European Spatial Development Perspective, 1999) placed securing public access to infrastructure and knowledge among the three main spatial planning objectives. Wide access to leisure and recreation could reduce social exclusion and increase employment opportunities (The UK Government White Paper: 'Saving lives: Our Healthier Nation', 1999).

The task of the research project is to introduce a model which will take into account the needs of pedestrian penetration of recreation terrain. The essential research question is whether there are new and inclusive patterns of leisure use occurring within the urban green infrastructure. Following from this, the research will ask what the most appropriate method of spatial planning is to promote accessible, connected and sustainable patterns of leisure activity. Public environmentally friendly transport could help in building and improving the education net. Greenways provide new opportunities for educational use of the area and a patchwork of natural and semi-natural habitats could be used for environmental education needs.

The EU Draft Work programme for 2007 for framework research – Theme 8: Socio-economic sciences and Humanities – puts attention on improving health and the quality of life, and decreasing social exclusion and discrimination. This project focuses on the emergence of a green infrastructure within the transformation of city-regions, particularly the role of accessible leisure and its applicability as a model for an enlarged EU.

## 4. The "Green Grid" model and its development on the example of the Lower Silesia region

### 4.1 'Green grids' in towns and cities

The compositional role of green areas is to create a clear division of a town/city into distinct historic and modern districts, at the same time separating the industrial parts. The placement of 'green grids' in a town/city depends on the social and economic function of the town/city, its location, as well as the

time it was established. In towns and cities of the Lower Silesia region, 'green grids' are placed like irregular patches on a canvas. This results from the topography of the area and, not seldom, from chaotic spatial development. When we take into consideration the health, ecological and aesthetic functions of the 'green grids', placing them in an unbroken arrangement would be more beneficial. In other words, forests surrounding the towns and cities could be connected with the greenery in the residential districts by wedges of greenery making their way among buildings. City parks complement and extend forest complexes, creating a smooth transition between the greenery of the open landscape and the urban landscape. Incorporating post-mining dumps rehabilitated into forests into the system of urban greenery can bring about similar results.

### 4.2 Creation of new post-industrial open places

The term 'post-industrial area' defines a number of terrain types which, as a result of various functional uses, have been degraded when compared to their original state. The following kinds of post-industrial areas can be distinguished, i.e. stockpiles, surface excavations, areas in which hard coal was extracted underground (including dumps and sedimentation tanks) and post-industrial areas within developed urban areas. There is no uniform and officially binding classification of these areas at present.

The Lower Silesia region in Poland has seen massive industrial and structural changes. Coal mining and the steel industry create a specific urban pattern. Mining and industrial activities were some of the main reasons for deterioration of the areas. The necessities of revitalising neglected land in the city and on the urban fringe and building sustainable communities are one of the main priorities.

Lower Silesia is a region with a very differentiated structure, ranging from typical urban features to productive agricultural areas, from very valuable ecological zones and landscapes to damaged industrial areas; which creates the basis for various activities fulfilling the different expectations of its inhabitants. Rapidly changing land use has left large areas of poorly utilised land following de-industrialisation, while at the same time there is a need to optimise the use of accessible land for multiple functions related to polycentric city-regions – recreation, water management, health, biodiversity, renewable energy, sustainable transport, etc.

Post-industrial cities are less clear in their urban-rural divide, and green networks are now pervading the urban fabric, at the same time as the countryside is becoming a setting for sustainable urban and industrial uses. The model of the 'Green Grid' presents a range of possibilities for creating new public spaces in post-industrial sites. The post-industrial landscape has the potential to create im-

portant new landscapes, generate new sources of employment and wealth, and contribute to public health and fitness, as well as having indirect benefits for a range of environmental services.

#### 4.3. *The role of green spaces in ecological integrity and waste treatment*

In cities one of the development priorities is to maintain and expand municipal forests and to improve the ecological network between the cities and their suburban neighbourhoods. In order to preserve the most valuable virtues of the environment and to prevent its further deterioration, the need to find solutions for building an environmentally functioning web is growing. Research has shown that many parts of the EU ecological network have been eroded and their continuity has been broken. In connection with this fact it is expected that the frequency of fluvial flooding along river corridors and other watercourses will increase. The flood in Poland in 1997 has shown how important establishing a system of passive and active protection for flood protection is. Green areas have a special significance in minimising the risk of flash floods and research shows that afforestating the upper reaches of a river delays water flows downstream. Hence, it is important to conduct research on renaturalisation objectives of ecosystems and increase forest cover in river catchments.

Environmental protection programmes of towns and cities of the Lower Silesia region include provisions describing the role green areas have in maintaining the ecological integrity of these urban areas. The Environmental Protection Programme for the city of Wałbrzych for the years 2004-2007 contains a number of significant arrangements. These are, among others, related to maintaining, creating and restoring green corridors, preventing the formation of new ecological barriers, protecting the valleys of the Pelcznica river and the Szczawinka stream together with their tributaries. The valleys are the best ecological corridors and potential flooding areas for flood waters. They are to be rehabilitated into forest and tree-covered areas. A part of these areas is also to be extensively used as meadows and pastures. To maintain ecological integrity, it is of paramount importance to reduce to a minimum the number of trees and bushes which are cut down along rivers and streams. Apart from this, marshlands and streams are to be preserved in river valleys, and selected fragments of the valleys are to be renatured.

Large urban areas and extensive agriculture creates pressure on water quality because of pollution and surface water run-off. River quality objectives included in the *Urban Waste Water Treatment Directive* (2008) have forced a search for new solutions in urban waste recycling in order to reduce direct effluent discharges to rivers. The Lower

Silesia Province is in the lead among Polish provinces in producing industrial waste (second place in the country after the Silesian Province). The usage of greenways in water and waste treatment has not been identified and research focusing on this issue should be provided.

#### 4.4. *Implementation of the "Green Grid" model – future perspectives*

In this interdisciplinary research it is necessary to make connections between the fields of landscape planning (emergent multifunctional post-industrial landscapes), polycentric spatial planning (modes of land use allocation), environmental management (building an environmental network), sociology and politics. It involves social survey techniques, Geographic Information Systems (GIS) and statistical data analysis. The final effect of the research: 'Multifunctional mosaic of green spaces' is to develop a model for urban planning of a sustainable system of green space management ('Green Grid') by using the Wałbrzych conurbation as a case study.

The methodology of the research combines:

- a desk study of practices and policies focusing on green area management, an analysis of green space development perspectives in EU countries,
- a desk study of Wałbrzych urban planning perspectives concerning environmental issues,
- construction of a GIS (Geographic Information System) model of green spaces in the city of Wałbrzych and its urban fringe,
- interviews with local government and non-governmental representatives,
- evaluation processing proposals after each step of the research.

The GIS studies involve four basic steps: collection, arrangement, testing and combination.

Collection: understanding the landscape character requires a number of layers of information which include: physical factors and the landscape cover. The CORINE Land Cover (CLC) Programme applies a method for land cover data collection based on a hardcopy inventory from satellite image printouts. The task is to build a data base of Wałbrzych and its urban fringe land cover. The collected information will include: data about the geographical environment (e.g. administrative units, water pattern, slopes, settlement pattern, transport network), nature base (e.g. biotopes, designated areas, natural vegetation areas), land base (e.g. soil type, land quality, soil erosion sites), a water resources base and it will also provide information on: soil erosion, pollutant emissions into the air by the vegetation, etc.

Arrangement: the analysis includes arrangement of the land cover after converting the database into a DXT format – to be read by ArcInfo. The GIS

allows the interaction of both modern and historical maps of Sheffield and the immediate surrounding areas. The data interpretation allows land cover classification: artificial surfaces (for example: urban fabric, industrial, commercial and transport units, mines), agricultural areas (e.g. arable land, pastures), forest and semi-natural areas, wetland and waterbodies and indicates zones of: scenic value, ecological value, hydrological value and recreational value.

Testing: this part of the research is focused on introducing various models of green space management. The patchwork of green spaces and greenways would be tested to form different models of the 'Green Grid'. This would include combining different layers of landscape characteristics to achieve the best scenario for green space management. Different combinations of green area management will be transmitted to the IDRISI GIS Programme, which operates on a raster system. The IDRISI Programme will allow impacts of land cover change on biodiversity to be modelled. The main purpose of comparing different concepts is to show the sphere of activity of the 'Green Grid' model and its application in different conditions. The final task of the research is to devise a functional and spatial scheme – the 'Green Grid' model, which could be introduced into the future development of urbanised regions. The model will be presented in a Genesis IV – GIS programme to interpret the landscape by using photorealistic rendering.

## 5. Conclusion

Individual patches and greenways should be treated as elements of the whole landscape. The main challenge in the organisation of spatial management is to find a basis in order to build a hierarchical system of functioning of green areas. Current studies show how important it is to work on different scales of green areas – from single parcels to the whole continent in order to maintain ecosystem integrity (Burgi, Herperger, Schneeberger, 2004). Greenways as linear wildlife corridors can provide linkages between green spaces in a city and its urban fringe and larger areas of habitats, and have a principal significance in increasing biological diversity. The 'Green Grid' could have an important meaning in air conditioning, improving the microclimate and flood protection, and eventually moderating the global warming effect.

High quality, nearby green spaces will encourage higher levels of physical activity, reduce travel distances, improve people's quality of life, provide opportunities for learning and encourage expenditure in the local economy. They may also make areas more attractive for inward investment. Building the 'Green Grid' system allows the reparation of ecosystem integrity and enhances biodiversity in

the urban environment, which influence better provision of goods and services to support human well-being. Current research on urban development emphasises the significance of communication, green spaces and other public spaces oriented towards pedestrians. The principal role of transport and its sustainable development have become a key objective of European Union policy. The 'Multi-functional mosaic of green spaces' system focuses on the issue of sustainable development by providing a spatial scheme based on the configuration of a green system network. Leisure uses are one of the key functions of this infrastructure, not least because it is increasingly essential for people to have access to local recreation facilities. The main purpose of the 'Green Grid' model is, in accordance with European Union policy, to promote sustainable development 'without sacrificing either economic growth or the freedom of movement'.

## 6. Final remarks

The usage of greenways in water and waste treatment has not been identified and research focusing on this issue should be provided. Greenways, from an ecological point of view, could be places to recycle storm water and non-toxic liquid wastes, and they are important buffers for urban communities. They can ensure a more natural approach to the treatment of rainwater by using SUDS (the Sustainable Urban Drainage System). They could be used to clean polluted rivers through nature's filtering systems and to recycle treated sewage effluent. The innovative task of the research project: 'Multifunctional mosaic of green spaces' is to confirm the ecological possibilities of greenways and join them into the 'Green Grid's' vital structure.

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